

## INSTITUTE OF GRADUATE PROGRAMS

The Graduate School of Sciences at Anadolu University was first established in 1982, but when this school became a part of the newly established Osmangazi University, the graduate school was re-founded in 1993. The main purpose of the graduate school is to offer MSc and PhD education at international standards and encourage students to carry out advanced research.

Director : Prof.Dr. Semra KURAMA  
Deputy Director : Dr. Lecturer Hüseyin Ersin EROL  
Deputy Director : Assoc. Prof.Dr. Gülçin IŞIK  
Secretary of Institute : Güray NİŞANCIOĞLU

## DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS

Head :

### DOCTORATE DEGREE (PH.D)

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	-	30.0	BES692	Seminar	3+0 7.5
	-			<i>Seçmeli Dersler</i>	-- 22.5
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		30.0			30.0
<b>III.Semester</b>				<b>IV.Semester</b>	
DYS000	Qualifying Exam	0+0	0.0 BES890-0	Thesis (Thesis Proposal)	0+1 30.0
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			--		30.0
<b>V.Semester</b>				<b>VI.Semester</b>	
BES890	Thesis	0+1	30.0 BES890	Thesis	0+1 30.0
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			30.0		30.0
<b>VII.Semester</b>				<b>VIII.Semester</b>	
BES890	Thesis	0+1	30.0 BES890	Thesis	0+1 30.0
			----		----
			30.0		30.0
<b>Elective Courses</b>					
BES601	Teaching Methodology in Physical Education and Sports			3+0	7.5
BES607	Sports for the Disabled			3+0	7.5
BES616	Medical Subjects in Sports and Health Organizations for Athletes			3+0	7.5
BES626	Contemporary Approaches in Sport and Exercise Psychology			3+0	7.5
BES627	Social Psychology of Sport			3+0	7.5

BES628	Arousal Theories in Sport	3+0	7.5
BES629	Research Methods and Techniques in Sports	3+0	7.5
BES631	Instructional Models for Physical Education	3+0	7.5
BES636	Pedobarographic Applications During Various Motor Tasks	2+1	7.5
BES648	Assessment of Reaction Analyses with Neuro-Physiological and Physiological Variables	2+1	7.5
BES652	Physical Fitness in Individuals with Special Needs	3+0	7.5
BES654	Fundamentals of Electroencephalography (EEG) and Signal Processing Methods	2+1	7.5
BES655	Use of Eye Tracking Technology in Different Sports Branches	3+0	7.5
BES657	Physical Education and Sports for Individuals with Special Needs	3+0	7.5
BES661	Motivational Orientations in Sport	3+0	7.5
BES663	Program Development Models in Physical Education	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
iST632	Statistics II	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UBE901	Research in Area of Specialization	5+0	7.5
UEB902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BES533	Introduction to Research Methods and Technics in Sports	3+0	7.5	BES592	Seminar	3+0	7.5
iST543	Statistics I <i>Seçmeli Dersler</i>	3+0	7.5	EDB501	Academic Writing Skills <i>Seçmeli Dersler</i>	3+0	7.5
		--	15.0			--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BES790	Thesis	0+1	30.0	BES790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

BES504	Sport Medicine	3+0	7.5
BES505	Protection Sport Accidents and Treatment Approaches	3+0	7.5
BES508	Exercise Physiology	3+0	7.5
BES517	Sport Physiology	3+0	7.5
BES526	Motivational Orientations in Sport	3+0	7.5
BES528	Planning and Evaluation in Physical Education Teaching	3+0	7.5
BES530	Antioxidants and Athletics Performance	3+0	7.5
BES531	Exercise and Sport Psychology	3+0	7.5
BES536	Evaluation of Physical and Motor Fitness in School	2+1	7.5
BES538	Laboratory Experiences in Functional Evaluation of Skeletal Muscle	2+1	7.5
BES539	Motor Control of Human Movement	3+0	7.5
BES540	Physical Activity and Health in Schools	3+0	7.5
BES541	Comparative Physical Education	3+0	7.5
BES544	Recreation Programs in Schools	3+0	7.5
BES546	Recreation and Sport Practices for the People with Disabilities	3+0	7.5
BES562	Evaluation of Physical Fitness in Individuals with Special Needs	3+0	7.5
BES563	Health and Exercise	3+0	7.5
BES564	Adapted Physical Education and Sport	3+0	7.5
BES568	New Approaches and Models in Physical Education and Sports	3+0	7.5
BES570	Academic Writing in Social Sciences: Movement Education, Physical Activity and Sedentary Behaviour	3+0	7.5
BES571	Model Based Physical Education Teaching	3+0	7.5

BES572	Sedentary Behaviour Epidemiology	3+0	7.5
BES573	Psychology for Physical Education and Sport	3+0	7.5
BES574	Human at Extreme	3+0	7.5
BES575	Basic Strategies and Design in the Preparation of Physical Education Programs	3+0	7.5
BES576	Sport and Ergonomics	3+0	7.5
BES577	Theoretical Foundations of Program Development in Physical Education	3+0	7.5
BES578	Upper and Lower Extremity Sports Injuries	3+0	7.5
BES579	Physical Activity and Population Health	3+0	7.5
BES581	Scientific Approaches In Movement and Sport Education	1+2	7.5
BES583	Social Determinants of Physical Activity	3+0	7.5
BES585	Hip and Groin Pain in Athletes	3+0	7.5
BES587	Psychology of Coaching	1+2	7.5
BES589	Research and Statistics in Sport Psychology	1+2	7.5
BES591	Team Processes in Sport Psychology	3+0	7.5
BES593	Individual Differences in Adapted Physical Education	2+1	7.5
BES595	Autism Spectrum Disorder and Exercise	2+1	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HAB521	Academic Writing Skills I	3+0	7.5
HAB523	Academic Writing Skills II	3+0	7.5
HAB535	Functional Anatomy	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEB701	Research in Area of Specialization	3+0	4.5
UEB702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF COMPUTER ENGINEERING

Head :

### DOCTORATE DEGREE (PH.D)

<b>PROGRAM</b>					
<b>I.Semester</b>			<b>II.Semester</b>		
<i>Seçmeli Dersler</i>	-	30.0	BİL692	Seminar	3+0 7.5
	-			<i>Seçmeli Dersler</i>	-- 22.5
		----			----
		30.0			30.0
<b>III.Semester</b>			<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	BiM890-0	Thesis (Thesis Proposal) 0+1 30.0
			---		----
			--		30.0
<b>V.Semester</b>			<b>VI.Semester</b>		
BiM890	Thesis	0+1	30.0	BiM890	Thesis 0+1 30.0
			----		----
			30.0		30.0
<b>VII.Semester</b>			<b>VIII.Semester</b>		
BiM890	Thesis	0+1	30.0	BiM890	Thesis 0+1 30.0
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30.0

30.0

**Elective Courses**

BİL604	Information Technology Management	3+0	7.5
BİL605	Distributed Computing Methods	3+0	7.5
BİL606	Natural Language Processing	3+0	7.5
BİL607	Advanced Information Retrieval Systems	3+0	7.5
BİL612	Data and Text Mining	3+0	7.5
BİL613	Machine Learning	3+0	7.5
BİL615	Special Topics in Information Technologies	3+0	7.5
BİL616	Pattern Recognition Applications	3+0	7.5
BİL617	Cryptology	3+0	7.5
BİL619	Advanced Discrete Mathematics	3+0	7.5
BİL620	Multi Agent Systems	3+0	7.5
BİL621	Text Analytics	3+0	7.5
BİL623	Advanced Engineering Mathematics	3+0	7.5
BİL624	Deep Learning Theory and Applications	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UBM901	Research in Area of Specialization	5+0	7.5
UBM902	Research in Area of Specialization	5+0	7.5

**MASTER OF SCIENCE (MS) DEGREE****PROGRAM**

<b>I.Semester</b>				<b>II.Semester</b>			
BİL519	Advanced Algorithm Analysis	3+0	7.5	BİL551	Advanced Database Management Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	BİL553	Object Oriented Systems	3+0	7.5
				BİL591	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BİL790	Thesis	0+1	30.0	BİL790	Thesis	0+1	30.0
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			30.0				30.0

**Elective Courses**

BİL532	Computer Vision	3+0	7.5
BİL533	Data Science	3+0	7.5
BİL534	Digital Image Processing	3+0	7.5
BİL535	Artificial Intelligence in Healthcare	3+0	7.5
BİL552	Programming Languages	3+0	7.5
BİL554	Operating Systems	3+0	7.5
BİL555	Advanced Computer Networks	3+0	7.5
BİL556	Computer Graphics	3+0	7.5
BİL557	Internet Software	3+0	7.5
BİL558	Parallel Programming	3+0	7.5
BİL559	Software Engineering	3+0	7.5
BİL561	Fuzzy Neural Networks	3+0	7.5
BİL562	Network Security	3+0	7.5
BİL563	Fuzzy Logic	3+0	7.5

BİL564	Data Acquisition and Mining	3+0	7.5
BİL565	Rough Sets Theory	3+0	7.5
BİL566	Pattern Analysis	3+0	7.5
BİL567	Introduction to Recommender Systems	3+0	7.5
BİL569	Big Data Systems	3+0	7.5
BİL571	Advanced Neural Network Models	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UBM701	Research in Area of Specialization	3+0	4.5
UBM702	Research in Area of Specialization	3+0	4.5

## COMPUTER ENGINEERING (MASTER) (WITH THESIS) (ENGLISH)

### PROGRAM IN INFORMATICS

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BİL505	Data Systems: Analysis and Design	3+0	7.5	BİL528	Computer Programming II	3+0	7.5
BİL527	Computer Programming I	3+0	7.5	BİL592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
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			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BİL790	Thesis	0+1	30.0	BİL790	Thesis	0+1	30.0
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			30.0				30.0

## ARTIFICIAL INTELLIGENCE (MS) (WITH THESIS) (ENGLISH)

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BİL537 (Eng)	Mathematics for Artificial Intelligence	3+0	7.5	BİL538 (Eng)	Machine Learning	3+0	7.5
BİL539 (Eng)	Artificial Intelligence	3+0	7.5	BİL592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
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			30.0				30.0

#### Elective Courses

BİL541 (Eng)	Computer Vision	3+0	7.5
BİL542 (Eng)	Digital Image Processing	3+0	7.5
BİL543 (Eng)	Fuzzy Logic	3+0	7.5
BİL544 (Eng)	Data Science	3+0	7.5
BİL545 (Eng)	Deep Learning	3+0	7.5

BİL546 (Eng)	Advanced Database Management Systems	3+0	7.5
BİL547 (Eng)	Text Mining	3+0	7.5
BİL548 (Eng)	Pattern Analysis	3+0	7.5
BİL549 (Eng)	Recommender Systems	3+0	7.5
BİL572 (Eng)	Big Data Systems	3+0	7.5
BİL573 (Eng)	Artificial Intelligence in Healthcare	3+0	7.5
BİL574 (Eng)	Advanced Neural Network Models	3+0	7.5
BİL576 (Eng)	Human Computer Interaction	3+0	7.5
BİL577 (Eng)	Fuzzy Neural Networks	3+0	7.5
BİL578 (Eng)	Data Mining	3+0	7.5
FBE510 (Eng)	Ethics of Science and Research Techniques	2+0	7.5
TAC701 (Eng)	Thesis Research Study	3+0	7.5

## (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN INFORMATICS

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BİL505	Data Systems: Analysis and Design	3+0	7.5	BİL528	Computer Programming II	3+0	7.5
BİL527	Computer Programming I	3+0	7.5	BİL599	Term Project	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0

#### Elective Courses

BİL503	Object Oriented Programming	3+0	7.5
BİL504	Data Structure and Algorithms	3+0	7.5
BİL506	Database Management Systems	3+0	7.5
BİL507	Introduction to Operating Systems	3+0	7.5
BİL509	Simulation and Modeling	3+0	7.5
BİL510	Artificial Intelligence	3+0	7.5
BİL511	Computer Aided Design	3+0	7.5
BİL513	Numerical Analysis	3+0	7.5
BİL514	Decision Support Systems	3+0	7.5
BİL517	Logic Design	3+0	7.5
BİL518	Microprocessors	3+0	7.5
BİL520	Advanced Communication Technology	3+0	7.5
BİL521	Management Information Systems	3+0	7.5
BİL522	Computer Organization	3+0	7.5
BİL523	Computer Networks	3+0	3.0
BİL525	Fast Application Development	3+0	3.0
BİL532	Computer Vision	3+0	7.5
BİL533	Data Science	3+0	7.5
BİL534	Digital Image Processing	3+0	7.5
BİL535	Artificial Intelligence in Healthcare	3+0	7.5
BİL560	Data Access Systems	3+0	7.5

### DEPARTMENT OF BIOLOGY

Head :

## DOCTORATE DEGREE (PH.D)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
	<i>Seçmeli Dersler</i>	-	30.0	BiY692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
DYS000	Qualifying Exam	0+0	0.0	BiY890-0	Thesis (Thesis Proposal)	0+1	30.0
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			--				30.0
<b>V.Semester</b>				<b>VI.Semester</b>			
BiY890	Thesis	0+1	30.0	BiY890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>VII.Semester</b>				<b>VIII.Semester</b>			
BiY890	Thesis	0+1	30.0	BiY890	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

BiY601	Microbial Laboratory Techniques	3+0	7.5
BiY602	Water Microbiology	3+0	7.5
BiY603	Environmental Pollution and Plants	3+0	7.5
BiY604	Recombinant DNA Technology	3+0	7.5
BiY605	Animal Tissue Culture	3+0	7.5
BiY606	Yeast Science	3+0	7.5
BiY607	Oceanology	3+0	7.5
BiY608	Advanced Endocrinology	3+0	7.5
BiY609	Parasite Plants	3+0	7.5
BiY611	Genomics	3+0	7.5
BiY612	Microbial Physiology	3+0	7.5
BiY613	Modern Mycology	3+0	7.5
BiY614	Basic Bioinformatics	3+0	7.5
BiY616	Biogeography	3+0	7.5
BiY617	Cellular Signal Transduction Pathways	3+0	7.5
BiY618	Phylogenetic Systematics	3+0	7.5
BiY620	Forest Vegetation of Turkey	3+0	7.5
BiY621	Advanced Molecular Genetics	3+0	7.5
BiY622	Soil Biology	3+0	7.5
BiY624	Use of Bioindicators in Environment	3+0	7.5
BiY625	Special Microscopic Techniques	3+0	7.5
BiY626	Environmental Microbiology	3+0	7.5
BiY627	Ecophysiology	3+0	7.5
BiY628	Genetic Regulation of Development	3+0	7.5

BiY629	Molecular Taxonomy	3+0	7.5
BiY630	Modern Methods in Plant Taxonomy	3+0	7.5
BiY631	Ecological Economics	3+0	7.5
BiY632	Biochemistry of Cancerogens and Mutanges	3+0	7.5
BiY633	Economic Botany	3+0	7.5
BiY634	Evolution of Microbial Pathogens	3+0	7.5
BiY635	Characteristic Behaviour of Animal Groups	3+0	7.5
BiY636	Biochemistry of Free Radicals	3+0	7.5
BiY637	Aquatic Entomology	3+0	7.5
BiY638	Archaeobacteria	3+0	7.5
BiY640	Basic Virology	3+0	7.5
BiY641	Soil Science	3+0	7.5
BiY642	Protein and Nucleic Acid Analysis Techniques	3+0	7.5
BiY644	Intracellular Traffic	3+0	7.5
BiY645	Biochemistry of Nucleic Acids	3+0	7.5
BiY646	Eutrophication in Lakes	3+0	7.5
BiY647	Human Biochemistry	3+0	7.5
BiY648	Applied Mycology and Biotechnology	3+0	7.5
BiY649	Plant Genetic Resources	3+0	7.5
BiY651	Vegetation Research Methods	3+0	7.5
BiY652	Microbiyal Genomics	3+0	7.5
BiY653	Advanced Molecular Biology	3+0	7.5
BiY654	Ecological Genetics	3+0	7.5
BiY655	Natural Antimicrobial Agents and Food	3+0	7.5
BiY656	Chemotaxonomy	3+0	7.5
BiY657	Food, Human Health and Probiotics	3+0	7.5
BiY658	Cell Regulation	3+0	7.5
BiY659	Cancer Genetics	3+0	7.5
BiY660	Medical Genetics	3+0	7.5
BiY661	The Molecular Basis of Cell Differentiation	3+0	7.5
BiY662	Basis of Molecular Evolution	3+0	7.5
BiY663	Araneology	3+0	7.5
BiY664	Ecological Restoration	3+0	7.5
BiY665	Advanced Biochemistry and Biochemical Techniques I	3+0	7.5
BiY666	Advanced Biochemistry and Biochemical Techniques II	3+0	7.5
BiY667	Actinomycetes in Biotechnology	3+0	7.5
BiY668	Advanced Protein Biochemistry	3+0	7.5
BiY669	Biology of Lichenicolous Fungi	3+0	7.5
BiY671	Statistical Analyses in Biology	3+0	7.5
BiY672	Advanced Biochemistry and Bioenergetics	3+0	7.5
BiY673	Molecular Industrial Biotechnology	3+0	7.5
BiY674	Molecular Microbial Ecology Techniques	3+0	7.5
BiY675	Microbial Biofilms	3+0	7.5
BiY676	Comparative Animal Physiology	3+0	7.5
BiY677	Fungal Systematic	3+0	7.5
BiY678	Significance of Plant Secondary Metabolites in Biotechnology	3+0	7.5
BiY679	Food Mycology	3+0	7.5
BiY681	Enzyme Analyses and Activity Detection Methods	3+0	7.5
BiY683	Advanced Cell Invertigation Methods	3+0	7.5
BiY684 (Eng)	Fundamentals of Epigenetics	3+0	7.5
BiY685 (Eng)	Environmental Physiology of Animals	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAC801	Thesis Research Study Course	3+0	7.5
UBJ901	Research in Area of Specialization	5+0	7.5
UBJ902	Research in Area of Specialization	5+0	7.5

## **MASTER OF SCIENCE (MS) DEGREE**

### **PROGRAM IN BOTANY**



## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY510	Flora of Turkey	3+0	7.5	BiY502	Methods of Plant Identification	3+0	7.5
BiY550	Molecular Techniques in Systematics	3+0	7.5	BiY592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
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			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BiY790	Thesis	0+1	30.0	BiY790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5

BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5
EBiY502	Microfungus Identification Methods	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UBJ701	Research in Area of Specialization	3+0	4.5
UBJ702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ECOLOGY

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
BiY583	Methods of Ecological Analysis <i>Seçmeli Dersler</i>	3+0	7.5	BiY502	Methods of Plant Identification	3+0	7.5
		--	22.5	BiY538	Vegetation Ecology	3+0	7.5
				BiY592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
						--	7.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
BiY790	Thesis	0+1	30.0	BiY790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5

BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5
EBiY502	Microfungus Identification Methods	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5

TAÇ701	Thesis Research Study Course	3+0	7.5
UBJ701	Research in Area of Specialization	3+0	4.5
UBJ702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN BIOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY505	Bacteriology	3+0	7.5	BiY584	Advanced Microbial Physiology	3+0	7.5
BiY549	Modern Methods for Microbial Identification and Typing	3+0	7.5	BiY592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BiY790	Thesis	0+1	30.0	BiY790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5

BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5
EBiY502	Microfungus Identification Methods	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UBJ701	Research in Area of Specialization	3+0	4.5
UBJ702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN MOLECULAR BIOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY511	Gene Regulation	3+0	7.5	BiY592	Seminar	3+0	7.5
BiY513	Advanced Cell Physiology	3+0	7.5	BiY710	Advance Molecular Genetic Methods	4+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BiY790	Thesis	0+1	30.0	BiY790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY591	Advanced Molecular Biology and Genetics	4+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5

BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5
EBiY502	Microfungus Identification Methods	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UBJ701	Research in Area of Specialization	3+0	4.5
UBJ702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN FUNDAMENTAL AND INDUSTRIAL MICROBIOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY505	Bacteriology	3+0	7.5	BiY584	Advanced Microbial Physiology	3+0	7.5
BiY549	Modern Methods for Microbial Identification and Typing	3+0	7.5	BiY592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BiY790	Thesis	0+1	30.0	BiY790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertabrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5

BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5
EBiY502	Microfungus Identification Methods	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UBJ701	Research in Area of Specialization	3+0	4.5
UBJ702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ZOOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY523	Zootaxonomy	3+0	7.5	BiY592	Seminar	3+0	7.5
BiY712	Research Methods In Zoology	3+0	7.5	BiY714	Animal Ecology	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			-----				-----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
BiY790	Thesis	0+1	30.0	BiY790	Thesis	0+1	30.0



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30.0

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30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Toxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5

BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5
EBiY502	Microfungus Identification Methods	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UBJ701	Research in Area of Specialization	3+0	4.5
UBJ702	Research in Area of Specialization	3+0	4.5

## (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN BOTANY

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY510	Flora of Turkey	3+0	7.5	BiY502	Methods of Plant Identification	3+0	7.5
BiY550	Molecular Techniques in Systematics	3+0	7.5	BiY599	Term Project Course	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0

#### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5

BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5

## PROGRAM IN ECOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY583	Methods of Ecological Analysis	3+0	7.5	BiY502	Methods of Plant Identification	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	BiY538	Vegetation Ecology	3+0	7.5
				BiY599	Term Project Course	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5

BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5

## PROGRAM IN BIOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY505	Bacteriology	3+0	7.5	BiY584	Advanced Microbial Physiology	3+0	7.5
BiY549	Modern Methods for Microbial Identification and Typing	3+0	7.5	BiY599	Term Project Course	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertabrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5

BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5

## PROGRAM IN MOLECULAR BIOLOGY

### PROGRAM

I.Semester				II.Semester			
BiY511	Gene Regulation	3+0	7.5	BiY599	Term Project Course	3+0	0.0
BiY513	Advanced Cell Physiology	3+0	7.5	BiY710	Advance Molecular Genetic Methods	4+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5

BiY531	Immunology			3+0	7.5
BiY535	Mineral Feeding Physiology in Plants			3+0	7.5
BiY537	Stress Physiology in Plants			3+0	7.5
BiY539	Microbial Enzymes and Biotechnology			3+0	7.5
BiY543	Plant Molecular Biology			3+0	7.5
BiY546	Methods of Genetic Toxicology			3+0	7.5
BiY547	Forest and Park Trees			3+0	7.5
BiY551	Stem Cell Biology			3+0	7.5
BiY552	Plant Science			3+0	7.5
BiY553	The Ecology of Bird Communities			3+0	7.5
BiY555	Birds of Turkey			3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I			3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II			3+0	7.5
BiY560	Instrumental Analyses in Biochemistry			3+0	7.5
BiY561	Animal Cell Culture			3+0	7.5
BiY562	Molecular Biotechnology			3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology			3+0	7.5
BiY565	Extremophiles			3+0	7.5
BiY567	In-Vitro Techniques			3+0	7.5
BiY571	Taxonomy			3+0	7.5
BiY572	Molecular Biology Methods			3+0	7.5
BiY574	Foodborn Pathogen Microorganisms			3+0	7.5
BiY575	Microorganisms and Biotechnology			3+0	7.5
BiY577	Enzyme Technology			3+0	7.5
BiY578	Arachnology			3+0	7.5
BiY579	Plant Bacteriology			3+0	7.5
BiY581	Permaculture			3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications			3+0	7.5
BiY585	Advanced Biochemistry and Metabolism			3+0	7.5
BiY586	Systematics of Lichens			3+0	7.5
BiY591	Advanced Molecular Biology and Genetics			4+0	7.5
BiY593	Toxicology			3+0	7.5
BiY594	Nanomedicine and Application Fields			3+0	7.5
BiY703	Insect Physiology			3+0	7.5
BiY703 (Eng)	Insect Physiology			3+0	7.5
BiY704	Fundamentals of Ecotoxicology			3+0	7.5
BiY705	Insect Behavior			3+0	7.5
BiY706	Advanced Bioimaging Techniques			3+0	7.5
BiY707	Advanced Mycology			3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture			3+0	7.5
BiY709	Soil Microfungi			3+0	7.5
BiY711	Fauna of Turkey			3+0	7.5
BiY716	Microfungus Identification Techniques			3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology			3+0	7.5

## PROGRAM IN FUNDAMENTAL AND INDUSTRIAL MICROBIOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
BiY505	Bacteriology	3+0	7.5	BiY584	Advanced Microbial Physiology	3+0	7.5
BiY549	Modern Methods for Microbial Identification and Typing	3+0	7.5	BiY599	Term Project Course	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0

**Foreign Language Courses**

BiY594	Nanomedicine and Application Fields	3+0	7.5
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**Elective Courses**

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5
BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5



BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5

## PROGRAM IN ZOOLOGY

### PROGRAM

I.Semester				II.Semester			
BiY523	Zootaxonomy	3+0	7.5	BiY599	Term Project Course	3+0	0.0
BiY712	Research Methods In Zoology	3+0	7.5	BiY714	Animal Ecology	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0

### Elective Courses

BiY501	Herbarium Techniques	3+0	7.5
BiY506	Enzymatic Regulation	3+0	7.5
BiY507	Biology of Lichens	3+0	7.5
BiY509	Special Histology	3+0	7.5
BiY511	Gene Regulation	3+0	7.5
BiY512	Principles of Zoological Nomenclature	3+0	7.5
BiY514	The Harmful Insects	3+0	7.5
BiY515	Forest Ecology	3+0	7.5
BiY516	Bioenergetics	3+0	7.5
BiY517	Water Pollution and Biological Effect	3+0	7.5
BiY518	Signal Transduction in The Cell	3+0	7.5
BiY519	Limnology	3+0	7.5
BiY520	Bacterial Plant Diseases	3+0	7.5
BiY521	Biophotography	3+0	7.5
BiY522	Investigation Methods of Ecosystems	3+0	7.5
BiY524	Fishery Biology and Population Dynamics	3+0	7.5
BiY525	The Collection Methods of Invertebrate Animals	3+0	7.5
BiY526	Cytogenetics	3+0	7.5
BiY527	Plant Microbiology	3+0	7.5
BiY528	DNA Repair Mechanisms	3+0	7.5
BiY529	Landscape Ecology	3+0	7.5
BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY535	Mineral Feeding Physiology in Plants	3+0	7.5
BiY537	Stress Physiology in Plants	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5
BiY543	Plant Molecular Biology	3+0	7.5
BiY546	Methods of Genetic Taxicology	3+0	7.5
BiY547	Forest and Park Trees	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY552	Plant Science	3+0	7.5
BiY553	The Ecology of Bird Communities	3+0	7.5
BiY555	Birds of Turkey	3+0	7.5
BiY556	Transmission Electron Microscopy and its Applications I	3+0	7.5
BiY557	Transmission Electron Microscopy And its Applications II	3+0	7.5
BiY560	Instrumental Analyses in Biochemistry	3+0	7.5
BiY561	Animal Cell Culture	3+0	7.5

BiY562	Molecular Biotechnology	3+0	7.5
BiY563	Halophilic Microorganisms and Their Potential in Biotechnology	3+0	7.5
BiY565	Extremophiles	3+0	7.5
BiY567	In-Vitro Techniques	3+0	7.5
BiY571	Taxonomy	3+0	7.5
BiY572	Molecular Biology Methods	3+0	7.5
BiY574	Foodborn Pathogen Microorganisms	3+0	7.5
BiY575	Microorganisms and Biotechnology	3+0	7.5
BiY577	Enzyme Technology	3+0	7.5
BiY578	Arachnology	3+0	7.5
BiY579	Plant Bacteriology	3+0	7.5
BiY581	Permaculture	3+0	7.5
BiY582	Cyanobacteria and Biotechnological Applications	3+0	7.5
BiY585	Advanced Biochemistry and Metabolism	3+0	7.5
BiY586	Systematics of Lichens	3+0	7.5
BiY593	Toxicology	3+0	7.5
BiY594	Nanomedicine and Application Fields	3+0	7.5
BiY703	Insect Physiology	3+0	7.5
BiY703 (Eng)	Insect Physiology	3+0	7.5
BiY704	Fundamentals of Ecotoxicology	3+0	7.5
BiY705	Insect Behavior	3+0	7.5
BiY706	Advanced Bioimaging Techniques	3+0	7.5
BiY707	Advanced Mycology	3+0	7.5
BiY708	Advantages and Disadvantages of Cell Culture	3+0	7.5
BiY709	Soil Microfungi	3+0	7.5
BiY711	Fauna of Turkey	3+0	7.5
BiY716	Microfungus Identification Techniques	3+0	7.5
EBiY501	Model Organisms used in Molecular Biology and Biotechnology	3+0	7.5

## DEPARTMENT OF ENVIRONMENTAL ENGINEERING

Head :

### PROGRAM IN ENVIRONMENTAL MANAGEMENT (DISTANCE LEARNING)

#### PROGRAM

I.Semester		II.Semester	
<i>Seçmeli Dersler</i>	- 30.0	ÇYÖ599	Term Project
	-		3+0 0.0
			<i>Seçmeli Dersler</i>
			-- 30.0
	----		----
	30.0		30.0

#### Elective Courses

ÇYÖ501	Domestic Wastewater Management	3+0	7.5
ÇYÖ502	Hazardous Waste Engineering and Management by Decision Making	3+0	7.5
ÇYÖ503	Legislation on Environmental Issues I	3+0	7.5
ÇYÖ504	Legislation on Environmental Issues II	3+0	7.5
ÇYÖ505	Bioenergy Production	3+0	7.5
ÇYÖ506	Quality Management System Approach in Testing Laboratories	3+0	7.5
ÇYÖ507	Industrial Wastewater Control	3+0	7.5
ÇYÖ508	Drinking Water Quality and Control	3+0	7.5
ÇYÖ509	Sustainable Practices in Agriculture and Environment	3+0	7.5

ÇYÖ510	Determining the Environmental Performance of Products and Processes	3+0	7.5
ÇYÖ512	Indoor Air Quality Measurement	3+0	7.5
ÇYÖ514	Urban Air Quality Management	3+0	7.5
ÇYÖ515	Global Climate Change and Natural/Meteorological Disasters	3+0	7.5
ÇYÖ516	Ecosystem Ecology	3+0	7.5
ÇYÖ517	Air Quality Management	3+0	7.5
ÇYÖ519	Data Analysis in Environmental Science	3+0	7.5
UCS572	Remote Sensing and Geographical Information Systems in Environmental Management	3+0	7.5

## DOCTORATE DEGREE (PH.D)

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	ÇEV692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	ÇEV890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
ÇEV890	Thesis	0+1	30.0	ÇEV890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
ÇEV890	Thesis	0+1	30.0	ÇEV890	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

ÇEV601	Special Topics in Environmental Engineering II	3+0	7.5
ÇEV604	Environmental Organic Chemistry	3+0	7.5
ÇEV609	Engineering for Sustainable Environment	3+0	7.5
ÇEV610	Industrial Environmental Quality Management	3+0	7.5
ÇEV611	Risk Assessment for Environmental Health	3+0	7.5
ÇEV612	Transfer Mechanisms of Incineration Processes	3+0	7.5
ÇEV614	Advanced Solid Waste Management II	3+0	7.5
ÇEV616	Advanced Disinfection Techniques	3+0	7.5
ÇEV617	Thermal Conversion Technologies	3+0	7.5
ÇEV619	Environment Quality Development Plans	3+0	7.5
ÇEV620	Transport and Fate of Pollutants in Water Systems	3+0	7.5
ÇEV621	Advanced Techniques for Atmospheric Analyses	3+0	7.5
ÇEV623	Global Warming Parameters and Control Techniques	3+0	7.5
ÇEV624	Atmospheric Chemistry	3+0	7.5
ÇEV625	Integrated Natural Resource Management	3+0	7.5
ÇEV626	Nanotechnology Applications in Water and Wastewater Treatment	3+0	7.5
ÇEV627	Environmental Biotechnology	3+0	7.5
ÇEV629	Biodiversity and Protected	3+0	7.5

ÇEV631	Electrochemical Water and Wastewater Treatment	3+0	7.5
ÇEV633	Biological Treatment Of Industrial Wastes	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UÇV901	Research in Area of Specialization	5+0	7.5
UÇV902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

I.Semester				II.Semester			
ÇEV523	Instrumental Analysis and Evaluation Methods in Environmental Engineering	3+0	7.5	ÇEV592	Seminar	3+0	7.5
ÇEV531	Statistical Analysis of Engineering Data	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
III.Semester				IV.Semester			
ÇEV790	Thesis	0+1	30.0	ÇEV790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

ÇEV501	Special Topics in Environmental Engineering I	3+0	7.5
ÇEV507	Biomoleculer Techniques in Water Treatment	3+0	7.5
ÇEV508	Microplastic Pollutants	3+0	7.5
ÇEV510	Sustainable Waste Management and Circular Economy	3+0	7.5
ÇEV513	Antimicrobial Activity Protocols and Environmental Applications	3+0	7.5
ÇEV515	Sustainable Infrastructure Engineering	3+0	7.5
ÇEV517	Modeling of Air Pollution	3+0	7.5
ÇEV524	Ecotoxicological Risks of Pollutants	3+0	7.5
ÇEV525	Biomonitoring and Techniques in Monitoring Environmental Quality	3+0	7.5
ÇEV526	Integrated Waste Management Economics	3+0	7.5
ÇEV527	Advanced Solid Waste Management I	3+0	7.5
ÇEV528	Industrial Air Pollutionand Control	3+0	7.5
ÇEV530	Anaerobic Biotechnology for the Treatment of Wastes	3+0	7.5
ÇEV533	Nonpoint Source Pollution	3+0	7.5
ÇEV535	Groundwater Pollution and Treatment	3+0	7.5
ÇEV536	Natural Treatment Systems	3+0	7.5
ÇEV539	Life Cycle Assessment	3+0	7.5
ÇEV540	Modelling of Environmental Systems	3+0	7.5
ÇEV541	Water Treatment Technologies and Applications	3+0	7.5
ÇEV542	Nitrogen and Phosphorus Removal from Municipal Wastewater	3+0	7.5
ÇEV543	Accreditation Process of Test Laboratories	3+0	7.5
ÇEV544	Metal Pollution and Environment	3+0	7.5
ÇEV545	Advanced Microbial Ecology	3+0	7.5
ÇEV546	Advanced Treatment Techniques	3+0	7.5
ÇEV547	Special Waste Management	3+0	7.5
ÇEV549	Advanced Techniques in Hazardous Waste Management	3+0	7.5
ÇEV551	Industrial Processes and Pollution Prevention	3+0	7.5
ÇEV552	Contaminated Site Remediation	3+0	7.5
ÇEV553	Green Building Certification Programs and Applications	3+0	7.5

ÇEV555	Different Decision Making Techniques in Environmental Management	3+0	7.5
ÇEV557	Scientific Research Processes	3+0	7.5
ÇEV559	Environmental Biogeochemistry	3+0	7.5
ÇEV561	Small Scale Drinking and Potable Water Treatment	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UÇV701	Research in Area of Specialization	3+0	4.5
UÇV702	Research in Area of Specialization	3+0	4.5

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING  
(ENGLISH)**

Head :

**DOCTORATE DEGREE (PH.D)**

**PROGRAM**

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	EEM692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	EEM890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
EEM890 (Eng)	Thesis	0+1	30.0	EEM890 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
EEM890 (Eng)	Thesis	0+1	30.0	EEM890 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
EEM603 (Eng)	Function Space Methods in Engineering					3+0	7.5
EEM604 (Eng)	Optimization in Power Systems					3+0	7.5
EEM605 (Eng)	Power Systems Stability					3+0	7.5
EEM606 (Eng)	Parallel Computer Architecture					3+0	7.5
EEM607 (Eng)	Parallel Computing					3+0	7.5
EEM608 (Eng)	Advanced Linear Control Design					3+0	7.5
EEM609 (Eng)	Multivariable Control Systems I					3+0	7.5
EEM610 (Eng)	Multivariable Control Systems II					3+0	7.5
EEM611 (Eng)	Power System Harmonics					3+0	7.5

EEM617 (Eng)	Special Topics in Systems Theory	3+0	7.5
EEM618 (Eng)	Power Quality Analysis	3+0	7.5
EEM619 (Eng)	Wireless Communication	3+0	7.5
EEM620 (Eng)	Special Topics in Control Engineering	3+0	7.5
EEM621 (Eng)	Nano and Micro-Fabrication Techniques	3+0	7.5
EEM623 (Eng)	Advanced Digital Signal Processing	3+0	7.5
EEM624 (Eng)	Advanced Topics in Deep Learning	3+0	7.5
EEM625 (Eng)	Advanced Topics in Digital Systems I	3+0	7.5
EEM641 (Eng)	Sensor Array Signal Processing	3+0	7.5
EEM642 (Eng)	Linear Systems Theory II	3+0	7.5
EEM643 (Eng)	Estimation Theory	3+0	7.5
EEM645 (Eng)	System Identification	3+0	7.5
EEM646 (Eng)	Fuzzy Systems	3+0	7.5
EEM651 (Eng)	Signal Transforms	3+0	7.5
EEM652 (Eng)	Optimal Control	3+0	7.5
EEM656 (Eng)	Large-scale Systems	3+0	7.5
EEM657 (Eng)	Control of Robotic Systems	3+0	7.5
EEM658 (Eng)	Adaptive Control	3+0	7.5
EEM660 (Eng)	Discrete Event Systems	3+0	7.5
EEM661 (Eng)	Advantage in Cryptology	3+0	7.5
EEM667 (Eng)	Statistical Signal Processing	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UEE901 (Eng)	Research in Area of Specialization	5+0	7.5
UEE902 (Eng)	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN CIRCUITS AND SYSTEMS THEORY (ENGLISH)

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM592 (Eng)	Seminar	3+0	7.5
EEM511 (Eng)	Introduction to Machine Learning	3+0	7.5		<i>Seçmeli Dersler</i>	--	22.5
EEM567 (Eng)	Advanced Computer Architecture	3+0	7.5				
	<i>Seçmeli Dersler</i>	--	7.5				
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

#### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5

EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM541 (Eng)	Linear Systems Theory I	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEE701 (Eng)	Research in Area of Specialization	3+0	4.5
UEE702 (Eng)	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ELECTRICAL MACHINERY (ENGLISH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM501 (Eng)	Advanced Power System Analysis and Smart Grids	3+0	7.5	EEM549 (Eng)	Advanced Electrical Machinery	3+0	7.5
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM592 (Eng)	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM541 (Eng)	Linear Systems Theory I	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology	3+0	7.5

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEE701 (Eng)	Research in Area of Specialization	3+0	4.5
UEE702 (Eng)	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ELECTRICAL INSTALLATION SYSTEMS (ENGLISH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM501 (Eng)	Advanced Power System Analysis and Smart Grids	3+0	7.5	EEM547 (Eng)	Fundamentals of Detection and Estimation	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	EEM549 (Eng)	Advanced Electrical Machinery	3+0	7.5
				EEM592 (Eng)	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0

<b>III.Semester</b>				<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5
EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEE701 (Eng)	Research in Area of Specialization	3+0	4.5
UEE702 (Eng)	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ELECTROMAGNETIC FIELDS AND MICROWAVE TECHNIQUE (ENGLISH)



## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM507 (Eng)	Integrated Optical Waveguides	3+0	7.5	EEM502 (Eng)	Antenna Engineering	3+0	7.5
EEM509 (Eng)	Radio Frequency and Microwave Circuits	3+0	7.5	EEM592 (Eng)	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEE701 (Eng)	Research in Area of Specialization	3+0	4.5
UEE702 (Eng)	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ELECTRONICS (ENGLISH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM507 (Eng)	Integrated Optical Waveguides	3+0	7.5	EEM547 (Eng)	Fundamentals of Detection and Estimation	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	EEM552 (Eng)	Micro-Nanodevices and Thin Film Applications	3+0	7.5
				EEM592 (Eng)	Seminar	3+0	7.5

					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
	<b>III.Semester</b>			<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System					3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control					3+0	7.5
EEM513 (Eng)	Network Security and BlockChain					3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery					3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits					3+0	7.5
EEM528 (Eng)	GPU Computing					3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design					3+0	7.5
EEM534 (Eng)	Data-Communication Networks					3+0	7.5
EEM545 (Eng)	System Modeling					3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics					3+0	7.5
EEM548 (Eng)	Power System Protection					3+0	7.5
EEM553 (Eng)	Digital Control Theory					3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems					3+0	7.5
EEM561 (Eng)	Machine Vision					3+0	7.5
EEM564 (Eng)	Artificial Neural Networks					3+0	7.5
EEM565 (Eng)	Image Processing					3+0	7.5
EEM566 (Eng)	Pattern Recognition					3+0	7.5
EEM567 (Eng)	Advanced Computer Architecture					3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology					3+0	7.5
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
MAT507 (Eng)	Applied Mathematics I					3+0	7.5
MAT508 (Eng)	Applied Mathematics II					3+0	7.5
TAÇ701	Thesis Research Study Course					3+0	7.5
UEE701 (Eng)	Research in Area of Specialization					3+0	4.5
UEE702 (Eng)	Research in Area of Specialization					3+0	4.5

## PROGRAM IN CONTROL SYSTEMS (ENGLISH)

### PROGRAM

	<b>I.Semester</b>			<b>II.Semester</b>			
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM592 (Eng)	Seminar	3+0	7.5
EEM541 (Eng)	Linear Systems Theory I	3+0	7.5		<i>Seçmeli Dersler</i>	--	22.5
EEM551 (Eng)	Control Design Methods	3+0	7.5				
	<i>Seçmeli Dersler</i>	--	7.5				
			----				----
			30.0				30.0
	<b>III.Semester</b>			<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEE701 (Eng)	Research in Area of Specialization	3+0	4.5
UEE702 (Eng)	Research in Area of Specialization	3+0	4.5

### PROGRAM IN TELECOMMUNICATIONS (ENGLISH)

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM547 (Eng)	Fundamentals of Detection and Estimation	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	EEM562 (Eng)	Signal Coding	3+0	7.5
				EEM592 (Eng)	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
EEM790 (Eng)	Thesis	0+1	30.0	EEM790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5

EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM568 (Eng)	Fundamentals of Energy Storage Technology	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UEE701 (Eng)	Research in Area of Specialization	3+0	4.5
UEE702 (Eng)	Research in Area of Specialization	3+0	4.5

## (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN CIRCUITS AND SYSTEMS THEORY (ENGLISH)

#### PROGRAM

I.Semester				II.Semester			
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM599 (Eng)	Semester Project	3+0	0.0
EEM511 (Eng)	Introduction to Machine Learning	3+0	7.5		<i>Seçmeli Dersler</i>	--	30.0
EEM567 (Eng)	Advanced Computer Architecture	3+0	7.5				
	<i>Seçmeli Dersler</i>	--	7.5				
			----				----
			30.0				30.0

#### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM541 (Eng)	Linear Systems Theory I	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

### PROGRAM IN ELECTRICAL MACHINERY (ENGLISH)

## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM501 (Eng)	Advanced Power System Analysis and Smart Grids	3+0	7.5	EEM549 (Eng)	Advanced Electrical Machinery	3+0	7.5
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM599 (Eng)	Semester Project	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM541 (Eng)	Linear Systems Theory I	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

## PROGRAM IN ELECTRICAL INSTALLATION SYSTEMS (ENGLISH)

## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM501 (Eng)	Advanced Power System Analysis and Smart Grids	3+0	7.5	EEM547 (Eng)	Fundamentals of Detection and Estimation	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	EEM549 (Eng)	Advanced Electrical Machinery	3+0	7.5
				EEM599 (Eng)	Semester Project	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0

### Elective Courses

EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5
EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5

EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

## PROGRAM IN ELECTROMAGNETIC FIELDS AND MICROWAVE TECHNIQUE (ENGILSH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM507 (Eng)	Integrated Optical Waveguides	3+0	7.5	EEM502 (Eng)	Antenna Engineering	3+0	7.5
EEM509 (Eng)	Radio Frequency and Microwave Circuits	3+0	7.5	EEM599 (Eng)	Semester Project	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
FBE510 (Eng)	Ethics of Science and Research Techniques	2+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

## PROGRAM IN ELECTRONICS (ENGILSH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM507 (Eng)	Integrated Optical Waveguides <i>Seçmeli Dersler</i>	3+0	7.5	EEM547 (Eng)	Fundamentals of Detection and Estimation	3+0	7.5
		--	22.5	EEM552 (Eng)	Micro-Nanodevices and Thin Film Applications	3+0	7.5
				EEM599 (Eng)	Semester Project	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
EEM567 (Eng)	Advanced Computer Architecture	3+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

## PROGRAM IN CONTROL SYSTEMS (ENGLISH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM599 (Eng)	Semester Project	3+0	0.0
EEM541 (Eng)	Linear Systems Theory I	3+0	7.5		<i>Seçmeli Dersler</i>	--	30.0
EEM551 (Eng)	Control Design Methods	3+0	7.5				
	<i>Seçmeli Dersler</i>	--	7.5				
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5

EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

## PROGRAM IN TELECOMMUNICATIONS (ENGLISH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EEM504 (Eng)	Random Variables and Stochastic Processes	3+0	7.5	EEM547 (Eng)	Fundamentals of Detection and Estimation	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	EEM562 (Eng)	Signal Coding	3+0	7.5
				EEM599 (Eng)	Semester Project	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0

### Elective Courses

EEM508 (Eng)	Reliability Analysis in Power System	3+0	7.5
EEM510 (Eng)	Machine Learning for Dynamical Systems and Control	3+0	7.5
EEM513 (Eng)	Network Security and BlockChain	3+0	7.5
EEM515 (Eng)	Dynamics of Electrical Machinery	3+0	7.5
EEM527 (Eng)	Advanced Power Electronics Circuits	3+0	7.5
EEM528 (Eng)	GPU Computing	3+0	7.5
EEM530 (Eng)	Hardware Security and Trusted Circuit Design	3+0	7.5
EEM534 (Eng)	Data-Communication Networks	3+0	7.5
EEM545 (Eng)	System Modeling	3+0	7.5
EEM546 (Eng)	Fundamentals of Robotics	3+0	7.5
EEM548 (Eng)	Power System Protection	3+0	7.5
EEM553 (Eng)	Digital Control Theory	3+0	7.5
EEM554 (Eng)	Nonlinear Control Systems	3+0	7.5
EEM561 (Eng)	Machine Vision	3+0	7.5
EEM564 (Eng)	Artificial Neural Networks	3+0	7.5
EEM565 (Eng)	Image Processing	3+0	7.5
EEM566 (Eng)	Pattern Recognition	3+0	7.5
MAT507 (Eng)	Applied Mathematics I	3+0	7.5
MAT508 (Eng)	Applied Mathematics II	3+0	7.5

## DEPARTMENT OF INDUSTRIAL ENGINEERING

Head :

## DOCTORATE DEGREE (PH.D)

### PROGRAM



	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	ENM692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	ENM890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
ENM890	Thesis	0+1	30.0	ENM890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
ENM890	Thesis	0+1	30.0	ENM890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
ENM601	Introduction to Convex Analysis					3+0	7.5
ENM602	Stochastic Analysis					3+0	7.5
ENM603	Unconstrained Optimization					3+0	7.5
ENM604	Constrained Optimization					3+0	7.5
ENM605	Operations Research in Healthcare					3+0	7.5
ENM606	Multi-Objective Optimization					3+0	7.5
ENM608	Fuzzy Sets and Systems					3+0	7.5
ENM610	Finance Engineering					3+0	7.5
ENM612	Data Mining with Mathematical Programming					3+0	7.5
ENM614	Material Handling and Warehousing Systems					3+0	7.5
ENM616	Ergonomics and Occupational Biomechanics					3+0	7.5
ENM618	Advanced Techniques in Simulation					3+0	7.5
ENM620	Heuristics and Matheuristics in Operations Research					3+0	7.5
ENM627	Dynamic Programming					3+0	7.5
ENM629	Mathematical Statistics					3+0	7.5
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
LOJ601	Logistics Planning and Modelling					3+0	7.5
MAT631	Mathematics for Operations Research					3+0	7.5
TAÇ801	Thesis Research Study Course					3+0	7.5
UEN901	Research in Area of Specialization					5+0	7.5
UEN902	Research in Area of Specialization					5+0	7.5

## MASTER OF ARTS (MA) DEGREE

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
ENM503	Advanced Techniques in Linear Programming	3+0	7.5	ENM502	Production Management Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	ENM592	Seminar	3+0	7.5

				İST522	Stochastic Processes	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0

	<b>III.Semester</b>				<b>IV.Semester</b>		
ENM790	Thesis	0+1	30.0	ENM790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

ENM501	Design and Analysis of Experiments					3+0	7.5
ENM504	Decision Making Methods					3+0	7.5
ENM505	Sequencing and Scheduling					3+0	7.5
ENM508	Reliability of Systems					3+0	7.5
ENM509	Supply Chain Management					3+0	7.5
ENM512	Research Techniques in Human Engineering					3+0	7.5
ENM514	Mathematical Programming					3+0	7.5
ENM515	Energy Systems					3+0	7.5
ENM516	Multi Criteria Decision Making					3+0	7.5
ENM517	Special Topics in Facilities Planning					3+0	7.5
ENM518	Metaheuristics					3+0	7.5
ENM519	Strategic Choice and Planning in International and National Context					3+0	7.5
ENM520	Advanced Management Technics					3+0	7.5
ENM521	Advanced Production Systems					3+0	7.5
ENM522	Multivariate Statistics,Application Tools and Techniques					3+0	7.5
ENM523	Introduction to Mathematical Optimization					3+0	7.5
ENM524	Predicting with Machine Learning					3+0	7.5
ENM525	Modeling and Analysis of Time Series Using R					1+2	7.5
ENM526	Advanced Data Analytics					3+0	7.5
ENM527	Logistics Modeling and Optimization					3+0	7.5
ENM528	Integer Programming					3+0	7.5
ENM529	Optimization for Machine Learning					3+0	7.5
ENM530	Social Network Analysis					3+0	7.5
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
MAT515	Engineering Mathematics					3+0	9.0
TAÇ701	Thesis Research Study Course					3+0	7.5
UEN701	Research in Area of Specialization					3+0	4.5
UEN702	Research in Area of Specialization					3+0	4.5

### (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

#### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
ENM503	Advanced Techniques in Linear Programming	3+0	7.5	ENM502	Production Management Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	ENM599	Term Project	3+0	0.0
				İST522	Stochastic Processes	3+0	7.5
					<i>Seçmeli Dersler</i>	--	15.0
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			30.0				30.0

### Elective Courses

ENM501	Design and Analysis of Experiments					3+0	7.5
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ENM504	Decision Making Methods	3+0	7.5
ENM505	Sequencing and Scheduling	3+0	7.5
ENM508	Reliability of Systems	3+0	7.5
ENM509	Supply Chain Management	3+0	7.5
ENM512	Research Techniques in Human Engineering	3+0	7.5
ENM514	Mathematical Programming	3+0	7.5
ENM515	Energy Systems	3+0	7.5
ENM516	Multi Criteria Decision Making	3+0	7.5
ENM517	Special Topics in Facilities Planning	3+0	7.5
ENM518	Metaheuristics	3+0	7.5
ENM519	Strategic Choice and Planning in International and National Context	3+0	7.5
ENM520	Advanced Management Technics	3+0	7.5
ENM521	Advanced Production Systems	3+0	7.5
ENM522	Multivariate Statistics, Application Tools and Techniques	3+0	7.5
ENM523	Introduction to Mathematical Optimization	3+0	7.5
ENM524	Predicting with Machine Learning	3+0	7.5
ENM525	Modeling and Analysis of Time Series Using R	1+2	7.5
ENM527	Logistics Modeling and Optimization	3+0	7.5
MAT515	Engineering Mathematics	3+0	9.0

## DEPARTMENT OF INDUSTRIAL ARTS

Head :

### MASTER OF SCIENCE (MS) DEGREE

#### PROGRAM IN INDUSTRIAL DESIGN

In globalized world, concept of Industrial design gets an important place in production, while products get importance both in function and in aesthetic by increasing competition in markets. Definition of industrial design, which is designing and making visual and functional definition of every mass produced products, emphasizes the place of this science in industrial field. In Industrial Design Department; which established in 2000; computer aided design education which is a requirement of contemporary design education, is supported by softwares which are products of latest technology. Design studios, computer laboratories and workshops supply transition from theory to application. Students graduated from Industrial Design Department get the title of INDUSTRIAL DESIGNER. They can work as freelance designers and as designers in firms and government establishments' research and development departments and also in design studios.

#### PROGRAM

I.Semester				II.Semester			
ENT501	Industrial Design I	3+0	7.5	ENT502	Industrial Design II	3+0	7.5
ENT531	Design Research Methods	3+0	7.5	ENT510	New Approaches in Design	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0	ENT592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
III.Semester				IV.Semester			
ENT790	Thesis	0+1	30.0	ENT790	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
ARY505	Scientific Research Planning and Evaluation					3+0	7.5

ENT503	Design Management	3+0	7.5
ENT504	Portfolio Presentation Techniques	3+0	7.5
ENT506	Media and Design	3+0	7.5
ENT507	Quality in Industrial Design	3+0	7.5
ENT508	Product Identity	3+0	7.5
ENT509	Cultural Problems	3+0	7.5
ENT511	Advanced Computer Aided Manufacturing	3+0	7.5
ENT512	Role of Sector in Product Development	2+2	7.5
ENT513	Creation of Brand and Market Strategies	3+0	7.5
ENT514	Theory and Origins of Sustainable Design	3+0	7.5
ENT515	Technical Analysis in Design	3+0	7.5
ENT516	Form and Meaning in Product Design	3+0	7.5
ENT518	Remote Design Research	3+0	7.5
ENT519	Advanced Presentation Techniques I	2+2	7.5
ENT520	Advanced Presentation Techniques II	2+2	7.5
ENT521	Computer Aided Design I	2+2	7.5
ENT522	Computer Aided Design II	2+2	7.5
ENT523	Visualisation	3+0	7.5
ENT525	Advanced Computer Aided Industrial Design I	2+2	7.5
ENT526	Advanced Computer Aided Industrial Design II	2+2	7.5
ENT527	Automotive Industry and Design	3+0	7.5
ENT528	Sustainable Design Practice	3+0	7.5
ENT529	Ocular Culture and Design Thinking	3+0	7.5
ENT533	Service Design	2+1	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UET701	Research in Area of Specialization	3+0	4.5
UET702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN FASHION DESIGN

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
MOD513	Advanced Projects in Fashion Design I <i>Seçmeli Dersler</i>	2+2	7.5	ENT592	Seminar	3+0	7.5
		--	22.5	MOD523	Philosophy of Design	3+0	7.5
				MOD529	Culturel Approaches in Fashion Design <i>Seçmeli Dersler</i>	3+0	7.5
						--	7.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
ENT790	Thesis	0+1	30.0	ENT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

ARY505	Scientific Research Planning and Evaluation	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MOD501	Pattern Design in Textile	3+0	7.5
MOD510	Fashion Concept in Design	3+0	7.5
MOD511	Intelligent Textiles and Clothing	3+0	7.5
MOD512	Art and Design	2+2	7.5
MOD514	Advanced Projects in Fashion Design II	2+2	7.5
MOD515	Fashion Design Presentation and Graphic Design Relation	3+0	7.5

MOD516	The Quest for a Form in Fashion Design	2+1	7.5
MOD517	Design, Art and Fashion Relationship	3+0	7.5
MOD518	Computer Based Technologies for Textile and Print Design Simulation	3+0	7.5
MOD519	New Approaches to Design of Fashion Accessories	3+0	7.5
MOD520	Experimental Draping	1+2	7.5
MOD521	Fiber Art I	3+0	7.5
MOD522	Fiber Art II	3+0	7.5
MOD524	Applied Studies on Natural Dyeing	2+1	7.5
MOD525	Experimental Printing Design	3+0	7.5
MOD527	Wearable Art	1+2	7.5
MOD531	Textile Surface Applications in Wearable Art	1+2	7.5
MOD533	Garment Comfort	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UET701	Research in Area of Specialization	3+0	4.5
UET702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF PHYSICS

Head :

## DOCTORATE DEGREE (PH.D)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	-	30.0	FİZ692	Seminar	3+0 7.5
	-			<i>Seçmeli Dersler</i>	-- 22.5
		----			----
		30.0			30.0
<b>III.Semester</b>				<b>IV.Semester</b>	
DYS000	Qualifying Exam	0+0	0.0 FİZ890-0	Thesis (Thesis Proposal)	0+1 30.0
			---		----
			--		30.0
<b>V.Semester</b>				<b>VI.Semester</b>	
FİZ890	Thesis	0+1	30.0 FİZ890	Thesis	0+1 30.0
			----		----
			30.0		30.0
<b>VII.Semester</b>				<b>VIII.Semester</b>	
FİZ890	Thesis	0+1	30.0 FİZ890	Thesis	0+1 30.0
			----		----
			30.0		30.0
<b>Elective Courses</b>					
FBE510	Ethics of Science and Research Techniques	2+0	7.5		
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5		
FİZ601	Clay and Clay Minerals I	3+0	7.5		
FİZ602	Clay and Clay Minerals II	3+0	7.5		
FİZ604	Selected Topics in Zeolite Molecular Sieves	3+0	7.5		

FİZ605	Selected Topics on Clay and Clay Minerals I	3+0	7.5
FİZ606	Selected Topics in Electromagnetic Wave Theory	3+0	7.5
FİZ607	Optical Properties of Semiconductors I	3+0	7.5
FİZ608	Optical Properties of Semiconductors II	3+0	7.5
FİZ610	Selected Topics on Clay and Clay Minerals II	3+0	7.5
FİZ611	Selected Topics in Solid State Physics	3+0	7.5
FİZ612	Dielectric Physics	3+0	7.5
FİZ614	Selected Topics in Classical Mechanics	3+0	7.5
FİZ616	Group Theory and Applications to Physics	3+0	7.5
FİZ617	Lie Groups and Physical Applications	3+0	7.5
FİZ619	Conduction Mechanisms in Solids	3+0	7.5
FİZ621	Selected Topics in Adsorption Technology	3+0	7.5
FİZ622	Selected Topics of Advanced Statistical Physics	3+0	7.5
FİZ623	Selected Topics in Mathematical Physics	3+0	7.5
FİZ624	Selected Topics in Semiconductors	3+0	7.5
FİZ627	Selected Topics in Ion Exchange	3+0	7.5
FİZ629	Electromagnetic Wave Theory	3+0	7.5
FİZ630	Magnetic Properties of Solids	3+0	7.5
FİZ631	Organic Semiconductor Physics	3+0	7.5
FİZ632	Classical Electrodynamics	3+0	7.5
FİZ633	Band Theory in Semiconductors	3+0	7.5
FİZ634	Gravitation and Cosmology	3+0	7.5
FİZ635	Ultra Cold Atomic Gases	3+0	7.5
FİZ636	Molecular Beam Epitaxy: Instrument and Application	3+0	7.5
FİZ637	Fundamental Properties and Gas Adsorption Applications of Naturel Adsorbents	3+0	7.5
FİZ638	Fundamentals of Semiconductor Device and Technology	3+0	7.5
FİZ639	Physical Mechanisms of Variables Stars	3+0	7.5
FİZ640	Structural Properties of Accretion Disc in Binary Stars	3+0	7.5
FİZ641	Gas Adsorption Applications of Clay Type Naturel Adsorbents	3+0	7.5
FİZ642	Infrared and Raman Spectroscopy	3+0	7.5
FİZ643	Matrix Isolation Techniques and Applications	3+0	7.5
FİZ644	Nuclear Magnetic Resonance Spectroscopy	3+0	7.5
FİZ645	Semiconductor Device Technology	3+0	7.5
FİZ646	Principles of Plasma Discharges	3+0	7.5
FİZ647	Natural Zeolites	3+0	7.5
FİZ649	Atom, Molecule and Spectroscopy	3+0	7.5
FİZ652	Recommended Course Content	3+0	7.5
FİZ653	Device Physics	3+0	7.5
FİZ654	Advanced Quantum Mechanics	3+0	7.5
FİZ655	Theories of Gravitation	3+0	7.5
FİZ658 (Eng)	Characterization of Porous Materials	3+0	7.5
FİZ658	Characterization of Porous Materials	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UFZ901	Research in Area of Specialization	5+0	7.5
UFZ902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
FİZ501	Mathematical Physics	3+0	7.5	FİZ508	Quantum Mechanics	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	FİZ542	Electromagnetic Theory	3+0	7.5
				FİZ592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0

<b>III.Semester</b>				<b>IV.Semester</b>			
FiZ790	Thesis	0+1	30.0	FiZ790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
FiZ503	Ion Exchange	3+0	7.5
FiZ505	Physical Adsorption	3+0	7.5
FiZ507	Quantum Mechanics and Molecular Spectroscopy	3+0	7.5
FiZ509	Instrumental Analysis Methods	3+0	7.5
FiZ510	Evolution of Stars	3+0	7.5
FiZ512	High Energy Astrophysics	3+0	7.5
FiZ514	Electromagnetic Wave Theory	3+0	7.5
FiZ515	Analysis of the X-ray Spectrum	3+0	7.5
FiZ522	Geometric Algebra and Applications	3+0	7.5
FiZ523	Optoelectronic Physics I	3+0	7.5
FiZ524	Optoelectronic Physics II	3+0	7.5
FiZ525	Some Biophysical Techniques Connected With Waves	3+0	7.5
FiZ526	Classical Mechanics	3+0	7.5
FiZ527	Advanced Statistical Physics	3+0	7.5
FiZ528	Adsorption Technology	3+0	7.5
FiZ529	Thin Film Characterization	3+0	7.5
FiZ530	Thin Film Technology	3+0	7.5
FiZ531	Amorphous Material Physics	3+0	7.5
FiZ532	Particle Physics	3+0	7.5
FiZ533	Special Function in Physics I	3+0	7.5
FiZ537	Fundamentals of Impedance Spectroscopy	3+0	7.5
FiZ538	Special Functions in Physics II	3+0	7.5
FiZ539	Dynamics and Relativity	3+0	7.5
FiZ540	Characterization of Solids	3+0	7.5
FiZ541	Semiconductors	3+0	7.5
FiZ543	Condensed Matter Physics I	3+0	7.5
FiZ544	Condensed Matter Physics II	3+0	7.5
FiZ545	Characterization Methods of Porous Solids and Powder Minerals	3+0	7.5
FiZ546	Infrared Detection Systems: Physics and Technology	3+0	7.5
FiZ547	Lab VIEW: Graphical Programming Language	3+0	7.5
FiZ549	Hypercomplex Numbers in Physics	3+0	7.5
FiZ550	Geometry and Topology in Physics	3+0	7.5
FiZ551	Plasma Physics	3+0	7.5
FiZ553	Molecular Modelling	3+0	7.5
FiZ554	Surfactants in Aqueous Solutions	3+0	7.5
FiZ556	Experimental Techniques in Particle Physics	3+0	7.5
FiZ557	Radiation Physics	3+0	7.5
FiZ559	Essential MATLAB Applications for Physicists	1+2	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UFZ701	Research in Area of Specialization	3+0	4.5
UFZ702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF INTERDISCIPLINARY MOVEMENT AND TRAINING SCIENCES

Head :

### DOCTORATE DEGREE (PH.D)

**PROGRAM**

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	HAB692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	HAB890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
HAB890	Thesis	0+1	30.0	HAB890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
HAB890	Thesis	0+1	30.0	HAB890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
BES533	Introduction to Research Methods and Technics in Sports					3+0	7.5
BES566	Practical Application to the Study of VO2 Kinetics					2+1	7.5
BES607	Sports for the Disabled					3+0	7.5
BES612	Neuromuscular Adaptation and Fatigue					3+0	7.5
BES616	Medical Subjects in Sports and Health Organizations for Athletes					3+0	7.5
BES619	Training Theory I					3+0	7.5
BES620	Training Theory II					3+0	7.5
BES626	Contemporary Approaches in Sport and Exercise Psychology					3+0	7.5
BES627	Social Psychology of Sport					3+0	7.5
BES628	Arousal Theories in Sport					3+0	7.5
BES630	Exercise Approaches for Special Groups					3+0	7.5
BES632	In Biological Systems Methods of Analysis of Reactive Oxygen Species					3+0	7.5
BES633	Exercise Prescription					3+0	7.5
BES635	Anti-Aging and Exercise					3+0	7.5
BES636	Pedobarographic Applications During Various Motor Tasks					2+1	7.5
BES638	Sportive Technical Analysis Applications					2+1	7.5
BES646	Global Positioning System (GPS) and Sport Specific Testing					1+2	7.5
BES649	Performance Monitoring in Sport					2+1	7.5
BES651	Training Load Monitorization and Field Test in Team Sports					1+2	7.5
FBES10	Ethics of Science and Research Techniques					2+0	7.5
FBES10-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
HAB622	Oxidative Stress Responses to Aerobic Exercise					3+0	7.5
HAB623	Oxidative Stress Responses To Resistance Exercise					3+0	7.5
HAB624	Muscle Damage Paradigm					3+0	7.5
HAB625	Physiological Basis Of Human Performance					3+0	7.5
HAB626	Fundamental Of High-Level Performance					3+0	7.5
HAB627	Training Periodization					3+0	7.5
HAB629	Advanced Anatomy in Sports					3+0	7.5
HAB630	Adaptation to Strength Training					3+0	7.5
HAB632	Biostatistics					3+0	7.5
HAB633	Training Theory I					3+0	7.5



HAB634	Adaptation to Strength Training	3+0	7.5
HAB635	Exercise Prescription	3+0	7.5
HAB636	Training Theory II	3+0	7.5
HAB637	Anti Aging and Exercise	3+0	7.5
HAB638	Exercise Approaches for Special Groups	3+0	7.5
HAB639	Performance Monitoring in Sport	2+1	7.5
HAB640	Sportive Technical Analysis Applications	2+1	7.5
HAB641	Biomechanics of Musculoskeletal System I	3+0	7.5
HAB642	Global Positioning System (GPS) and Sport Specific Testing	3+0	7.5
HAB643	Neuromuscular Adaptation and Fatigue	3+0	7.5
HAB644	Biomechanics of Musculoskeletal System II	3+0	7.5
HAB645	Training Load Monitorization and Field Test in Team Sports	1+2	7.5
HAB646	Electromyography Signal Processing	3+0	7.5
HAB647	Current Issues in Athletic Performance Enhancing	3+0	7.5
HAB648	Strength and Conditioning Fundamentals for Tactical Forces and Civil Society Volunteers	3+0	7.5
HAB649	Recommendations for Physical Inactivity and Sedentary Behaviors	3+0	7.5
HAB650	Physical Fitness Tests and Exercise Programming	3+0	7.5
HAB901	Research in Area of Specialization	5+0	7.5
HAB902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
HAB535	Functional Anatomy	3+0	7.5	HAB521	Academic Writing Skills I	3+0	7.5
HAB569	Applied Statistics	3+0	7.5	HAB535	Functional Anatomy	3+0	7.5
HAB571	Research Methods in Movement and Training Sciences	3+0	7.5	HAB592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
		----	----			----	----
			37.5				37.5
<b>III.Semester</b>				<b>IV.Semester</b>			
HAB790	Thesis	0+1	30.0	HAB790	Thesis	0+1	30.0
		----	----			----	----
			30.0				30.0

### Elective Courses

ANA501	Functional Anatomy	3+0	7.5
ANA503	Physiology I	3+0	7.5
ANA504	Physiology II	3+0	7.5
BES504	Sport Medicine	3+0	7.5
BES505	Protection Sport Accidents and Treatment Approaches	3+0	7.5
BES508	Exercise Physiology	3+0	7.5
BES517	Sport Physiology	3+0	7.5
BES518	Physical Appropriateness	3+0	7.5
BES520	Experimental Applications in Sportive Performance	3+0	5.0
BES522	Experimental Approach to Exercise Neurophysiology	3+0	7.5
BES526	Motivational Orientations in Sport	3+0	7.5
BES531	Exercise and Sport Psychology	3+0	7.5
BES533	Introduction to Research Methods and Technics in Sports	3+0	7.5
BES536	Evaluation of Physical and Motor Fitness in School	2+1	7.5
BES539	Motor Control of Human Movement	3+0	7.5
BES540	Physical Activity and Health in Schools	3+0	7.5
BES555	Analysis of Sportive Technique	3+0	7.5
BES556	Training Periodization in Team Sports	3+0	7.5

BES557	Periodization Methodologies in Football	3+0	7.5
BES558	Current Approaches and Corrective Exercises in Fitness Applications	2+1	7.5
BES559	Match and Player Analysis in Team Sports	3+0	7.5
BES561	Introduction to Exercise Neurophysiology	3+0	7.5
BES565	Electrophysiological Training Methods in Sports	2+1	7.5
BES567	Oxygen Uptake Kinetics	2+1	7.5
BES569	Acute and Chronic Adaptation to Exercise at High Altitude	2+1	7.5
BES637	Exercise and Oxidative Stress	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HAB521	Academic Writing Skills I	3+0	7.5
HAB522	High-Intensity Interval Training (HIIT) in Team Sports	3+0	7.5
HAB523	Academic Writing Skills II	3+0	7.5
HAB524	Talent Identification And Development In Sports	3+0	7.5
HAB526	Training Principles For Spine, Upper, and Lower Extremities	3+0	7.5
HAB527	Antioxidants and Athletics Performance	3+0	7.5
HAB528	Current Trends In Strength Training	3+0	7.5
HAB529	Scientific Fundamentals Of Training	3+0	7.5
HAB531	Body Composition and Performance	3+0	7.5
HAB532	Sports for Disability Persons	3+0	7.5
HAB533	Motivation in Sport	3+0	7.5
HAB534	Movement And Training Principles	3+0	7.5
HAB536	Experimental Approach to Exercise Neurophysiology	3+0	7.5
HAB537	Introduction to Exercise Neurophysiology	3+0	7.5
HAB538	The Fundamentals of Kinesiological Electromyography	3+0	7.5
HAB539	Physiology I	3+0	7.5
HAB540	Physiology II	3+0	7.5
HAB541	Physical Appropriateness	3+0	7.5
HAB542	Experimental Applications in Sportive Performance	3+0	7.5
HAB543	Talent and Talent Identification for Sports in Children	3+0	7.5
HAB544	Advanced Training Theory	3+0	7.5
HAB545	Basic Training Theory	3+0	7.5
HAB546	Monitoring Training and Performance in Athletes	3+0	7.5
HAB547	Movement Science and Performance Training	3+0	7.5
HAB548	Training Periodization in Team Sports	3+0	7.5
HAB549	Analysis of Sportive Technique	3+0	7.5
HAB550	Current Approaches and Corrective Exercises in Fitness Applications	2+1	7.5
HAB551	Periodization Methodologies in Football	3+0	7.5
HAB552	Practical Application to the Study of VO2 Kinetics	2+1	7.5
HAB553	Match and Player Analysis in Team Sports	3+0	7.5
HAB555	Electrophysiological Training Methods in Sports	2+1	7.5
HAB556	Physical Activity and Technology Use	3+0	7.5
HAB557	Oxygen Uptake Kinetics	2+1	7.5
HAB559	Acute and Chronic Adaptation to Exercise at High Altitude	2+1	7.5
HAB561	Exercise and Oxidative Stress	3+0	7.5
HAB563	Current Literature in Movement and Training and Applied Project Development	2+1	7.5
HAB565	Physical Activity Recommendations and Assessment	3+0	7.5
HAB567	Geriatrics and Physical Activity	3+0	7.5
HAB701	Research in Area of Specialization	3+0	4.5
HAB702	Research in Area of Specialization	3+0	4.5
IST543	Statistics I	3+0	7.5

## **DEPARTMENT OF AIR TRAFFIC CONTROL**

Head

:

### **DOCTORATE DEGREE (PH.D)**

#### **PROGRAM**

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	HTK692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	HTK890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
HTK890	Thesis	0+1	30.0	HTK890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
HTK890	Thesis	0+1	30.0	HTK890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
HTK601	Air Traffic Management and Aircraft Performance II					3+0	7.5
HTK603	Models and Simulation in Air Traffic Management II					3+0	7.5
HTK604	Aviation Safety Management Application					3+0	7.5
HTK605	New Concepts and Visions in Air Traffic					3+0	7.5
HTK606	Advanced Aircraft Controls and Navigation II					3+0	7.5
HTK607	Measuring of Quality and Customer Satisfaction in Air Traffic Control Services					3+0	7.5
HTK609	Air Traffic Management and Environment					3+0	7.5
HTK610	Cost Analysis in Air Traffic Management					3+0	7.5
HTK611	Artificial Intelligence Applications in Air Traffic Control					3+0	7.5
HTK613	Universal Design in Air Traffic Control					3+0	7.5
HTK615	Critical Questioning in Air Traffic Control					3+0	7.5
SHA601	Airline Management					3+0	7.5
SHA602	Aircraft Dynamics					3+0	7.5
SHA608	Optimization Methods in Flight Mechanics					3+0	7.5
SHA614	Airport Design					3+0	7.5
SHA626	Genetic Algorithms and Applications of Control Systems					3+0	7.5
SHA628	Airspace Management					3+0	7.5
SHA632	Free Flight Concept and Analysis					3+0	7.5
TAÇ801	Thesis Research Study Course					3+0	7.5
UHT901	Research in Area of Specialization					5+0	7.5
UHT902	Research in Area of Specialization					5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
HTK501	Air Traffic Management and Aircraft Performance I	3+0	7.5	HTK502	Models and Simulation in Air Traffic Management I	3+0	7.5

	<i>Seçmeli Dersler</i>	--	22.5	HTK592	Seminar	3+0	7.5
				SHA538	Flight Procedures And Airspace Design	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			-----				-----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
HTK790	Thesis	0+1	30.0	HTK790	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
HTK504	Air Traffic Flow Management and Airspace Capacity Analysis					3+0	7.5
HTK505	Multi-Criteria Decision-Making					3+0	7.5
HTK506	Statistical Analysis for Air Traffic System					3+0	7.5
HTK507	Research Methods for Air Traffic System					3+0	7.5
HTK508	Human Factors in Air Traffic Control					3+0	7.5
HTK509	Real Time Simulation and Data Analysis in Air Traffic Control					3+0	7.5
HTK510	Advanced Aircraft Controls and Navigation I					3+0	7.5
HTK511	Air Traffic System and Evulation Criterion					3+0	7.5
HTK512	Performance Based Navigation and Design Methods					3+0	7.5
HTK513	Quantitative and Qalitative Research Methods in Air Traffic Control					3+0	7.5
HTK515	Human-Computer Interactin in Air Traffic Control					3+0	7.5
HTK517	Scientific Research Projects in Air Traffic Control					3+0	7.5
HTK519	Dynamic Airspace Management					3+0	7.5
HTK520	Air Traffic Management and Environmental Impacts					3+0	7.5
HTK521	System Analysis and Desing					3+0	7.5
HTK522	Airspace Capacity and Traffic Flow Optimization					3+0	7.5
HTK524	Use of Decision Models for the Solutions of Air Traffic Management Problems					3+0	7.5
TAÇ701	Thesis Research Study Course					3+0	7.5
UHT701	Research in Area of Specialization					3+0	4.5
UHT702	Research in Area of Specialization					3+0	4.5

## DEPARTMENT OF AIR TRAFFIC CONTROL

Head :

### DOCTORATE DEGREE (PH.D)

#### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	HTK692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			-----				-----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	HTK890-0	Thesis (Thesis Proposal)	0+1	30.0

			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
HTK890	Thesis	0+1	30.0	HTK890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
HTK890	Thesis	0+1	30.0	HTK890	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HTK601	Air Traffic Management and Aircraft Performance II	3+0	7.5
HTK603	Models and Simulation in Air Traffic Management II	3+0	7.5
HTK604	Aviation Safety Management Application	3+0	7.5
HTK605	New Concepts and Visions in Air Traffic	3+0	7.5
HTK606	Advanced Aircraft Controls and Navigation II	3+0	7.5
HTK607	Measuring of Quality and Customer Satisfaction in Air Traffic Control Services	3+0	7.5
HTK609	Air Traffic Management and Environment	3+0	7.5
HTK610	Cost Analysis in Air Traffic Management	3+0	7.5
HTK611	Artificial Intelligence Applications in Air Traffic Control	3+0	7.5
HTK612	Metaheuristic Algorithms for Air Traffic Control	3+0	7.5
HTK613	Universal Design in Air Traffic Control	3+0	7.5
HTK615	Critical Questioning in Air Traffic Control	3+0	7.5
SHA601	Airline Management	3+0	7.5
SHA602	Aircraft Dynamics	3+0	7.5
SHA608	Optimization Methods in Flight Mechanics	3+0	7.5
SHA614	Airport Design	3+0	7.5
SHA626	Genetic Algorithms and Applications of Control Systems	3+0	7.5
SHA628	Airspace Management	3+0	7.5
SHA632	Free Flight Concept and Analysis	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UHT901	Research in Area of Specialization	5+0	7.5
UHT902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
HTK501	Air Traffic Management and Aircraft Performance I	3+0	7.5	HTK502	Models and Simulation in Air Traffic Management I	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	HTK592	Seminar	3+0	7.5
				SHA538	Flight Procedures And Airspace Design	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
HTK790	Thesis	0+1	30.0	HTK790	Thesis	0+1	30.0

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30.0 -----  
30.0

**Elective Courses**

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HTK504	Air Traffic Flow Management and Airspace Capacity Analysis	3+0	7.5
HTK505	Multi-Criteria Decision-Making	3+0	7.5
HTK506	Statistical Analysis for Air Traffic System	3+0	7.5
HTK507	Research Methods for Air Traffic System	3+0	7.5
HTK508	Human Factors in Air Traffic Control	3+0	7.5
HTK509	Real Time Simulation and Data Analysis in Air Traffic Control	3+0	7.5
HTK510	Advanced Aircraft Controls and Navigation I	3+0	7.5
HTK511	Air Traffic System and Evaluation Criterion	3+0	7.5
HTK512	Performance Based Navigation and Design Methods	3+0	7.5
HTK513	Quantitative and Qalitative Research Methods in Air Traffic Control	3+0	7.5
HTK515	Human-Computer Interactin in Air Traffic Control	3+0	7.5
HTK517	Scientific Research Projects in Air Traffic Control	3+0	7.5
HTK519	Dynamic Airspace Management	3+0	7.5
HTK520	Air Traffic Management and Environmental Impacts	3+0	7.5
HTK521	System Analysis and Desing	3+0	7.5
HTK522	Airspace Capacity and Traffic Flow Optimization	3+0	7.5
HTK524	Use of Decision Models for the Solutions of Air Traffic Management Problems	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UHT701	Research in Area of Specialization	3+0	4.5
UHT702	Research in Area of Specialization	3+0	4.5

**DEPARTMENT OF AVIONICS**

Head :

**DOCTORATE DEGREE (PH.D)**

**PROGRAM**

<b>I.Semester</b>				<b>II.Semester</b>			
	<i>Seçmeli Dersler</i>	-	30.0	HEE692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			-----				-----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
DYS000	Qualifying Exam	0+0	0.0	HEE890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				-----
			--				30.0
<b>V.Semester</b>				<b>VI.Semester</b>			
HEE890	Thesis	0+1	30.0	HEE890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

<b>VII.Semester</b>				<b>VIII.Semester</b>			
HEE890	Thesis	0+1	30.0	HEE890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

#### Elective Courses

FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
HEE602	Signal Processing in Receivers of Satellite Based Navigation System					3+0	7.5
HEE610	Systems of Modern Gas Turbine Engines					3+0	7.5
HEE611	Space Propulsion Systems, Sensors and Instruments					3+0	7.5
HEE613	Soft Computing in Aviation					3+0	7.5
HEE615	Dielectric Properties of Polymer Materials					3+0	7.5
SHA601	Airline Management					3+0	7.5
SHA602	Aircraft Dynamics					3+0	7.5
SHA604	Engineering Economic Analysis					3+0	7.5
SHA608	Optimization Methods in Flight Mechanics					3+0	7.5
SHA614	Airport Design					3+0	7.5
SHA618	Fault Tolerant Flight Control System Design					3+0	7.5
SHA620	Aircraft Performance and Operational Analysis II					3+0	7.5
SHA626	Genetic Algorithms and Applications of Control Systems					3+0	7.5
TAÇ801	Thesis Research Study Course					3+0	7.5
UHE901	Research in Area of Specialization					5+0	7.5
UHE902	Research in Area of Specialization					5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
HEE501	Satellite Based Navigation Systems	3+0	7.5	HEE592	Seminar	3+0	7.5
SHA511	Aircraft Performance And Operation Analysis I	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			-----				-----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
HEE790	Thesis	0+1	30.0	HEE790	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

#### Elective Courses

FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
HEE502	Sensors and Transducers					3+0	7.5
HEE511	Fundamental Measurement Methods in Aviation					3+0	7.5
HEE512	Aviation Applications with Matlab					3+0	7.5
HEE514	Fundamental Sensor Technologies					3+0	7.5
SHA524	Modern Control Systems					3+0	7.5
SHA525	CNS-ATM Systems					3+0	7.5
SHA536	Flight Control System Design					3+0	7.5
SHA545	Fuzzy Logic Applications in Aviation					3+0	7.5
SHA547	Flight Tests and Instrumentation					3+0	7.5
SHA554	Aviation Lighting Technics					3+0	7.5
TAÇ701	Thesis Research Study Course					3+0	7.5
UHE701	Research in Area of Specialization					3+0	4.5

UHE702

Research in Area of Specialization

3+0 4.5

**DEPARTMENT OF AVIATION MANAGEMENT**

Head

:

**DOCTORATE DEGREE (PH.D)****PROGRAM**

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	SHY692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	SHY890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
SHY890	Thesis	0+1	30.0	SHY890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
SHY890	Thesis	0+1	30.0	SHY890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
ARY621	Structural Equation Modeling					3+0	7.5
ARY626	Qualitative Research Methods					3+0	7.5
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
PZL610	Consumer Behaviours					3+0	7.5
SHY609	Airport Planning					3+0	7.5
SHY610	Airport Operations and Management					3+0	7.5
SHY612	Corporate Strategies in Aviation Business					3+0	7.5
SHY613	Fleet Planning and Aircraft Selection Practices					3+0	7.5
SHY615	Current Marketing Practices Air Transportation					3+0	7.5
SHY616	Current Management Practices in Air Transportation					3+0	7.5
SHY617	Simulation and Applications in Aviation					3+0	7.5
SHY619	Digital Transformation in Aviation					3+0	7.5
SHY620	Human Resources Applications in Aviation					3+0	7.5
SHY621	Airline Cost Analysis					3+0	7.5
SHY622	Airline Management Strategies					3+0	7.5
SHY623	Micro Organization Theory and Aviation Practices I					3+0	7.5
SHY625	Power and Politics in Organization Theories: Applications to Aviation					3+0	7.5
SHY626	Change Management in Aviation					3+0	7.5



SHY627	Behavioral Finance and Aviation Applications	3+0	7.5
SHY628	Micro Organization Theory and Applications in Aviation	3+0	7.5
SHY630	Micro Organization Theory and Aviation Practices II	3+0	7.5
SHY632	Airline Marketing Strategies	3+0	7.5
SHY634	Strategic HR Management and Aviation Applications	3+0	7.5
SHY636	Global Leadership and Critical Decision Making in Aviation	3+0	7.5
SHY638	Lean Management and Cases and Insights from Aviation Industry	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
USH901	Research in Area of Specialization	5+0	7.5
USH902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
ARY535	Quantitative Research Methods	3+0	7.5	ARY524	Qualitative Research Design	3+0	7.5
SHY540	Air Transportation Management	3+0	7.5	SHY592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
SHY790	Thesis	0+1	30.0	SHY790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
SHY517	Aviation Safety Management	3+0	7.5
SHY527	Air Transportation Economics	3+0	7.5
SHY529	Cost Management in Aviation Companies	3+0	7.5
SHY531	Crisis and Risk Management in Aviation	3+0	7.5
SHY534	Service Marketing in Airline Industry	3+0	7.5
SHY536	Aviation and The Environment	3+0	7.5
SHY538	Case Studies in Aviation Management	3+0	7.5
SHY541	Marketing Management in Airlines	3+0	7.5
SHY542	Financing Applications in Air Transportation	3+0	7.5
SHY544	Airport Safety, Operations and Management	3+0	7.5
SHY545	Operations Management in Aviation	3+0	7.5
SHY546	Management and Leadership	3+0	7.5
SHY547	Supply Chain Management in Aviation	3+0	7.5
SHY548	Data Mining Applications in Aviation	3+0	7.5
SHY549	Strategic Management and Planning in Aviation	3+0	7.5
SHY551	Contemporary Approaches to Management	3+0	7.5
SHY555	Sustainability in Aviation Businesses	3+0	7.5
SHY557	Aviation Analytics	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
USH701	Research in Area of Specialization	3+0	4.5
USH702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF INTERIOR ARCHITECTURE

Head

: Prof.Dr. Onur ÜLKER

## PROFICIENCY IN ARTS

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
iÇT601	Design Researches Workshop I	3+0	7.5	iÇT602	Design Researches Workshop II	3+0	7.5
iÇT615	Lighting Design and Technology <i>Seçmeli Dersler</i>	3+0	7.5	iÇT692	Seminar	3+0	7.5
		--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
DYS000	Qualifying Exam	0+0	0.0	iÇT890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
<b>V.Semester</b>				<b>VI.Semester</b>			
iÇT890	Thesis	0+1	30.0	iÇT890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>VII.Semester</b>				<b>VIII.Semester</b>			
iÇT890	Thesis	0+1	30.0	iÇT890	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
iÇT603	Spatial Relationships and Interfaces	3+0	7.5
iÇT605	Globalisation, Identity and Design	3+0	7.5
iÇT606	Aesthetic Criticism on Interior Design	3+0	7.5
iÇT607	Earthquake Security and Space Design	3+0	7.5
iÇT609	Analytical Approach on Interior Design	3+0	7.5
iÇT611	Consumption and Design	3+0	7.5
iÇT612	Formation of Determination of Semantic Quality in Interiors	3+0	7.5
iÇT613	New Museology-Cultural Heritage and Museum Space Design	3+0	7.5
iÇT616	Bending Furniture Design and Manufacturing Technology	3+0	7.5
iÇT617	User Experience Design Research	3+0	7.5
iÇT619	Methodology for Design Research	3+0	7.5
iÇT621	Housing and Changing Boundaries of the House	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UiÇ901	Research in Area of Specialization	5+0	7.5
UiÇ902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

## PROGRAM

I.Semester				II.Semester			
iÇT513	Design Studio I	3+0	7.5	iÇT514	Design Studio II	3+0	7.5
iÇT529	Design Studies	3+0	7.5	iÇT592	Seminar	3+0	7.5
iÇT531	Interior Space	3+0	7.5		<i>Seçmeli Dersler</i>	--	15.0
	<i>Seçmeli Dersler</i>	--	7.5				
			----				----
			30.0				30.0
III.Semester				IV.Semester			
iÇT790	Thesis	0+1	30.0	iÇT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
iÇT503	Design Theory I	2+0	7.5
iÇT504	Design Theory II	2+0	7.5
iÇT507	Furniture design and Conceptual Approaches	3+0	7.5
iÇT517	Professional Ethics	3+0	7.5
iÇT518	Continuity in Interior and Environmental Design	3+0	7.5
iÇT519	Psychology and Space	3+0	7.5
iÇT521	20th Century Interior Design History	3+0	7.5
iÇT524	Human/User Centered Space Design	3+0	7.5
iÇT525	Material Design	3+0	7.5
iÇT527	Computer Aided Manufacturing and Practice	3+0	7.5
iÇT528	Composite Material Technology	3+0	7.5
iÇT533	User Experience Research	3+0	7.5
iÇT552	Corporate Identity and Space Design	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiÇ701	Research in Area of Specialization	3+0	4.5
UiÇ702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF ADVANCED TECHNOLOGIES

Head :

### DOCTORATE DEGREE (PH.D)

### ENERGY TECHNOLOGY (DOKTORA) (INTERDISCIPLINARY)

## PROGRAM

I.Semester		II.Semester	
<i>Seçmeli Dersler</i>	- 30.0	İTE692	Seminar 3+0 7.5
	-		

					<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	İTE890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
İTE890	Thesis	0+1	30.0	İTE790	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
İTE601	Biomass and Conversion Technology					3+0	7.5
İTE602	Environmental and Economic Impacts of Nuclear Energy					3+0	7.5
İTE604	Smart Grid Optimization					3+0	7.5
İTE605	Electric Power Generation, Transmission and Distribution					3+0	7.5
İTE606	Energy and Natural Resources Security					3+0	7.5
İTE607	Characterization of Materials Used in Energy Applications					3+0	7.5
İTE608	Electrochemical Energy Conversion and Storage					3+0	7.5
İTE610	Environment and Textile					3+0	7.5
İTE612	Carbon Tax and Applications					3+0	7.5
UİT901	Research in Area of Specialization					5+0	7.5
UİT902	Research in Area of Specialization					5+0	7.5

## PROGRAM IN NANOTECHNOLOGY (ENGLISH)

<b>PROGRAM</b>							
	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	İTN692 (Eng)	Seminar	3+0	7.5
			-				
			----		<i>Seçmeli Dersler</i>	--	22.5
			30.0				----
							30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	İTN890-0 (Eng)	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
İTN890 (Eng)	Thesis	0+1	30.0	İTN890 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
İTN890 (Eng)	Thesis	0+1	30.0	İTN890 (Eng)	Thesis	0+1	30.0

-----  
30.0

### Elective Courses

FBE510 (Eng)	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
İTN609 (Eng)	Fundamentals of Semiconductor Devices and Technology	3+0	7.5
İTN610 (Eng)	Nano Imaging and Nano Analysis	3+0	7.5
İTN611 (Eng)	Applied Quantum Mechanics	3+0	7.5
İTN612 (Eng)	Molecular Beam Epitaxy:Principles and Applications	3+0	7.5
İTN613 (Eng)	Photovoltaics and Solar Energy Materials	3+0	7.5
İTN614 (Eng)	Nuclear Magnetic Resonance Spectroscopy	3+0	7.5
İTN615 (Eng)	Electron Backscattered Diffractometry	3+0	7.5
İTN617 (Eng)	Advanced Topics in Nanotechnology	3+0	7.5
İTN619 (Eng)	Computation,Simulation and Modelling in Nanotechnology	3+0	7.5
İTN620 (Eng)	Properties and Synthesis of Carbon Nanomaterials	3+0	7.5
İTN621 (Eng)	Focussed Ion Beam Techniques for Nanofabrication	3+0	7.5
İTN622 (Eng)	Soft Materials	3+0	7.5
İTN623 (Eng)	Reticular Materials	3+0	7.5
İTN625 (Eng)	Advanced Functional Materials	3+0	7.5
TAÇ801 (Eng)	Thesis Research Study	3+0	7.5
UİT901 (Eng)	Research in Area of Specialization	5+0	7.5
UİT902 (Eng)	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN BIOTECHNOLOGY

Advanced Technologies Research Unit was founded in 2004 in order to plan, coordinate and to put in application the interdisciplinary research projects which will be performed according to the scientific and technological priorities of the 21st century. Mission of the Advanced Technologies Research Unit: -Determining the science and technology platform of Anadolu University -Performing interdisciplinary projects -Improving University-Industry collaboration -Tending to be a technology center Mission of the Advanced Technologies Research Unit: Providing Anadolu University to have an important position at the field of science and technology both in Turkey and in the world, and to be a center of excellence at certain fields. Advanced Technologies Research Unit has three sub-units: -Nanotechnology -Biotechnology -Documenting Cultural Heritage

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
İTB501	Biotechnology	3+0	7.5	İTB504	Biotechnology Laboratory Techniques II	3+0	7.5
İTB503	Biotechnology Laboratory Techniques I	3+0	7.5	İTB592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			-----				-----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
İTB790	Thesis	0+1	30.0	İTB790	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

### Elective Courses

BiY530	Plant Tissue Culture	3+0	7.5
BiY531	Immunology	3+0	7.5
BiY539	Microbial Enzymes and Biotechnology	3+0	7.5

BiY545	Advanced Biochemistry	3+0	7.5
BiY548	Modern Biotechnology	3+0	7.5
BiY551	Stem Cell Biology	3+0	7.5
BiY614	Basic Bioinformatics	3+0	7.5
BiY621	Advanced Molecular Genetics	3+0	7.5
ÇEV530	Anaerobic Biotechnology for the Treatment of Wastes	3+0	7.5
ÇEV616	Advanced Disinfection Techniques	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
FKG510	Pharmacobiotechnology	3+0	7.5
FKL501	Experimental Pharmacology	3+0	7.5
FTK501	Advanced Toxicology	3+0	7.5
İTB505	Biomaterials	3+0	7.5
İTB506	Drug Design and Application	3+0	7.5
İTB507	Biometer	3+0	7.5
İTB508	Applications of High Performance Liquid Chromatography in Biotechnology	3+0	7.5
İTB509	Biotechnological Production of Medicine Raw Materials	3+0	7.5
İTB510	Biosensors and Their Basic Principles	3+0	7.5
İTB511	DNA Vaccines and Viral Vector	3+0	7.5
İTB513	Antisense Technology and its Applications	3+0	7.5
İTB515	Microorganisms in Bioelectrochemical Systems	3+0	7.5
İTB517	Biosafety in Microbiology Laboratory	3+0	7.5
İTB519	Microbial Bioremediation and Biodegradation	3+0	7.5
İTB521	Microbial Biotechnology	3+0	7.5
İTB523	Molecular Pharmacological Methods	2+1	7.5
İTB525	Introduction to Synthetic Biology and Metabolic Engineering	3+0	7.5
İTB526	Advanced Chromatographic Techniques	3+0	7.5
İTB527	Biological Screening Tests of Natural Products	3+0	7.5
İTB529	Separation and Purification Techniques of Biomolecules	3+0	7.5
İTB531	Electrochemical Biosensors	3+0	7.5
İTB533	Gas Chromatography and Applications in Biotechnology	2+1	7.5
İTB535	Gene Therapy Techniques	3+0	7.5
KİM609	Advanced Polymer Chemistry	3+0	7.5
KMH516	Physical Operations in Food Technologies	3+0	7.5
KMH518	New and Renewable Energy Sources	3+0	7.5
MAT517	Applied Mathematics	3+0	7.5
MİM505	Ecological Planning and Design	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UİT701	Research in Area of Specialization	3+0	4.5
UİT702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ENERGY RESOURCES AND MANAGEMENT

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
İTE503	Energy Economics	3+0	7.5	İTE502	Sustainable Energy Management	3+0	7.5
İTE505	Renewable Energy Sources	3+0	7.5	İTE592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
İTE790	Thesis	0+1	30.0	İTE790	Thesis	0+1	30.0
			----				----
			30.0				30.0

**Elective Courses**

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
İTE516	Petroleum Refinery Engineering	3+0	7.5
İTE517	Cable Grouping Technique and Quality Control	3+0	7.5
İTE518	Using of Coal and Coal Technologies	3+0	7.5
İTE519	Solar Energy and its Applications	3+0	7.5
İTE520	Electrochemical Energy Conversion Systems	3+0	7.5
İTE521	Fuels and Combustion Technology	3+0	7.5
İTE522	Renewable Energy Sources and Smart Grids	3+0	7.5
İTE523	Coal Processing Technologies	3+0	7.5
İTE524	Energy Audit for Buildings	3+0	7.5
İTE525	Management of Energy Plant Wastes	3+0	7.5
İTE526	Wind Energy	4+0	7.5
İTE527	Energy Efficient Lighting Technologies	3+0	7.5
İTE528	Nuclear Energy and Politics	3+0	7.5
İTE529	Different Energy Sources, Sustainability and Life Cycle Assessment	3+0	7.5
İTE530	Energy Storage Devices and Applications	3+0	7.5
İTE531	Waste-to-Energy Systems Credit	3+0	7.5
İTE532	Electromagnetic Energy: From Motors to Laser	3+0	7.5
İTE533	Conventional Energy Resources	3+0	7.5
İTE534	Wind Turbine Design and Manufacturing Processes	3+0	7.5
İTE535	Power Plants and Generation Systems	3+0	7.5
İTE536	The Physics of Energy	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UIT701	Research in Area of Specialization	3+0	4.5
UIT702	Research in Area of Specialization	3+0	4.5

**PROGRAM IN NANOTECHNOLOGY**

Advanced Technologies Research Unit was founded in 2004 in order to plan, coordinate and to put in application the interdisciplinary research projects which will be performed according to the scientific and technological priorities of the 21st century. Mission of the Advanced Technologies Research Unit: -Determining the science and technology platform of Anadolu University -Performing interdisciplinary projects -Improving University-Industry collaboration -Tending to be a technology center Mission of the Advanced Technologies Research Unit: Providing Anadolu University to have an important position at the field of science and technology both in Turkey and in the world, and to be a center of excellence at certain fields. Advanced Technologies Research Unit has three sub-units: -Nanotechnology -Biotechnology -Documenting Cultural Heritage

**PROGRAM**

<b>I.Semester</b>				<b>II.Semester</b>			
İTN501	Atom and Molecular Structure	3+0	7.5	İTN503	Applications of Nanotechnology	3+0	7.5
İTN502	Nanotechnology <i>Seçmeli Dersler</i>	3+0	7.5	İTN592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
		--	15.0			--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
İTN790	Thesis	0+1	30.0	İTN790	Thesis	0+1	30.0
			----				----
			30.0				30.0

**Elective Courses**

ENT501	Industrial Design I	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
FİZ501	Mathematical Physics	3+0	7.5
FİZ508	Quantum Mechanics	3+0	7.5

FİZ514	Electromagnetic Wave Theory	3+0	7.5
FİZ624	Selected Topics in Semiconductors	3+0	7.5
İTN505	Nanocharacterisation I	3+0	7.5
İTN506	Nanocharacterisation II	3+0	7.5
İTN507	Nanomaterials	3+0	7.5
İTN508	Synthesis of Nanomaterials	3+0	7.5
İTN509	Nano-Biotechnology	3+0	7.5
İTN510	Structure Property Relationship in Nanomaterials	3+0	7.5
İTN511	Properties of Nanomaterials	3+0	7.5
İTN512	Nanodevices and Design	3+0	7.5
İTN513	Nanotechnology Applications in Textiles	3+0	7.5
İTN514	Nanomagnetism and Applications	3+0	7.5
İTN515	Epitaxial Crystal Structures and Applications	3+0	7.5
İTN517	Photovoltaic Technologies and Applications	4+0	7.5
KİM513	Chemical Thermodynamics	3+0	7.5
KİM525	Quantum Chemistry	3+0	7.5
KİM529	Catalytic Chemistry	3+0	7.5
KİM531	Modern Analysis Methods I	3+0	7.5
KİM532	Modern Analysis Methods II	3+0	3.0
KİM536	Chromatographic Techniques	3+0	7.5
KİM609	Advanced Polymer Chemistry	3+0	7.5
MAT517	Applied Mathematics	3+0	7.5
MLZ551	Mechanical Behavior of Materials	3+0	7.5
SRM503	Dielectric Materials and Devices	3+0	7.5
SRM506	Structure-Property Relationships in Ceramics	3+0	3.0
SRM521	X-Ray Diffraction Techniques in Materials Characterization	3+0	7.5
SRM528	Advanced Composite Materials	3+0	7.5
SRM602	Transmission Electron Microscopy and Interphase Boundaries	3+0	7.5
SRM608	Ferroelectrics Materials and Devices	3+0	7.5
SRM609	Scanning Electron Microscopy and Chemical Analysis Techniques	3+0	3.0
SRM612	Crystal Anisotropy	3+0	7.5
SRM614	Colloid Chemistry and Rheological Behaviour	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
ÜİT701	Research in Area of Specialization	3+0	4.5
ÜİT702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN NANOTECHNOLOGY (ENGLISH)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
İTN519 (Eng)	Introduction to Nanoscience and Nanotechnology	3+0	7.5	İTN524 (Eng)	Semiconductor Materials and Devices in Nanotechnology	3+0	7.5
İTN521 (Eng)	Nanotechnology and Society	3+0	7.5	İTN592 (Eng)	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
İTN790 (Eng)	Thesis	0+1	30.0	İTN790 (Eng)	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
FBE510	Ethics of Science and Research Techniques	2+0	7.5				
FBE510 (Eng)	Ethics of Science and Research Techniques	2+0	7.5				
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5				



FİZ552 (Eng)	Quantum Physics	3+0	7.5
İTN504 (Eng)	Mathematical Applications in Nanotechnology	3+0	7.5
İTN518 (Eng)	Experimental Techniques for Nanotechnology	3+0	7.5
İTN520 (Eng)	Synthesis of Nanoparticles	3+0	7.5
İTN522 (Eng)	Introduction to Micro and Nano Fabrication	3+0	7.5
İTN523 (Eng)	Physics and Technology for Infrared Detection	3+0	7.5
İTN525 (Eng)	Nano-Electronic Devices	3+0	7.5
İTN527 (Eng)	Basic Characterization Techniques in Nanotechnology	3+0	7.5
İTN528 (Eng)	Nanotechnology Sensors	3+0	7.5
İTN529 (Eng)	Machine Learning	3+0	7.5
İTN530 (Eng)	Nanobiosensors	3+0	7.5
İTN531 (Eng)	Computational Approaches in Nanomaterials	3+0	7.5
İTN532 (Eng)	X-Ray Diffraction in Analysis of Thin Films	3+0	7.5
İTN533 (Eng)	Nanotechnology and Biological Applications	3+0	7.5
İTN534 (Eng)	Chemistry and Applications of Organic Electronic Materials	3+0	7.5
İTN535 (Eng)	Transparent Ceramic and Glass-Ceramic Materials	3+0	7.5
İTN536 (Eng)	Atomistic Simulation Laboratory	2+1	7.5
İTN537 (Eng)	Deep Learning and Artificial Neural Networks	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
TAÇ701 (Eng)	Thesis Research Study	3+0	7.5
UİT701 (Eng)	Research in Area of Specialization	3+0	4.5
UİT702 (Eng)	Research in Area of Specialization	3+0	4.5

### (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

## PROGRAM IN ENERGY RESOURCES AND MANAGEMENT

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
İTE503	Energy Economics	3+0	7.5	İTE502	Sustainable Energy Management	3+0	7.5
İTE505	Renewable Energy Sources	3+0	7.5	İTE599	Semester Project	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0

### Elective Courses

İTE516	Petroleum Refinery Engineering	3+0	7.5
İTE517	Cable Grouping Technique and Quality Control	3+0	7.5
İTE518	Using of Coal and Coal Technologies	3+0	7.5
İTE519	Solar Energy and its Applications	3+0	7.5
İTE520	Electrochemical Energy Conversion Systems	3+0	7.5
İTE521	Fuels and Combustion Technology	3+0	7.5
İTE522	Renewable Energy Sources and Smart Grids	3+0	7.5
İTE523	Coal Processing Technologies	3+0	7.5
İTE524	Energy Audit for Buildings	3+0	7.5
İTE525	Management of Energy Plant Wastes	3+0	7.5
İTE526	Wind Energy	4+0	7.5
İTE527	Energy Efficient Lighting Technologies	3+0	7.5
İTE528	Nuclear Energy and Politics	3+0	7.5
İTE529	Different Energy Sources, Sustainability and Life Cycle Assessment	3+0	7.5
İTE531	Waste-to-Energy Systems Credit	3+0	7.5
İTE533	Conventional Energy Resources	3+0	7.5
İTE534	Wind Turbine Design and Manufacturing Processes	3+0	7.5

İTE535	Power Plants and Generation Systems					3+0	7.5
İTE536	The Physics of Energy					3+0	7.5

## PROGRAM IN DOCUMENTING CULTURAL HERITAGE

### PROGRAM

I.Semester				II.Semester			
BEL501	Terrestrial Photogrammetry and Laser Scanning	2+2	7.5	BEL599	Term Project	3+0	0.0
KOR525	Conservation History and Theories	3+0	7.5		<i>Seçmeli Dersler</i>	--	30.0
KOR527	Research and Documentation Methods in Protection	3+0	7.5				
	<i>Seçmeli Dersler</i>	--	7.5				
			----				----
			30.0				30.0

### Elective Courses

ARK546	Construction Elements in Archaic Age					3+0	7.5
ARK547	Architecture and Urbanization in Archaic Age					3+0	7.5
ARK567	Structural and Chemical Properties of Archaeological Structure Materials					3+0	7.5
BEL505	Construction History Researches					3+0	7.5
BEL507	Dating Methods Used in Archaeology					3+0	7.5
BEL509	Dating by OSL/TL Methods					3+0	7.5
BEL511	Application of SEM and X-ray Analysis Techniques on Archaeological Samples					3+0	7.5
BEL513	Archaeological Stratigraphy					4+0	7.5
KOR506	Technics of Documentation					3+0	7.5
KOR520	The Management of Cultural Heritage					3+0	7.5
KOR521	World Heritage Sites in Turkey					3+0	7.5
KOR545	Cultural Heritage And Accessibility					3+0	7.5
KOR610	Conservation of Rural Architectural Heritage					3+0	7.5
KOR613	New Touches to The Historical Texture					3+0	7.5
KOR614	Typological Readings in the Historical Environment					3+0	7.5
UCS519	Automated Mapping and Facility Management Systems					3+0	7.5
UCS533	Fundamentals of Mapping and Geographical Information Systems					3+0	7.5

## DEPARTMENT OF COMMUNICATION SCIENCES

Head :

### VISUAL COMMUNICATION AND DIGITAL MEDIA (MS) (WITHOUT THESIS)

### PROGRAM

I.Semester				II.Semester			
	<i>Seçmeli Dersler</i>	-	30.0	İLT599	Term Project	3+0	0.0
		-			<i>Seçmeli Dersler</i>	--	30.0
			----				----
			30.0				30.0

**Elective Courses**

iLT551	Digital Radio and Podcast Applications	3+0	7.5
iLT553	Data Mining and Applications	3+0	7.5
iLT554	Digital Citizenship	3+0	7.5
iLT555	Digital Audio Technology	3+0	7.5
iLT556	Big Data Applications	3+0	7.5
iLT557	Digital Publishing Applications	3+0	7.5
iLT558	Statistics for Social Sciences	3+0	7.5
iLT559	Media Analytics	3+0	7.5
iLT560	Digital Journalism	3+0	7.5
iLT561	Digital Media and Artificial Intelligence	3+0	7.5
iLT562	Web Design	3+0	7.5
iLT563	Media Theories and Digital Literacy	3+0	7.5
iLT564	Social Networking Approaches	3+0	7.5
iLT565	Digital Visual Culture and Applications	3+0	7.5
iLT566	Digital Corporate Communication	3+0	7.5
iLT567	Digital Sociology	3+0	7.5
iLT568	Digital Game Design	3+0	7.5
iLT569	Digital Media Ethics and Law	3+0	7.5
iLT571	Research Methods and Applications in Communication Studies	3+0	7.5
iLT572	Digital Media and Content Development	3+0	7.5
iLT574	Creative Scriptwriting and Digital Storytelling	3+0	7.5

**DEPARTMENT OF CIVIL ENGINEERING**

Head :

**DOCTORATE DEGREE (PH.D)****PROGRAM**

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	iNŞ692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	iNŞ890-0	Thesis (Thesis Proposal)	0+1	30.0
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			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
iNŞ890	Thesis	0+1	30.0	iNŞ890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
iNŞ890	Thesis	0+1	30.0	iNŞ890	Thesis	0+1	30.0

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30.0-----  
30.0

**Elective Courses**

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
iNŞ605	Mechanics of Continua I	3+0	7.5
iNŞ606	Mechanics of Continua II	3+0	7.5
iNŞ607	Soil Behavior	3+0	7.5
iNŞ611	Earthquake Engineering	3+0	7.5
iNŞ614	Project Management	3+0	7.5
iNŞ615	Quality Management in Construction	3+0	7.5
iNŞ616	Computational Hydraulics	3+0	7.5
iNŞ621	Soil Dynamics	3+0	7.5
iNŞ622	Measurement of Soil Properties	3+0	7.5
iNŞ623	In-situ Testing of Concrete	3+0	7.5
iNŞ626	Cross-Cultural Management in International Construction Projects	3+0	7.5
iNŞ627	Advanced Labor Health and Job Safety Management	3+0	7.5
iNŞ628	Knowledge Management in Construction	3+0	7.5
iNŞ629	Pavement Management Systems	3+0	7.5
iNŞ630	Experimental and Computational Methods to Characterize Bituminous Materials	3+0	7.5
iNŞ631	Design of Seismic Isolated Structures	3+0	7.5
iNŞ632	Design of Ductile Steel Structures	3+0	7.5
iNŞ633	Hydrological Forecasting and Early Warning Systems	3+0	7.5
iNŞ635	Seismic Performance Assessment of Buildings	3+0	7.5
iNŞ636	Experimental Design in Geotechnical Engineering	3+0	7.5
iNŞ637	Remote Sensing and Geographic Information Systems Applications in Water Resources	3+0	7.5
iNŞ639	Experimental Design in Structural Engineering	3+0	7.5
iNŞ642	Fluid Dynamics Simulation Based Design	3+0	7.5
iNŞ643	Seismic Isolator Tests, Characterization and Modeling	3+0	7.5
iNŞ645	Durability in Concrete Structures	3+0	7.5
iNŞ647	Designing with Geosynthetics in Civil Engineering	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UiN901	Research in Area of Specialization	5+0	7.5
UiN902	Research in Area of Specialization	5+0	7.5

**MASTER OF SCIENCE (MS) DEGREE**

**PROGRAM IN GEOTECHNIQUES**

**PROGRAM**

	<b>I.Semester</b>				<b>II.Semester</b>		
iNŞ577	Experimental Applications in Geotechnical Engineering	1+2	7.5	iNŞ592	Seminar	3+0	7.5
MEK501	Advanced Soil Mechanics <i>Seçmeli Dersler</i>	3+0	7.5	MAT517	Applied Mathematics <i>Seçmeli Dersler</i>	3+0	7.5
		--	15.0			--	15.0
			----- 30.0				----- 30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
iNŞ790	Thesis	0+1	30.0	iNŞ790	Thesis	0+1	30.0
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**Elective Courses**

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HiD501	Watershed Hydrology	3+0	7.5
iN\$503	Advanced Foundation Engineering	3+0	7.5
iN\$504	Soil Modeling	3+0	7.5
iN\$505	Slope Stability Analysis	3+0	7.5
iN\$509	River Hydraulics	3+0	7.5
iN\$510	Economic Analysis of Engineering Systems	3+0	7.5
iN\$511	Flood Control	3+0	7.5
iN\$513	Dams	3+0	7.5
iN\$514	Planning and Design of Dams	3+0	7.5
iN\$520	Advanced Groundwater Hydrology	3+0	7.5
iN\$526	Construction Management	3+0	7.5
iN\$528	Construction Cost Analysis and Estimating	3+0	7.5
iN\$531	Contract and Cost Management	3+0	7.5
iN\$536	Law in Construction Projects	3+0	7.5
iN\$539	Introduction to Finite Elements	3+0	7.5
iN\$541	Advanced Pavement Design	3+0	7.5
iN\$542	Neural Network Applications In Transportation Engineering	3+0	7.5
iN\$543	Theory of Elasticity	3+0	7.5
iN\$544	Structural Dynamics	3+0	7.5
iN\$545	Advanced Structural Analysis	3+0	7.5
iN\$546	Theory and Design for Tests and Measurements on Construction Materials	3+0	7.5
iN\$547	Urban Hydrology and Hydraulics	3+0	7.5
iN\$548	Applications of Geosynthetics	3+0	7.5
iN\$549	Deep Excavations and Retaining Structures	3+0	7.5
iN\$551	Repair and Strengthening of Structures	3+0	7.5
iN\$552	Advanced Railway Design	3+0	7.5
iN\$553	Advanced Highway Design	3+0	7.5
iN\$554	International Construction Project Management	3+0	7.5
iN\$556	Plastic Design of Steel Structures	3+0	7.5
iN\$557	Soil Structures and Ground Improvement Techniques	3+0	7.5
iN\$558	Hydrology of Floods and Droughts	3+0	7.5
iN\$559	Hydrologic Modeling	3+0	7.5
iN\$560	Bituminous Mixtures Design and Technology	3+0	7.5
iN\$561	Pavement Maintenance-Rehabilitation and Recycling Strategies	3+0	7.5
iN\$562	Applications of Soil Dynamics	3+0	7.5
iN\$563	Advances in Sediment Transport Research	3+0	7.5
iN\$564	Materials Science of Concrete	3+0	7.5
iN\$565	Cold-Formed Steel Structures	3+0	7.5
iN\$566	Similarity and Model Theory	3+0	7.5
iN\$567	Experimental Methods in Advanced Fluid Mechanics	3+0	7.5
iN\$568	Special Concretes	3+0	7.5
iN\$569	Design of Composite Structures	3+0	7.5
iN\$571	Geotechnical Engineering and Computer Applications	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiN701	Research in Area of Specialization	3+0	4.5
UiN702	Research in Area of Specialization	3+0	4.5

**PROGRAM IN HYDRAULICS****PROGRAM****I.Semester****II.Semester**

iNŞ519	Water Resources Systems	3+0	7.5	iNŞ592	Seminar	3+0	7.5
iNŞ547	Urban Hydrology and Hydraulics	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
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			30.0				30.0

### III.Semester

iNŞ790	Thesis	0+1	30.0
			----
			30.0

### IV.Semester

iNŞ790	Thesis	0+1	30.0
			----
			30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HiD501	Watershed Hydrology	3+0	7.5
iNŞ503	Advanced Foundation Engineering	3+0	7.5
iNŞ504	Soil Modeling	3+0	7.5
iNŞ505	Slope Stability Analysis	3+0	7.5
iNŞ508	Stochastic Methods in Hydrology	3+0	7.5
iNŞ509	River Hydraulics	3+0	7.5
iNŞ510	Economic Analysis of Engineering Systems	3+0	7.5
iNŞ511	Flood Control	3+0	7.5
iNŞ513	Dams	3+0	7.5
iNŞ514	Planning and Design of Dams	3+0	7.5
iNŞ520	Advanced Groundwater Hydrology	3+0	7.5
iNŞ526	Construction Management	3+0	7.5
iNŞ528	Construction Cost Analysis and Estimating	3+0	7.5
iNŞ531	Contract and Cost Management	3+0	7.5
iNŞ539	Introduction to Finite Elements	3+0	7.5
iNŞ541	Advanced Pavement Design	3+0	7.5
iNŞ542	Neural Network Applications In Transportation Engineering	3+0	7.5
iNŞ543	Theory of Elasticity	3+0	7.5
iNŞ544	Structural Dynamics	3+0	7.5
iNŞ545	Advanced Structural Analysis	3+0	7.5
iNŞ546	Theory and Design for Tests and Measurements on Construction Materials	3+0	7.5
iNŞ548	Applications of Geosynthetics	3+0	7.5
iNŞ549	Deep Excavations and Retaining Structures	3+0	7.5
iNŞ551	Repair and Strengthening of Structures	3+0	7.5
iNŞ552	Advanced Railway Design	3+0	7.5
iNŞ553	Advanced Highway Design	3+0	7.5
iNŞ554	International Construction Project Management	3+0	7.5
iNŞ556	Plastic Design of Steel Structures	3+0	7.5
iNŞ557	Soil Structures and Ground Improvement Techniques	3+0	7.5
iNŞ558	Hydrology of Floods and Droughts	3+0	7.5
iNŞ559	Hydrologic Modeling	3+0	7.5
iNŞ560	Bituminous Mixtures Design and Technology	3+0	7.5
iNŞ561	Pavement Maintenance-Rehabilitation and Recycling Strategies	3+0	7.5
iNŞ563	Advances in Sediment Transport Research	3+0	7.5
iNŞ564	Materials Science of Concrete	3+0	7.5
iNŞ565	Cold-Formed Steel Structures	3+0	7.5
iNŞ566	Similarity and Model Theory	3+0	7.5
iNŞ567	Experimental Methods in Advanced Fluid Mechanics	3+0	7.5
iNŞ568	Special Concretes	3+0	7.5
iNŞ569	Design of Composite Structures	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiN701	Research in Area of Specialization	3+0	4.5
UiN702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN MECHANICS

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
İNŞ573	Computer Programing for Structural Engineering	3+0	7.5	İNŞ522	Matrix Methods for Computing Structural Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	İNŞ592	Seminar	3+0	7.5
				MAT517	Applied Mathematics	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			-----				-----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
İNŞ790	Thesis	0+1	30.0	İNŞ790	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HİD501	Watershed Hydrology	3+0	7.5
İNŞ503	Advanced Foundation Engineering	3+0	7.5
İNŞ504	Soil Modeling	3+0	7.5
İNŞ505	Slope Stability Analysis	3+0	7.5
İNŞ509	River Hydraulics	3+0	7.5
İNŞ510	Economic Analysis of Engineering Systems	3+0	7.5
İNŞ511	Flood Control	3+0	7.5
İNŞ513	Dams	3+0	7.5
İNŞ514	Planning and Design of Dams	3+0	7.5
İNŞ520	Advanced Groundwater Hydrology	3+0	7.5
İNŞ526	Construction Management	3+0	7.5
İNŞ528	Construction Cost Analysis and Estimating	3+0	7.5
İNŞ531	Contract and Cost Management	3+0	7.5
İNŞ539	Introduction to Finite Elements	3+0	7.5
İNŞ541	Advanced Pavement Design	3+0	7.5
İNŞ542	Neural Network Applications In Transportation Engineering	3+0	7.5
İNŞ543	Theory of Elasticity	3+0	7.5
İNŞ544	Structural Dynamics	3+0	7.5
İNŞ545	Advanced Structural Analysis	3+0	7.5
İNŞ546	Theory and Design for Tests and Measurements on Construction Materials	3+0	7.5
İNŞ547	Urban Hydrology and Hydraulics	3+0	7.5
İNŞ548	Applications of Geosynthetics	3+0	7.5
İNŞ549	Deep Excavations and Retaining Structures	3+0	7.5
İNŞ551	Repair and Strengthening of Structures	3+0	7.5
İNŞ552	Advanced Railway Design	3+0	7.5
İNŞ553	Advanced Highway Design	3+0	7.5
İNŞ554	International Construction Project Management	3+0	7.5
İNŞ556	Plastic Design of Steel Structures	3+0	7.5
İNŞ557	Soil Structures and Ground Improvement Techniques	3+0	7.5
İNŞ558	Hydrology of Floods and Droughts	3+0	7.5
İNŞ559	Hydrologic Modeling	3+0	7.5
İNŞ560	Bituminous Mixtures Design and Technology	3+0	7.5
İNŞ561	Pavement Maintenance-Rehabilitation and Recycling Strategies	3+0	7.5
İNŞ563	Advances in Sediment Transport Research	3+0	7.5
İNŞ564	Materials Science of Concrete	3+0	7.5

iNŞ565	Cold-Formed Steel Structures	3+0	7.5
iNŞ566	Similarity and Model Theory	3+0	7.5
iNŞ567	Experimental Methods in Advanced Fluid Mechanics	3+0	7.5
iNŞ568	Special Concretes	3+0	7.5
iNŞ569	Design of Composite Structures	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiN701	Research in Area of Specialization	3+0	4.5
UiN702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN TRANSPORTATION

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
iNŞ575	Rigid Pavements	3+0	7.5	iNŞ552	Advanced Railway Design	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	iNŞ592	Seminar	3+0	7.5
				MAT517	Applied Mathematics	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
iNŞ790	Thesis	0+1	30.0	iNŞ790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HiD501	Watershed Hydrology	3+0	7.5
iNŞ503	Advanced Foundation Engineering	3+0	7.5
iNŞ504	Soil Modeling	3+0	7.5
iNŞ505	Slope Stability Analysis	3+0	7.5
iNŞ509	River Hydraulics	3+0	7.5
iNŞ510	Economic Analysis of Engineering Systems	3+0	7.5
iNŞ511	Flood Control	3+0	7.5
iNŞ513	Dams	3+0	7.5
iNŞ514	Planning and Design of Dams	3+0	7.5
iNŞ520	Advanced Groundwater Hydrology	3+0	7.5
iNŞ526	Construction Management	3+0	7.5
iNŞ528	Construction Cost Analysis and Estimating	3+0	7.5
iNŞ531	Contract and Cost Management	3+0	7.5
iNŞ539	Introduction to Finite Elements	3+0	7.5
iNŞ540	Advanced Highway Materials	3+0	7.5
iNŞ541	Advanced Pavement Design	3+0	7.5
iNŞ542	Neural Network Applications In Transportation Engineering	3+0	7.5
iNŞ543	Theory of Elasticity	3+0	7.5
iNŞ544	Structural Dynamics	3+0	7.5
iNŞ545	Advanced Structural Analysis	3+0	7.5
iNŞ546	Theory and Design for Tests and Measurements on Construction Materials	3+0	7.5
iNŞ547	Urban Hydrology and Hydraulics	3+0	7.5
iNŞ548	Applications of Geosynthetics	3+0	7.5
iNŞ549	Deep Excavations and Retaining Structures	3+0	7.5
iNŞ551	Repair and Strengthening of Structures	3+0	7.5



iNŞ553	Advanced Highway Design	3+0	7.5
iNŞ554	International Construction Project Management	3+0	7.5
iNŞ556	Plastic Design of Steel Structures	3+0	7.5
iNŞ557	Soil Structures and Ground Improvement Techniques	3+0	7.5
iNŞ558	Hydrology of Floods and Droughts	3+0	7.5
iNŞ559	Hydrologic Modeling	3+0	7.5
iNŞ560	Bituminous Mixtures Design and Technology	3+0	7.5
iNŞ561	Pavement Maintenance-Rehabilitation and Recycling Strategies	3+0	7.5
iNŞ563	Advances in Sediment Transport Research	3+0	7.5
iNŞ564	Materials Science of Concrete	3+0	7.5
iNŞ565	Cold-Formed Steel Structures	3+0	7.5
iNŞ566	Similarity and Model Theory	3+0	7.5
iNŞ567	Experimental Methods in Advanced Fluid Mechanics	3+0	7.5
iNŞ568	Special Concretes	3+0	7.5
iNŞ569	Design of Composite Structures	3+0	7.5
iNŞ629	Pavement Management Systems	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiN701	Research in Area of Specialization	3+0	4.5
UiN702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN CONSTRUCTION

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
iNŞ573	Computer Programing for Structural Engineering	3+0	7.5	iNŞ522	Matrix Methods for Computing Structural Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	iNŞ592	Seminar	3+0	7.5
				MAT517	Applied Mathematics	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
iNŞ790	Thesis	0+1	30.0	iNŞ790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HiD501	Watershed Hydrology	3+0	7.5
iNŞ503	Advanced Foundation Engineering	3+0	7.5
iNŞ504	Soil Modeling	3+0	7.5
iNŞ505	Slope Stability Analysis	3+0	7.5
iNŞ509	River Hydraulics	3+0	7.5
iNŞ510	Economic Analysis of Engineering Systems	3+0	7.5
iNŞ511	Flood Control	3+0	7.5
iNŞ513	Dams	3+0	7.5
iNŞ514	Planning and Design of Dams	3+0	7.5
iNŞ520	Advanced Groundwater Hydrology	3+0	7.5
iNŞ526	Construction Management	3+0	7.5
iNŞ528	Construction Cost Analysis and Estimating	3+0	7.5
iNŞ531	Contract and Cost Management	3+0	7.5

iNŞ539	Introduction to Finite Elements	3+0	7.5
iNŞ541	Advanced Pavement Design	3+0	7.5
iNŞ542	Neural Network Applications In Transportation Engineering	3+0	7.5
iNŞ543	Theory of Elasticity	3+0	7.5
iNŞ544	Structural Dynamics	3+0	7.5
iNŞ545	Advanced Structural Analysis	3+0	7.5
iNŞ546	Theory and Design for Tests and Measurements on Construction Materials	3+0	7.5
iNŞ547	Urban Hydrology and Hydraulics	3+0	7.5
iNŞ548	Applications of Geosynthetics	3+0	7.5
iNŞ549	Deep Excavations and Retaining Structures	3+0	7.5
iNŞ551	Repair and Strengthening of Structures	3+0	7.5
iNŞ552	Advanced Railway Design	3+0	7.5
iNŞ553	Advanced Highway Design	3+0	7.5
iNŞ554	International Construction Project Management	3+0	7.5
iNŞ556	Plastic Design of Steel Structures	3+0	7.5
iNŞ557	Soil Structures and Ground Improvement Techniques	3+0	7.5
iNŞ558	Hydrology of Floods and Droughts	3+0	7.5
iNŞ559	Hydrologic Modeling	3+0	7.5
iNŞ560	Bituminous Mixtures Design and Technology	3+0	7.5
iNŞ561	Pavement Maintenance-Rehabilitation and Recycling Strategies	3+0	7.5
iNŞ563	Advances in Sediment Transport Research	3+0	7.5
iNŞ564	Materials Science of Concrete	3+0	7.5
iNŞ565	Cold-Formed Steel Structures	3+0	7.5
iNŞ566	Similarity and Model Theory	3+0	7.5
iNŞ567	Experimental Methods in Advanced Fluid Mechanics	3+0	7.5
iNŞ568	Special Concretes	3+0	7.5
iNŞ569	Design of Composite Structures	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UİN701	Research in Area of Specialization	3+0	4.5
UİN702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN CONSTRUCTION MATERIALS

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
iNŞ555	Advanced Concrete Technology	3+0	7.5	iNŞ536	Law in Construction Projects	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	iNŞ592	Seminar	3+0	7.5
				MAT517	Applied Mathematics	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
iNŞ790	Thesis	0+1	30.0	iNŞ790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

ENM501	Design and Analysis of Experiments	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HiD501	Watershed Hydrology	3+0	7.5
iNŞ503	Advanced Foundation Engineering	3+0	7.5

iNŞ504	Soil Modeling	3+0	7.5
iNŞ505	Slope Stability Analysis	3+0	7.5
iNŞ509	River Hydraulics	3+0	7.5
iNŞ510	Economic Analysis of Engineering Systems	3+0	7.5
iNŞ511	Flood Control	3+0	7.5
iNŞ513	Dams	3+0	7.5
iNŞ514	Planning and Design of Dams	3+0	7.5
iNŞ520	Advanced Groundwater Hydrology	3+0	7.5
iNŞ526	Construction Management	3+0	7.5
iNŞ528	Construction Cost Analysis and Estimating	3+0	7.5
iNŞ531	Contract and Cost Management	3+0	7.5
iNŞ539	Introduction to Finite Elements	3+0	7.5
iNŞ541	Advanced Pavement Design	3+0	7.5
iNŞ542	Neural Network Applications In Transportation Engineering	3+0	7.5
iNŞ543	Theory of Elasticity	3+0	7.5
iNŞ544	Structural Dynamics	3+0	7.5
iNŞ545	Advanced Structural Analysis	3+0	7.5
iNŞ546	Theory and Design for Tests and Measurements on Construction Materials	3+0	7.5
iNŞ547	Urban Hydrology and Hydraulics	3+0	7.5
iNŞ548	Applications of Geosynthetics	3+0	7.5
iNŞ549	Deep Excavations and Retaining Structures	3+0	7.5
iNŞ551	Repair and Strengthening of Structures	3+0	7.5
iNŞ552	Advanced Railway Design	3+0	7.5
iNŞ553	Advanced Highway Design	3+0	7.5
iNŞ554	International Construction Project Management	3+0	7.5
iNŞ556	Plastic Design of Steel Structures	3+0	7.5
iNŞ557	Soil Structures and Ground Improvement Techniques	3+0	7.5
iNŞ558	Hydrology of Floods and Droughts	3+0	7.5
iNŞ559	Hydrologic Modeling	3+0	7.5
iNŞ560	Bituminous Mixtures Design and Technology	3+0	7.5
iNŞ561	Pavement Maintenance-Rehabilitation and Recycling Strategies	3+0	7.5
iNŞ563	Advances in Sediment Transport Research	3+0	7.5
iNŞ564	Materials Science of Concrete	3+0	7.5
iNŞ565	Cold-Formed Steel Structures	3+0	7.5
iNŞ566	Similarity and Model Theory	3+0	7.5
iNŞ567	Experimental Methods in Advanced Fluid Mechanics	3+0	7.5
iNŞ568	Special Concretes	3+0	7.5
iNŞ569	Design of Composite Structures	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiN701	Research in Area of Specialization	3+0	4.5
UiN702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN CONSTRUCTION MANAGEMENT

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
iNŞ554	International Construction Project Management	3+0	7.5	iNŞ536	Law in Construction Projects	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	iNŞ592	Seminar	3+0	7.5
				MAT517	Applied Mathematics	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			-----				-----
			30.0				30.0

<b>III.Semester</b>				<b>IV.Semester</b>			
iN\$790	Thesis	0+1	30.0	iN\$790	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

**Elective Courses**

FBE510	Ethics of Science and Research Techniques			2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)			2+0	7.5
HiD501	Watershed Hydrology			3+0	7.5
iN\$503	Advanced Foundation Engineering			3+0	7.5
iN\$504	Soil Modeling			3+0	7.5
iN\$505	Slope Stability Analysis			3+0	7.5
iN\$509	River Hydraulics			3+0	7.5
iN\$510	Economic Analysis of Engineering Systems			3+0	7.5
iN\$511	Flood Control			3+0	7.5
iN\$513	Dams			3+0	7.5
iN\$514	Planning and Design of Dams			3+0	7.5
iN\$520	Advanced Groundwater Hydrology			3+0	7.5
iN\$526	Construction Management			3+0	7.5
iN\$528	Construction Cost Analysis and Estimating			3+0	7.5
iN\$531	Contract and Cost Management			3+0	7.5
iN\$539	Introduction to Finite Elements			3+0	7.5
iN\$541	Advanced Pavement Design			3+0	7.5
iN\$542	Neural Network Applications In Transportation Engineering			3+0	7.5
iN\$543	Theory of Elasticity			3+0	7.5
iN\$544	Structural Dynamics			3+0	7.5
iN\$545	Advanced Structural Analysis			3+0	7.5
iN\$546	Theory and Design for Tests and Measurements on Construction Materials			3+0	7.5
iN\$547	Urban Hydrology and Hydraulics			3+0	7.5
iN\$548	Applications of Geosynthetics			3+0	7.5
iN\$549	Deep Excavations and Retaining Structures			3+0	7.5
iN\$551	Repair and Strengthening of Structures			3+0	7.5
iN\$552	Advanced Railway Design			3+0	7.5
iN\$553	Advanced Highway Design			3+0	7.5
iN\$556	Plastic Design of Steel Structures			3+0	7.5
iN\$557	Soil Structures and Ground Improvement Techniques			3+0	7.5
iN\$558	Hydrology of Floods and Droughts			3+0	7.5
iN\$559	Hydrologic Modeling			3+0	7.5
iN\$560	Bituminous Mixtures Design and Technology			3+0	7.5
iN\$561	Pavement Maintenance-Rehabilitation and Recycling Strategies			3+0	7.5
iN\$563	Advances in Sediment Transport Research			3+0	7.5
iN\$564	Materials Science of Concrete			3+0	7.5
iN\$565	Cold-Formed Steel Structures			3+0	7.5
iN\$566	Similarity and Model Theory			3+0	7.5
iN\$567	Experimental Methods in Advanced Fluid Mechanics			3+0	7.5
iN\$568	Special Concretes			3+0	7.5
iN\$569	Design of Composite Structures			3+0	7.5
MAT507	Applied Mathematics I			3+0	7.5
MAT508	Applied Mathematics II			3+0	7.5
TAÇ701	Thesis Research Study Course			3+0	7.5
UiN701	Research in Area of Specialization			3+0	4.5
UiN702	Research in Area of Specialization			3+0	4.5

**DEPARTMENT OF STATISTICS**

Head :

**DOCTORATE DEGREE (PH.D)**

## PROGRAM

		<b>I.Semester</b>			<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	iST692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
		<b>III.Semester</b>			<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	iST890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
		<b>V.Semester</b>			<b>VI.Semester</b>		
iST890	Thesis	0+1	30.0	iST890	Thesis	0+1	30.0
			----				----
			30.0				30.0
		<b>VII.Semester</b>			<b>VIII.Semester</b>		
iST890	Thesis	0+1	30.0	iST890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
	FBE510			Ethics of Science and Research Techniques		2+0	7.5
	FBE510-O			Ethics of Science and Research Techniques (Online)		2+0	7.5
	iST604			Econometric Models		3+0	7.5
	iST608			Mathematical Methods of Statistics		3+0	7.5
	iST610			Conjoint Analysis		3+0	7.5
	iST611			Pearson System I		3+0	7.5
	iST612			Pearson System II		3+0	7.5
	iST613			Artificial Neural Networks and Statistical Models I		3+0	7.5
	iST614			Artificial Neural Networks and Statistical Models II		3+0	7.5
	iST615			Mathematics Foundation in Regression Analysis I		3+0	7.5
	iST616			Mathematics Foundation in Regression Analysis II		3+0	7.5
	iST617			Modern Regression Techniques		3+0	7.5
	iST618			Information Theory and Statistics		3+0	7.5
	iST621			Advanced Circular Data Analysis		3+0	7.5
	iST622			Fuzzy Neural Integrated Systems		3+0	7.5
	iST623			Fuzzy Artificial Neural Networks		3+0	7.5
	iST625			Entropy Optimization Methods With Applications		3+0	7.5
	iST626			Numerical Methods in Modeling with Entropy Optimization Distributions		3+0	7.5
	iST627			Fundamentals of Stochastic Differential Equations		3+0	7.5
	iST628			Stochastic Differential Equations and Applications		3+0	7.5
	iST629			Stochastic Modeling and Analysis		3+0	7.5
	iST631			Robust Statistical Methods		3+0	7.5
	iST633			Data Visualization		3+0	7.5
	iST635			Advanced Theory of Statistics		3+0	7.5
	iST636			Econometric Modelling		3+0	7.5
	iST637			Stochastic Differential Equations I		3+0	7.5
	iST638			Stochastic Differential Equations II		3+0	7.5
	iST639			Fuzzy Statistics and Probability		3+0	7.5
	iST640			Advanced Experimental Design		3+0	7.5

iST641	Advanced Nonparametric Regresyon Models	3+0	7.5
iST642	Modeling with Stochastic Differential Equations	3+0	7.5
iST647	Reliability Theory	3+0	7.5
iST649	Stochastic Differential Equations	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UiS901	Research in Area of Specialization	5+0	7.5
UiS902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
iST506	The Theory of Measure and Probability	3+0	7.5	iST531	Linear Models	3+0	7.5
iST530	Theory of Statistics <i>Seçmeli Dersler</i>	3+0	7.5	iST592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
		--	15.0			--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
iST790	Thesis	0+1	30.0	iST790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

ARY505	Scientific Research Planning and Evaluation	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
iST505	Econometric Analysis	3+0	7.5
iST507	Circular Data Analysis	3+0	7.5
iST510	Nonparametric Statistical Techniques	3+0	7.5
iST511	Advanced Regression Analysis	3+0	7.5
iST512	Artificial Neural Networks and Statistics	3+0	7.5
iST514	Advanced Statistical Techniques for Researchers	3+0	7.5
iST517	Multiple Relation Techniques for Questionnaires Analysis	3+0	7.5
iST520	Maximum Entropy Method and Its Applications	3+0	7.5
iST521	Continuous Markov Processes	3+0	7.5
iST523	Nonparametric Models With Spline Regression	3+0	7.5
iST524	Generalized Additive Models With Spline Regression	3+0	7.5
iST528	Probabilistic Mixture Theory	3+0	7.5
iST532	Fuzzy Statistical Methods	3+0	7.5
iST536	Statistical Softwares	3+0	7.5
iST537	Actuarial Models	3+0	7.5
iST539	Statistical Simulation	3+0	7.5
iST540	Robust Statistical Methods and Applications	3+0	7.5
iST541	Time Series Analysis with Application	3+0	7.5
iST542	Sampling Theory and Methods	3+0	7.5
iST544	Nonparametric Regression Models	3+0	7.5
iST545	Statistical Analysis with Statistical Packages	3+0	7.5
iST551	Applied Multivariate Statistical Analysis	3+0	7.5
iST552	R For Data Science	3+0	7.5
iST553	Time Series Analysis with Application	3+0	7.5
iST554	Intelligent Optimization Techniques	3+0	7.5
iST555	Machine Learning with R	3+0	7.5
iST556	Statistics	3+0	7.5
iST557	Explainable Artificial Intelligence	3+0	7.5

iST559	Data Science with Julia	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UiS701	Research in Area of Specialization	3+0	4.5
UiS702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF CHEMISTRY

Head :

### DOCTORATE DEGREE (PH.D)

<b>PROGRAM</b>			
	<b>I.Semester</b>		<b>II.Semester</b>
	<i>Seçmeli Dersler</i>	- 30.0	Seminar
		-	3+0 7.5
		-	<i>Seçmeli Dersler</i>
		----	-- 22.5
		30.0	----
			30.0
	<b>III.Semester</b>		<b>IV.Semester</b>
DYS000	Qualifying Exam	0+0 0.0	Thesis (Thesis Proposal)
		---	0+1 30.0
		--	----
			30.0
	<b>V.Semester</b>		<b>VI.Semester</b>
KiM890	Thesis	0+1 30.0	Thesis
		----	0+1 30.0
		30.0	----
			30.0
	<b>VII.Semester</b>		<b>VIII.Semester</b>
KiM890	Thesis	0+1 30.0	Thesis
		----	0+1 30.0
		30.0	----
			30.0
<b>Elective Courses</b>			
EKiM610	X-Ray Photoelectron Spectroscopy and its Applications	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KiM601	Investigations of Mechanisms in Organic Chemistry I	3+0	7.5
KiM602	Investigations of Mechanisms in Organic Chemistry II	3+0	7.5
KiM603	Organic Synthesis	3+0	7.5
KiM606	Molecular Symmetry and Spectroscopy	3+0	7.5
KiM609	Advanced Polymer Chemistry	3+0	7.5
KiM612	Pericyclic Chemistry	3+0	7.5
KiM614	Conducting Polymers	3+0	7.5
KiM615	Chemistry of Drugs I	3+0	7.5
KiM616	Chemistry of Drugs II	3+0	7.5
KiM617	Statistical Thermodynamics	3+0	3.0
KiM618	Molecular Imprinted Polymers and Applications	3+0	7.5
KiM619	Organic Electrochemistry	3+0	7.5

KiM620	Surface Chemistry	3+0	3.0
KiM621	Supercritical Fluids	3+0	7.5
KiM622	Ion Selective Electrodes	3+0	7.5
KiM623	Affinity Chromatography	3+0	7.5
KiM624	Solvent Extraction Chemistry	3+0	7.5
KiM642	Photochemistry	3+0	7.5
KiM643	Named Reactions in Heterocyclic Chemistry	3+0	7.5
KiM644	Stereochemistry	3+0	7.5
KiM645	Bioorganic Chemistry	3+0	7.5
KiM646	Nanochemistry	3+0	7.5
KiM647	Molecular Structure Calculations and Theories	3+0	7.5
KiM648	Named Reactions in Organic Chemistry	3+0	7.5
KiM649	Organic Functional Group Preparations I	3+0	7.5
KiM650	Organic Functional Group Preparations II	3+0	7.5
KiM651	Biosensors	3+0	7.5
KiM654	Proteomics and Genomics	3+0	7.5
KiM657	Asymmetric Organic Synthesis I	3+0	7.5
KiM658	Asymmetric Organic Synthesis II	3+0	7.5
KiM659	Synthesis of Amino Acids and Peptides	3+0	7.5
KiM665	Bioorganometallic Chemistry	3+0	7.5
KiM667	Metals in Catalytic Reactions I	3+0	7.5
KiM669	Analytical Method Development and Validation	3+0	7.5
KiM675	Polymer-Clay Nanocomposites	3+0	7.5
KiM676	Applications of HPLC and Other Chromatographic Methods in Food Analysis	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UKM901	Research in Area of Specialization	5+0	7.5
UKM902	Research in Area of Specialization	5+0	7.5

## PROGRAM IN CHEMISTRY (DISTANCE LEARNING)

<b>PROGRAM</b>			
<b>I.Semester</b>			<b>II.Semester</b>
<i>Seçmeli Dersler</i>	-	30.0	KiM598
	-		Term Project
			3+0 0.0
			<i>Seçmeli Dersler</i>
			-- 30.0
		----	----
		30.0	30.0

### Elective Courses

KiM585	Name Reactions in Organic Chemistry	3+0	6.0
KiM586	Sensor Technology	3+0	6.0
KiM587	Alternative Reaction Systems	3+0	6.0
KiM588	Computational Chemistry Applications	0+3	6.0
KiM589	Adsorption	3+0	6.0
KiM591	Thermal and Surface Characterization Methods	3+0	6.0
KiM593	Applications of Modern Analysis Methods I	0+3	6.0
KiM594	Applications of Modern Analysis Methods II	0+3	6.0
KiM595	Analytical Method Development Validation	3+0	6.0
KiM596	Chemistry of Main Elements	3+0	6.0

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN ANALYTICAL CHEMISTRY



## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
KİM523	Complex Equilibria in Analytical Chemistry	3+0	7.5	KİM584	Modern Analysis Methods II	3+0	7.5
KİM583	Modern Analysis Methods I <i>Seçmeli Dersler</i>	3+0	7.5	KİM592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
		--	15.0			--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
KİM790	Thesis	0+1	30.0	KİM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EKİM510 (Eng)	Organic Chemistry of Biomaterials	3+0	7.5
EKİM513	Gas Chromatography and Applications	2+1	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KİM506	Polymer Chemistry	3+0	7.5
KİM509	Carbon-Carbon Bond Formation	3+0	7.5
KİM510	Advanced NMR Techniques	3+0	7.5
KİM511	Electrochemistry	3+0	7.5
KİM516	Physical Organic Chemistry	3+0	7.5
KİM517	Selected Topics in Inorganic Chemistry I	3+0	7.5
KİM521	Adsorption	3+0	7.5
KİM522	Bioanalytical Chemistry	3+0	7.5
KİM524	Bioinorganic Chemistry	3+0	7.5
KİM525	Quantum Chemistry	3+0	7.5
KİM526	Microwave Organic Synthesis	3+0	7.5
KİM529	Catalytic Chemistry	3+0	7.5
KİM533	Electroanalytical Chemistry	3+0	7.5
KİM535	Data Analysis in Chemistry	3+0	7.5
KİM536	Chromatographic Techniques	3+0	7.5
KİM537	Organic Macro Molecules	3+0	7.5
KİM539	Quantitative Structure Property Relationship	3+0	7.5
KİM550	Reagents In Organic Synthesis	3+0	7.5
KİM551	Sensors and Their Applications	3+0	7.5
KİM558	Biochromatography	3+0	7.5
KİM560	Alternative Reaction Systems	3+0	7.5
KİM561	Novel Tendencies in Liquid Chromatography	3+0	7.5
KİM562	Inorganic Polymers	3+0	7.5
KİM563	Natural Product Synthesis I	3+0	7.5
KİM564	Natural Product Synthesis II	3+0	7.5
KİM565	Literature Search in Chemistry	3+0	7.5
KİM566	Stereo Selective Reactions and Practical Approach	3+0	7.5
KİM567	Applications of Computational Chemistry	3+0	7.5
KİM568	Solvent-free Organic Synthesis	3+0	7.5
KİM569	Structure Determination of Organic Chemistry	3+0	7.5
KİM701	Physical Chemistry of Foods	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UKM701	Research in Area of Specialization	3+0	4.5
UKM702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN INORGANIC CHEMISTRY

## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
KİM534	Organometallic Chemistry	3+0	7.5	KİM515	Complexes Chemistry	3+0	7.5
KİM583	Modern Analysis Methods I	3+0	7.5	KİM518	Selected Topics in Inorganic Chemistry II	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0	KİM592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
KİM790	Thesis	0+1	30.0	KİM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EKİM510 (Eng)	Organic Chemistry of Biomaterials					3+0	7.5
EKİM513	Gas Chromatography and Applications					2+1	7.5
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
KİM506	Polymer Chemistry					3+0	7.5
KİM509	Carbon-Carbon Bond Formation					3+0	7.5
KİM510	Advanced NMR Techniques					3+0	7.5
KİM511	Electrochemistry					3+0	7.5
KİM516	Physical Organic Chemistry					3+0	7.5
KİM517	Selected Topics in Inorganic Chemistry I					3+0	7.5
KİM521	Adsorption					3+0	7.5
KİM522	Bioanalytical Chemistry					3+0	7.5
KİM524	Bioinorganic Chemistry					3+0	7.5
KİM525	Quantum Chemistry					3+0	7.5
KİM526	Microwave Organic Synthesis					3+0	7.5
KİM529	Catalytic Chemistry					3+0	7.5
KİM533	Electroanalytical Chemistry					3+0	7.5
KİM535	Data Analysis in Chemistry					3+0	7.5
KİM536	Chromatographic Techniques					3+0	7.5
KİM537	Organic Macro Molecules					3+0	7.5
KİM539	Quantitative Structure Property Relationship					3+0	7.5
KİM550	Reagents In Organic Synthesis					3+0	7.5
KİM551	Sensors and Their Applications					3+0	7.5
KİM558	Biochromatography					3+0	7.5
KİM560	Alternative Reaction Systems					3+0	7.5
KİM561	Novel Tendencies in Liquid Chromatography					3+0	7.5
KİM562	Inorganic Polymers					3+0	7.5
KİM563	Natural Product Synthesis I					3+0	7.5
KİM564	Natural Product Synthesis II					3+0	7.5
KİM565	Literature Search in Chemistry					3+0	7.5
KİM566	Stereo Selective Reactions and Practical Approach					3+0	7.5
KİM567	Applications of Computational Chemistry					3+0	7.5
KİM568	Solvent-free Organic Synthesis					3+0	7.5
KİM569	Structure Determination of Organic Chemistry					3+0	7.5
KİM701	Physical Chemistry of Foods					3+0	7.5
TAÇ701	Thesis Research Study Course					3+0	7.5
UKM701	Research in Area of Specialization					3+0	4.5
UKM702	Research in Area of Specialization					3+0	4.5

## PROGRAM IN BIOCHEMISTRY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
KiM571	Molecular and Cellular Biochemistry	3+0	7.5	KiM584	Modern Analysis Methods II	3+0	7.5
KiM583	Modern Analysis Methods I	3+0	7.5	KiM592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
KiM790	Thesis	0+1	30.0	KiM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EKiM510 (Eng)	Organic Chemistry of Biomaterials	3+0	7.5
EKiM513	Gas Chromatography and Applications	2+1	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KiM506	Polymer Chemistry	3+0	7.5
KiM509	Carbon-Carbon Bond Formation	3+0	7.5
KiM510	Advanced NMR Techniques	3+0	7.5
KiM511	Electrochemistry	3+0	7.5
KiM516	Physical Organic Chemistry	3+0	7.5
KiM517	Selected Topics in Inorganic Chemistry I	3+0	7.5
KiM521	Adsorption	3+0	7.5
KiM522	Bioanalytical Chemistry	3+0	7.5
KiM524	Bioinorganic Chemistry	3+0	7.5
KiM525	Quantum Chemistry	3+0	7.5
KiM526	Microwave Organic Synthesis	3+0	7.5
KiM529	Catalytic Chemistry	3+0	7.5
KiM533	Electroanalytical Chemistry	3+0	7.5
KiM535	Data Analysis in Chemistry	3+0	7.5
KiM536	Chromatographic Techniques	3+0	7.5
KiM537	Organic Macro Molecules	3+0	7.5
KiM539	Quantitative Structure Property Relationship	3+0	7.5
KiM550	Reagents In Organic Synthesis	3+0	7.5
KiM551	Sensors and Their Applications	3+0	7.5
KiM558	Biochromatography	3+0	7.5
KiM560	Alternative Reaction Systems	3+0	7.5
KiM561	Novel Tendencies in Liquid Chromatography	3+0	7.5
KiM562	Inorganic Polymers	3+0	7.5
KiM563	Natural Product Synthesis I	3+0	7.5
KiM564	Natural Product Synthesis II	3+0	7.5
KiM565	Literature Search in Chemistry	3+0	7.5
KiM566	Stereo Selective Reactions and Practical Approach	3+0	7.5
KiM567	Applications of Computational Chemistry	3+0	7.5
KiM568	Solvent-free Organic Synthesis	3+0	7.5
KiM569	Structure Determination of Organic Chemistry	3+0	7.5
KiM701	Physical Chemistry of Foods	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UKM701	Research in Area of Specialization	3+0	4.5
UKM702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN PHYSICAL CHEMISTRY

### PROGRAM

I.Semester				II.Semester			
KiM504	Chemical Kinetics	3+0	7.5	KiM513	Chemical Thermodynamics	3+0	7.5
KiM583	Modern Analysis Methods I	3+0	7.5	KiM592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0

III.Semester				IV.Semester			
KiM790	Thesis	0+1	30.0	KiM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EKiM510 (Eng)	Organic Chemistry of Biomaterials	3+0	7.5
EKiM513	Gas Chromatography and Applications	2+1	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KiM506	Polymer Chemistry	3+0	7.5
KiM509	Carbon-Carbon Bond Formation	3+0	7.5
KiM510	Advanced NMR Techniques	3+0	7.5
KiM511	Electrochemistry	3+0	7.5
KiM516	Physical Organic Chemistry	3+0	7.5
KiM517	Selected Topics in Inorganic Chemistry I	3+0	7.5
KiM521	Adsorption	3+0	7.5
KiM522	Bioanalytical Chemistry	3+0	7.5
KiM524	Bioinorganic Chemistry	3+0	7.5
KiM525	Quantum Chemistry	3+0	7.5
KiM526	Microwave Organic Synthesis	3+0	7.5
KiM529	Catalytic Chemistry	3+0	7.5
KiM533	Electroanalytical Chemistry	3+0	7.5
KiM535	Data Analysis in Chemistry	3+0	7.5
KiM536	Chromatographic Techniques	3+0	7.5
KiM537	Organic Macro Molecules	3+0	7.5
KiM539	Quantitative Structure Property Relationship	3+0	7.5
KiM550	Reagents In Organic Synthesis	3+0	7.5
KiM551	Sensors and Their Applications	3+0	7.5
KiM558	Biochromatography	3+0	7.5
KiM560	Alternative Reaction Systems	3+0	7.5
KiM561	Novel Tendencies in Liquid Chromatography	3+0	7.5
KiM562	Inorganic Polymers	3+0	7.5
KiM563	Natural Product Synthesis I	3+0	7.5
KiM564	Natural Product Synthesis II	3+0	7.5
KiM565	Literature Search in Chemistry	3+0	7.5
KiM566	Stereo Selective Reactions and Practical Approach	3+0	7.5
KiM567	Applications of Computational Chemistry	3+0	7.5
KiM568	Solvent-free Organic Synthesis	3+0	7.5
KiM569	Structure Determination of Organic Chemistry	3+0	7.5
KiM701	Physical Chemistry of Foods	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UKM701	Research in Area of Specialization	3+0	4.5
UKM702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ORGANIC CHEMISTRY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
EKİM511	Advanced Organic Chemistry I	3+0	7.5	EKİM512	Advanced Organic Chemistry II	3+0	7.5
KİM569	Structure Determination of Organic Chemistry <i>Seçmeli Dersler</i>	3+0	7.5	EKİM514	Heterocyclic Chemistry	3+0	7.5
		--	15.0	KİM592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
KİM790	Thesis	0+1	30.0	KİM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

EKİM510 (Eng)	Organic Chemistry of Biomaterials	3+0	7.5
EKİM513	Gas Chromatography and Applications	2+1	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KİM501	Selected Topics in Organic Chemistry I	3+0	7.5
KİM502	Selected Topics in Organic Chemistry II	3+0	7.5
KİM506	Polymer Chemistry	3+0	7.5
KİM509	Carbon-Carbon Bond Formation	3+0	7.5
KİM510	Advanced NMR Techniques	3+0	7.5
KİM511	Electrochemistry	3+0	7.5
KİM516	Physical Organic Chemistry	3+0	7.5
KİM517	Selected Topics in Inorganic Chemistry I	3+0	7.5
KİM519	Heterocyclic Chemistry I	3+0	7.5
KİM520	Heterocyclic Chemistry II	3+0	7.5
KİM521	Adsorption	3+0	7.5
KİM522	Bioanalytical Chemistry	3+0	7.5
KİM524	Bioinorganic Chemistry	3+0	7.5
KİM525	Quantum Chemistry	3+0	7.5
KİM526	Microwave Organic Synthesis	3+0	7.5
KİM529	Catalytic Chemistry	3+0	7.5
KİM533	Electroanalytical Chemistry	3+0	7.5
KİM535	Data Analysis in Chemistry	3+0	7.5
KİM536	Chromatographic Techniques	3+0	7.5
KİM537	Organic Macro Molecules	3+0	7.5
KİM539	Quantitative Structure Property Relationship	3+0	7.5
KİM550	Reagents In Organic Synthesis	3+0	7.5
KİM551	Sensors and Their Applications	3+0	7.5
KİM558	Biochromatography	3+0	7.5
KİM560	Alternative Reaction Systems	3+0	7.5
KİM561	Novel Tendencies in Liquid Chromatography	3+0	7.5
KİM562	Inorganic Polymers	3+0	7.5
KİM563	Natural Product Synthesis I	3+0	7.5
KİM564	Natural Product Synthesis II	3+0	7.5
KİM565	Literature Search in Chemistry	3+0	7.5
KİM566	Stereo Selective Reactions and Practical Approach	3+0	7.5
KİM567	Applications of Computational Chemistry	3+0	7.5
KİM568	Solvent-free Organic Synthesis	3+0	7.5

KİM701	Physical Chemistry of Foods	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UKM701	Research in Area of Specialization	3+0	4.5
UKM702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF CHEMICAL ENGINEERING

Head :

### DOCTORATE DEGREE (PH.D)

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	-	30.0	KMH692	Seminar	3+0 7.5
	-			<i>Seçmeli Dersler</i>	-- 22.5
		-----			-----
		30.0			30.0
<b>III.Semester</b>				<b>IV.Semester</b>	
DYS000	Qualifying Exam	0+0	0.0	KMH890-0	Thesis (Thesis Proposal) 0+1 30.0
			---		-----
			--		30.0
<b>V.Semester</b>				<b>VI.Semester</b>	
KMH890	Thesis	0+1	30.0	KMH890	Thesis 0+1 30.0
			-----		-----
			30.0		30.0
<b>VII.Semester</b>				<b>VIII.Semester</b>	
KMH890	Thesis	0+1	30.0	KMH890	Thesis 0+1 30.0
			-----		-----
			30.0		30.0

#### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KMH601	Stage Separation Processes I	3+0	7.5
KMH602	Stage Separation Processes II	3+0	7.5
KMH604	Petroleum Refinery Engineering	3+0	7.5
KMH605	Heterogeneous Reaction Kinetics and Reactor Design	3+0	7.5
KMH606	Advanced Mathematical Modeling in Chemical Engineering	3+0	7.5
KMH609	Synthetic Fuel Production By Thermochemical Methods	3+0	7.5
KMH611	Advanced Carbon Materials from Biomass	3+0	7.5
KMH613	Coal Technology	3+0	7.5
KMH615	Principles and Applications of Biocatalysis	3+0	7.5
KMH617	Catalytic Conversion Technologies of Biomass	3+0	7.5
KMH622	Mathematical Methods in Chemical Engineering II	3+0	7.5
KMH630	Numerical Methods in Chemical Engineering II	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UKH901	Research in Area of Specialization	5+0	7.5

UKH902 Research in Area of Specialization 5+0 7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
KMH513	Advanced Transport Phenomena	3+0	7.5	KMH501	Advanced Chemical Engineering Thermodynamics	3+0	7.5
KMH521	Mathematical Methods in Chemical Engineering I <i>Seçmeli Dersler</i>	3+0	7.5	KMH510	Advanced Reactor Design	3+0	7.5
		--	15.0	KMH592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
			----			--	7.5
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
KMH790	Thesis	0+1	30.0	KMH790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KMH505	Advanced Mass Transfer	3+0	7.5
KMH506	Advanced Process Control	3+0	7.5
KMH507	Advanced Heat Transfer	3+0	7.5
KMH509	Fuel and Energy	3+0	7.5
KMH511	Advanced Instrumental Analysis	3+0	7.5
KMH516	Physical Operations in Food Technologies	3+0	7.5
KMH517	Advanced Stoichiometry	3+0	7.5
KMH518	New and Renewable Energy Sources	3+0	7.5
KMH519	Advanced Fluid Mechanics	3+0	7.5
KMH520	Chromatographic Separation Processes	3+0	7.5
KMH523	Advanced Separations Processes	3+0	7.5
KMH524	Materials' Synthesis, Characterization and Applications	3+0	7.5
KMH525	Supercritical Fluid Extraction	3+0	7.5
KMH526	Membrane Separation Processes	3+0	7.5
KMH527	Electrochemical Engineering	3+0	7.5
KMH528	Fuel Cells	3+0	7.5
KMH529	Numerical Methods in Chemical Engineering I	3+0	7.5
KMH530	Design of Experiments in Chemical Engineering	3+0	7.5
KMH531	Bioseparation Engineering	3+0	7.5
KMH532	Biochemical Engineering	3+0	7.5
KMH533	Polymer Synthesis	3+0	7.5
KMH534	New Carbon Materials	3+0	7.5
KMH535	Porous Materials	3+0	7.5
KMH536	Advanced Concrete Admixtures	3+0	7.5
KMH537	Hydrogen Production from Biomass	3+0	7.5
KMH538	Geopolymers	3+0	7.5
KMH539 (Eng)	Materials and Fire	3+0	7.5
KMH540	Pharmaceutical Manufacturing Technologies	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UKH701	Research in Area of Specialization	3+0	4.5
UKH702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF LOGISTICS MANAGEMENT

Head :

## LOGISTICS MANAGEMENT (DISTANCE LEARNING)

### PROGRAM

<b>I.Semester</b>		<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	- 30.0 LOJ599	Term Project	3+0 0.0
	-	<i>Seçmeli Dersler</i>	-- 30.0
	----		----
	30.0		30.0

### Elective Courses

LOJ511	Carriage of Dangerous Goods	3+0	7.5
LOJ512	Supply Chain Design	3+0	7.5
LOJ513	Logistics Principles	3+0	7.5
LOJ514	Logistics Planning and Modelling	3+0	7.5
LOJ515	Transportation Economics	3+0	7.5
LOJ516	Coorporate Communication In Logistics Bussinesses	3+0	7.5
LOJ517	Human Resources Strategies on Logistics Sector	3+0	7.5
LOJ518	Transportation Systems	3+0	7.5
LOJ519	Warehouse And Inventory Management	3+0	7.5
LOJ520	Logistics Practices	3+0	7.5
LOJ521	Digital Marketing	3+0	7.5
LOJ522	Coaching and Leadership Skills for Managers	3+0	7.5
LOJ523	Total Quality Management in Logistics Businesses	3+0	7.5
LOJ524	Logistics Costs Analysis	3+0	7.5
LOJ525	Logistics Law	3+0	7.5
LOJ527	Research Methods in the Field of Logistics	3+0	7.5

## DEPARMENT OF MECHANICAL ENGINEERING

Head :

## DOCTORATE DEGREE (PH.D)

### PROGRAM

<b>I.Semester</b>		<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	- 30.0 MKM692	Seminar	3+0 7.5
	-	<i>Seçmeli Dersler</i>	-- 22.5
	----		----
	30.0		30.0



	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	MKM890-0	Thesis Proposal	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
MKM890	Thesis	0+1	30.0	MKM890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
MKM890	Thesis	0+1	30.0	MKM890	Thesis	0+1	30.0
			----				----
			30.0				30.0

#### Elective Courses

MKM611	Artificial Intelligence in Mechanical Engineering Applications	3+0	7.5				
MKM612	Micro-Nanoscale Heat Transfer	3+0	7.5				
MKM613	Advanced Exergy Analysis of Energy Systems	3+0	7.5				
MKM614	Automotive Control Systems	3+0	7.5				
MKM615 (Eng)	Optimization Methods and Applications	3+0	7.5				
MKM616	Advanced Thermodynamics in Mechanical Engineering	3+0	7.5				
MKM618	Design for Additive Manufacturing	3+0	7.5				

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
MKM503	Academic Development	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
MKM539	Analytical Methods in Engineering	3+0	7.5	MKM592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
MKM790	Thesis	0+1	30.0	MKM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

#### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5				
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5				
MKM501	Advanced Heat and Mass Transfer	3+0	7.5				
MKM509	Machining Dynamics	3+0	7.5				
MKM511	Advanced C++ Programming	3+0	7.5				
MKM513	Experimental Methods for Fluid Dynamics	3+0	7.5				
MKM514	Atomistic Simulation of Materials	3+0	7.5				
MKM515	Renewable Energy Systems	3+0	7.5				
MKM516	Additive Manufacturing Methods	3+0	7.5				
MKM517	Computer Aided Analysis	3+0	7.5				
MKM518	Sustainable Manufacturing	3+0	7.5				
MKM519	Exergy and Entropy Analysis	3+0	7.5				
MKM520	Computer Aided Engineering	3+0	7.5				

MKM522	Mechanical Behavior of Materials	3+0	7.5
MKM523	Vehicle Systems Design	3+0	7.5
MKM524	Smart Materials and Applications	3+0	7.5
MKM525	Superalloys	3+0	7.5
MKM526	Advanced Powerplant System Technologies and Applications	3+0	7.5
MKM527	Design for Manufacturing and Assembly	3+0	7.5
MKM528	Advanced Level Nondestructive Inspection Methodologies	3+0	7.5
MKM529	Selected Topics In Mechanics	3+0	7.5
MKM530	Vehicle Control Systems	3+0	7.5
MKM532	Biomass and Bioenergy Systems	3+0	7.5
MKM533	Exergy Analysis in Mechanical Engineering	3+0	7.5
MKM534	Thermal System Design	3+0	7.5
MKM535	Advanced Fluid Mechanics in Mechanical Engineering	3+0	7.5
MKM536	Engineering Failure Analysis	3+0	7.5
MKM537	Mechanics of Composite Materials	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMK701	Research in Area of Specialization	3+0	4.5
UMK702	Research in Area of Specialization	3+0	4.5

### (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

#### PROGRAM

I.Semester				II.Semester			
MKM503	Academic Development	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
MKM522	Mechanical Behavior of Materials	3+0	7.5	MKM599	Term Project	3+0	0.0
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0

#### Elective Courses

MKM501	Advanced Heat and Mass Transfer	3+0	7.5
MKM509	Machining Dynamics	3+0	7.5
MKM511	Advanced C++ Programming	3+0	7.5
MKM513	Experimental Methods for Fluid Dynamics	3+0	7.5
MKM514	Atomistic Simulation of Materials	3+0	7.5
MKM515	Renewable Energy Systems	3+0	7.5
MKM516	Additive Manufacturing Methods	3+0	7.5
MKM517	Computer Aided Analysis	3+0	7.5
MKM518	Sustainable Manufacturing	3+0	7.5
MKM519	Exergy and Entropy Analysis	3+0	7.5
MKM520	Computer Aided Engineering	3+0	7.5
MKM523	Vehicle Systems Design	3+0	7.5
MKM524	Smart Materials and Applications	3+0	7.5
MKM525	Superalloys	3+0	7.5
MKM526	Advanced Powerplant System Technologies and Applications	3+0	7.5
MKM527	Design for Manufacturing and Assembly	3+0	7.5
MKM528	Advanced Level Nondestructive Inspection Methodologies	3+0	7.5
MKM529	Selected Topics In Mechanics	3+0	7.5
MKM530	Vehicle Control Systems	3+0	7.5
MKM532	Biomass and Bioenergy Systems	3+0	7.5
MKM533	Exergy Analysis in Mechanical Engineering	3+0	7.5
MKM534	Thermal System Design	3+0	7.5
MKM535	Advanced Fluid Mechanics in Mechanical Engineering	3+0	7.5
MKM536	Engineering Failure Analysis	3+0	7.5
MKM537	Mechanics of Composite Materials	3+0	7.5

### DEPARTMENT OF MATERIAL SCIENCE AND ENGINEERING

Head :

## DOCTORATE DEGREE (PH.D)

### PROGRAM

<b>I.Semester</b>					<b>II.Semester</b>			
	<i>Seçmeli Dersler</i>	-	30.0	MLZ692	Seminar	3+0	7.5	
		-			<i>Seçmeli Dersler</i>	--	22.5	
			----				----	
			30.0				30.0	
<b>III.Semester</b>					<b>IV.Semester</b>			
DYS000	Qualifying Exam	0+0	0.0	MLZ890-0	Thesis (Thesis Proposal)	0+1	30.0	
			---				----	
			--				30.0	
<b>V.Semester</b>					<b>VI.Semester</b>			
MLZ890	Thesis	0+1	30.0	MLZ890	Thesis	0+1	30.0	
			----				----	
			30.0				30.0	
<b>VII.Semester</b>					<b>VIII.Semester</b>			
MLZ890	Thesis	0+1	30.0	MLZ890	Thesis	0+1	30.0	
			----				----	
			30.0				30.0	
<b>Elective Courses</b>								
CAM601	Ionic Diffusion in Oxide Based Glasses					3+0	7.5	
CAM602	Glass Science and Technological Improvements					3+0	7.5	
FBE510	Ethics of Science and Research Techniques					2+0	7.5	
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5	
MLZ601	Scanning Electron Microscopy and Chemical Analysis Techniques					3+0	7.5	
MLZ602	Transmission Electron Microscope and Chemical Analysis Techniques					3+0	7.5	
MLZ603	Special X-Ray Techniques and Their Applications					3+0	7.5	
MLZ604	Inorganic Powder Synthesis Technologies					3+0	7.5	
MLZ605	Sintering of Particulate Materials					3+0	7.5	
MLZ607	Alloy Development-Principles, New Horizons and Extreme Applications					3+0	7.5	
MLZ608	Polymer Rheology					3+0	7.5	
MLZ609	Modeling of Polymer Composites Manufacturing Processes					3+0	7.5	
MLZ610	Kinetics					3+0	7.5	
MLZ611	Diffusion in Solids					3+0	7.5	
MLZ612	Ferroelectric Materials and Devices					3+0	7.5	
MLZ613	Crystal Anisotropy					3+0	7.5	
MLZ614	Spintronic and Applications					3+0	7.5	
MLZ615	Material and Energy Balance in Production					3+0	7.5	
MLZ616	Colloid Chemistry and Rheological Behaviour					3+0	7.5	
MLZ617	Inorganic Pigments and Pigments Interactions					3+0	7.5	
MLZ618	The Relationship between Structure and Properties in Industrial Glazes					3+0	7.5	
MLZ619	Phase Transformation Mechanisms of Metals					3+0	7.5	
MLZ621	Electrical and Magnetic Characterization					3+0	7.5	
MLZ622	Porous Materials					3+0	7.5	

MLZ623	Structural and Optical Characterization	3+0	7.5
MLZ624	Advanced Manufacturing Techniques	3+0	7.5
MLZ626	Material Characterization and Inspection Techniques	3+0	7.5
MLZ628	Powder Metallurgy	3+0	7.5
MLZ630	Advanced Surface Engineering	3+0	7.5
MLZ632	Fracture Mechanics and Fatigue	3+0	7.5
MLZ651	Materials Science and Advanced Materials Technology	3+0	7.5
MLZ652	Fatigue and Creep Behaviour of Aircraft Materials	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UMM901	Research in Area of Specialization	5+0	7.5
UMM902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MLZ501	The Structure-Property Relationships in Materials	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	MLZ502	Thermodynamic Applications in Material Science	3+0	7.5
				MLZ592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			-----				-----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MLZ790	Thesis	0+1	30.0	MLZ790	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

### Elective Courses

CAM513	Metallic Glasses	3+0	7.5
CAM514	Chemical Durability of Glasses	3+0	7.5
CAM515	Engineering Glasses	3+0	7.5
ENM501	Design and Analysis of Experiments	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MLZ503	Electrical Properties of Materials	3+0	7.5
MLZ505	Thermal Analysis of Polymeric Materials	3+0	7.5
MLZ506	Mathematical Methods in Polymer Science and Technology	3+0	7.5
MLZ507	Fundamentals of Polymer Engineering	3+0	7.5
MLZ508	Mechanics of Polymer-Based Laminated Composites	3+0	7.5
MLZ509	Advanced Composite Materials	3+0	7.5
MLZ510	Thin Film Production and Vacuum Technologies	3+0	7.5
MLZ511	Dielectric Materials and Devices	3+0	7.5
MLZ512	Applications of Crystallography	3+0	7.5
MLZ513	Raw Materials and Mineral Processing	3+0	7.5
MLZ514	The use of Glass Materials in Industry	3+0	7.5
MLZ515	Refractory Technology	3+0	7.5
MLZ516	Coating Techniques	3+0	7.5
MLZ517	X-Ray Diffraction Techniques in Materials Characterisation	3+0	7.5
MLZ518	Strengthening Mechanisms in Materials	3+0	7.5
MLZ519	Atomic Force Microscopy and Applications	3+0	7.5
MLZ521	Fracture Mechanics of Materials	3+0	7.5
MLZ522	Application of Electrochromic and Photochromic Polymers	3+0	7.5
MLZ523	Polymer Chemistry and Physics	3+0	7.5
MLZ524	Electrochemical Characterization of Conducting Polymer	3+0	7.5

MLZ525	Cutting Tool Materials	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMM701	Research in Area of Specialization	3+0	4.5
UMM702	Research in Area of Specialization	3+0	4.5

### (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

#### PROGRAM

I.Semester				II.Semester			
MLZ501	The Structure-Property Relationships in Materials	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	MLZ502	Thermodynamic Applications in Material Science	3+0	7.5
				MLZ599	Term Project	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
			-----				-----
			30.0				30.0

#### Elective Courses

CAM513	Metallic Glasses	3+0	7.5
CAM514	Chemical Durability of Glasses	3+0	7.5
CAM515	Engineering Glasses	3+0	7.5
ENM501	Design and Analysis of Experiments	3+0	7.5
MLZ503	Electrical Properties of Materials	3+0	7.5
MLZ505	Thermal Analysis of Polymeric Materials	3+0	7.5
MLZ506	Mathematical Methods in Polymer Science and Technology	3+0	7.5
MLZ507	Fundamentals of Polymer Engineering	3+0	7.5
MLZ508	Mechanics of Polymer-Based Laminated Composites	3+0	7.5
MLZ509	Advanced Composite Materials	3+0	7.5
MLZ510	Thin Film Production and Vacuum Technologies	3+0	7.5
MLZ511	Dielectric Materials and Devices	3+0	7.5
MLZ512	Applications of Crystallography	3+0	7.5
MLZ513	Raw Materials and Mineral Processing	3+0	7.5
MLZ514	The use of Glass Materials in Industry	3+0	7.5
MLZ515	Refractory Technology	3+0	7.5
MLZ516	Coating Techniques	3+0	7.5
MLZ517	X-Ray Diffraction Techniques in Materials Characterisation	3+0	7.5
MLZ518	Strengthening Mechanisms in Materials	3+0	7.5
MLZ519	Atomic Force Microscopy and Applications	3+0	7.5
MLZ521	Fracture Mechanics of Materials	3+0	7.5
MLZ522	Application of Electrochromic and Photochromic Polymers	3+0	7.5
MLZ523	Polymer Chemistry and Physics	3+0	7.5
MLZ524	Electrochemical Characterization of Conducting Polymer	3+0	7.5
MLZ525	Cutting Tool Materials	3+0	7.5

### DEPARTMENT OF MATHEMATICS

Head :

### DOCTORATE DEGREE (PH.D)

**PROGRAM**

		<b>I.Semester</b>			<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	MAT692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
		<b>III.Semester</b>			<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	MAT890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
		<b>V.Semester</b>			<b>VI.Semester</b>		
MAT890	Thesis	0+1	30.0	MAT890	Thesis	0+1	30.0
			----				----
			30.0				30.0
		<b>VII.Semester</b>			<b>VIII.Semester</b>		
MAT890	Thesis	0+1	30.0	MAT890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
MAT601	Stability of Linear Systems					3+0	7.5
MAT602	Stability of Nonlinear Dynamical Systems					3+0	7.5
MAT603	Convex Analysis					3+0	7.5
MAT604	Topological Vector Spaces					3+0	7.5
MAT605	Differential Inclusions Theory					3+0	7.5
MAT606	Riemannian Geometry					3+0	7.5
MAT607	Topological Groups					3+0	7.5
MAT608	Analysis on Fractals					3+0	7.5
MAT609	Knot Theory					3+0	7.5
MAT610	Basic Topics of the Set Valued Analysis					3+0	7.5
MAT611	Introduction to Gauge Theory					3+0	3.0
MAT612	Fractals and Kaos					3+0	7.5
MAT613	Clifford Algebras					3+0	7.5
MAT614	Continuous Modules					3+0	7.5
MAT615	Compact Operators					3+0	7.5
MAT616	Fiber Bundles					3+0	7.5
MAT619	Vector Optimization I					3+0	7.5
MAT620	Vector Optimization II					3+0	7.5
MAT621	Metric Geometry					3+0	7.5
MAT622	Characteristic Classes					3+0	7.5
MAT623	Bochner Technique on Riemannian Manifolds					3+0	7.5
MAT624	Stability of Switched Linear Systems					3+0	7.5
MAT625	Generalized Functions					3+0	7.5
MAT626	Boundary Value Problems					3+0	7.5
MAT627	Antagonistic Differential Games					3+0	7.5
MAT628	Rings and Radicals					3+0	7.5
MAT629	Complex Analysis					3+0	7.5
MAT630	Hardy-Hilbert Space and its Operators					3+0	7.5
MAT632	Complex Geometry					3+0	7.5
MAT633	Measure Theory and Integral					3+0	7.5
MAT634	Compactness Theorems on Riemannian Manifolds					3+0	7.5
MAT635	Graph Theory					3+0	7.5

MAT636	Asymptotic Solutions of Differential Equations	3+0	7.5
MAT637	Fuchsian Groups	3+0	7.5
MAT639	Differential Topology	3+0	7.5
MAT641	Asymptotic Approximation of Integrals	3+0	7.5
MAT643	Introduction to the Theory of Elastic Waves	3+0	7.5
MAT645	Fractional Differential Equations I	3+0	7.5
MAT646	Fractional Differential Equations II	3+0	7.5
MAT647	Algorithmic Graph Theory	3+0	7.5
MAT649	Near-Rings	3+0	7.5
MAT651	Chotic Dynamical systems in Higher Dimensions	3+0	7.5
MAT653	Z-Numbers Theory	3+0	7.5
TAC801	Thesis Research Study Course	3+0	7.5
UMT901	Research in Area of Specialization	5+0	7.5
UMT902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM IN ANALYSIS AND FUNCTIONS THEORY

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MAT502	Analysis	3+0	7.5	MAT503	Topology	3+0	7.5
MAT532	Functional Analysis	3+0	7.5	MAT592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MAT790	Thesis	0+1	30.0	MAT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

#### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT504	Differential Equations	3+0	7.5
MAT506	Real Analysis	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
MAT509	Algebraic Topology I	3+0	7.5
MAT510	Algebraic Topology II	3+0	7.5
MAT511	Dynamical Systems I	3+0	7.5
MAT512	Dynamical Systems II	3+0	7.5
MAT513	Axiomatic Sets Theory	3+0	7.5
MAT517	Applied Mathematics	3+0	7.5
MAT520	Lie Algebras	3+0	7.5
MAT521	Geometric Topology	3+0	7.5
MAT523	Introduction to Riemann Geometry	3+0	7.5
MAT524	Geometry of Differential Forms	3+0	7.5
MAT525	Equations of Mathematical Physics I	3+0	7.5
MAT526	Equations of Mathematical Physics II	3+0	7.5
MAT527	Numerical Solutions of Partial Differential Equations	3+0	7.5
MAT528	Optimization Methods I	3+0	7.5
MAT529	Optimization Methods II	3+0	7.5
MAT530	Introduction to the Theory of Nonlinear Optimization	3+0	7.5

MAT531	Tensor Analysis	3+0	7.5
MAT533	Differentiable Manifolds	3+0	7.5
MAT534	Selected Topics in Algebra	3+0	7.5
MAT535	Hyperbolic Geometry	3+0	7.5
MAT539	Fractal Geometry	3+0	7.5
MAT542	Game Theory	3+0	7.5
MAT545	Integral Equations I	3+0	7.5
MAT546	Integral Equations II	3+0	7.5
MAT547	Asymptotic Methods in Analysis	3+0	7.5
MAT548	Numerical Solutions of Ordinary Differential Equations	3+0	7.5
MAT549	Introduction to Graph Theory	3+0	7.5
MAT551	Ring and Module Theory	3+0	7.5
MAT552	Introduction to Mathematical Elasticity	3+0	7.5
MAT553	Fuzzy Set Theory	3+0	7.5
MAT554	Integral Transforms and Their Application	3+0	7.5
MAT555	Introduction to Chaotic Dynamical Systems	3+0	7.5
MAT556	Linear Programming	3+0	7.5
MAT558	Vector Analysis	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMT701	Research in Area of Specialization	3+0	4.5
UMT702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN ALGEBRA AND NUMBERS THEORY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MAT502	Analysis	3+0	7.5	MAT503	Topology	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	MAT519	Algebra	3+0	7.5
				MAT592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MAT790	Thesis	0+1	30.0	MAT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT504	Differential Equations	3+0	7.5
MAT506	Reel Analysis	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
MAT509	Algebraic Topology I	3+0	7.5
MAT510	Algebraic Topology II	3+0	7.5
MAT511	Dynamical Systems I	3+0	7.5
MAT512	Dynamical Systems II	3+0	7.5
MAT513	Axiomatic Sets Theory	3+0	7.5
MAT517	Applied Mathematics	3+0	7.5
MAT520	Lie Algebras	3+0	7.5
MAT521	Geometric Topology	3+0	7.5
MAT523	Introduction to Riemann Geometry	3+0	7.5
MAT524	Geometry of Differential Forms	3+0	7.5
MAT525	Equations of Mathematical Physics I	3+0	7.5
MAT526	Equations of Mathematical Physics II	3+0	7.5
MAT527	Numerical Solutions of Partial Differential Equations	3+0	7.5



MAT528	Optimization Methods I	3+0	7.5
MAT529	Optimization Methods II	3+0	7.5
MAT530	Introduction to the Theory of Nonlinear Optimization	3+0	7.5
MAT531	Tensor Analysis	3+0	7.5
MAT533	Differentiable Manifolds	3+0	7.5
MAT534	Selected Topics in Algebra	3+0	7.5
MAT535	Hyperbolic Geometry	3+0	7.5
MAT539	Fractal Geometry	3+0	7.5
MAT542	Game Theory	3+0	7.5
MAT545	Integral Equations I	3+0	7.5
MAT546	Integral Equations II	3+0	7.5
MAT547	Asymptotic Methods in Analysis	3+0	7.5
MAT548	Numerical Solutions of Ordinary Differential Equations	3+0	7.5
MAT549	Introduction to Graph Theory	3+0	7.5
MAT551	Ring and Module Theory	3+0	7.5
MAT552	Introduction to Mathematical Elasticity	3+0	7.5
MAT553	Fuzzy Set Theory	3+0	7.5
MAT554	Integral Transforms and Their Application	3+0	7.5
MAT555	Introduction to Chaotic Dynamical Systems	3+0	7.5
MAT556	Linear Programming	3+0	7.5
MAT558	Vector Analysis	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMT701	Research in Area of Specialization	3+0	4.5
UMT702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN GEOMETRY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MAT502	Analysis	3+0	7.5	MAT503	Topology	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	MAT519	Algebra	3+0	7.5
				MAT592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MAT790	Thesis	0+1	30.0	MAT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT504	Differential Equations	3+0	7.5
MAT506	Real Analysis	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
MAT509	Algebraic Topology I	3+0	7.5
MAT510	Algebraic Topology II	3+0	7.5
MAT511	Dynamical Systems I	3+0	7.5
MAT512	Dynamical Systems II	3+0	7.5
MAT513	Axiomatic Sets Theory	3+0	7.5
MAT517	Applied Mathematics	3+0	7.5
MAT520	Lie Algebras	3+0	7.5
MAT521	Geometric Topology	3+0	7.5
MAT523	Introduction to Riemann Geometry	3+0	7.5
MAT524	Geometry of Differential Forms	3+0	7.5

MAT525	Equations of Mathematical Physics I	3+0	7.5
MAT526	Equations of Mathematical Physics II	3+0	7.5
MAT527	Numerical Solutions of Partial Differential Equations	3+0	7.5
MAT528	Optimization Methods I	3+0	7.5
MAT529	Optimization Methods II	3+0	7.5
MAT530	Introduction to the Theory of Nonlinear Optimization	3+0	7.5
MAT531	Tensor Analysis	3+0	7.5
MAT533	Differentiable Manifolds	3+0	7.5
MAT534	Selected Topics in Algebra	3+0	7.5
MAT535	Hyperbolic Geometry	3+0	7.5
MAT539	Fractal Geometry	3+0	7.5
MAT542	Game Theory	3+0	7.5
MAT545	Integral Equations I	3+0	7.5
MAT546	Integral Equations II	3+0	7.5
MAT547	Asymptotic Methods in Analysis	3+0	7.5
MAT548	Numerical Solutions of Ordinary Differential Equations	3+0	7.5
MAT549	Introduction to Graph Theory	3+0	7.5
MAT551	Ring and Module Theory	3+0	7.5
MAT552	Introduction to Mathematical Elasticity	3+0	7.5
MAT553	Fuzzy Set Theory	3+0	7.5
MAT554	Integral Transforms and Their Application	3+0	7.5
MAT555	Introduction to Chaotic Dynamical Systems	3+0	7.5
MAT556	Linear Programming	3+0	7.5
MAT558	Vector Analysis	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMT701	Research in Area of Specialization	3+0	4.5
UMT702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN TOPOLOGY

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MAT502	Analysis	3+0	7.5	MAT503	Topology	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	MAT519	Algebra	3+0	7.5
				MAT592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MAT790	Thesis	0+1	30.0	MAT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBES10	Ethics of Science and Research Techniques	2+0	7.5
FBES10-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT504	Differential Equations	3+0	7.5
MAT506	Real Analysis	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
MAT509	Algebraic Topology I	3+0	7.5
MAT510	Algebraic Topology II	3+0	7.5
MAT511	Dynamical Systems I	3+0	7.5
MAT512	Dynamical Systems II	3+0	7.5
MAT513	Axiomatic Sets Theory	3+0	7.5
MAT517	Applied Mathematics	3+0	7.5
MAT520	Lie Algebras	3+0	7.5

MAT521	Geometric Topology	3+0	7.5
MAT523	Introduction to Riemann Geometry	3+0	7.5
MAT524	Geometry of Differential Forms	3+0	7.5
MAT525	Equations of Mathematical Physics I	3+0	7.5
MAT526	Equations of Mathematical Physics II	3+0	7.5
MAT527	Numerical Solutions of Partial Differential Equations	3+0	7.5
MAT528	Optimization Methods I	3+0	7.5
MAT529	Optimization Methods II	3+0	7.5
MAT530	Introduction to the Theory of Nonlinear Optimization	3+0	7.5
MAT531	Tensor Analysis	3+0	7.5
MAT533	Differentiable Manifolds	3+0	7.5
MAT534	Selected Topics in Algebra	3+0	7.5
MAT535	Hyperbolic Geometry	3+0	7.5
MAT539	Fractal Geometry	3+0	7.5
MAT542	Game Theory	3+0	7.5
MAT545	Integral Equations I	3+0	7.5
MAT546	Integral Equations II	3+0	7.5
MAT547	Asymptotic Methods in Analysis	3+0	7.5
MAT548	Numerical Solutions of Ordinary Differential Equations	3+0	7.5
MAT549	Introduction to Graph Theory	3+0	7.5
MAT551	Ring and Module Theory	3+0	7.5
MAT552	Introduction to Mathematical Elasticity	3+0	7.5
MAT553	Fuzzy Set Theory	3+0	7.5
MAT554	Integral Transforms and Their Application	3+0	7.5
MAT555	Introduction to Chaotic Dynamical Systems	3+0	7.5
MAT556	Linear Programming	3+0	7.5
MAT558	Vector Analysis	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMT701	Research in Area of Specialization	3+0	4.5
UMT702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN APPLIED MATHEMATICS

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MAT502	Analysis	3+0	7.5	MAT519	Algebra	3+0	7.5
MAT532	Functional Analysis	3+0	7.5	MAT592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MAT790	Thesis	0+1	30.0	MAT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBES10	Ethics of Science and Research Techniques	2+0	7.5
FBES10-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT504	Differential Equations	3+0	7.5
MAT506	Real Analysis	3+0	7.5
MAT507	Applied Mathematics I	3+0	7.5
MAT508	Applied Mathematics II	3+0	7.5
MAT509	Algebraic Topology I	3+0	7.5
MAT510	Algebraic Topology II	3+0	7.5
MAT511	Dynamical Systems I	3+0	7.5
MAT512	Dynamical Systems II	3+0	7.5
MAT513	Axiomatic Sets Theory	3+0	7.5

MAT517	Applied Mathematics	3+0	7.5
MAT520	Lie Algebras	3+0	7.5
MAT521	Geometric Topology	3+0	7.5
MAT523	Introduction to Riemann Geometry	3+0	7.5
MAT524	Geometry of Differential Forms	3+0	7.5
MAT525	Equations of Mathematical Physics I	3+0	7.5
MAT526	Equations of Mathematical Physics II	3+0	7.5
MAT527	Numerical Solutions of Partial Differential Equations	3+0	7.5
MAT528	Optimization Methods I	3+0	7.5
MAT529	Optimization Methods II	3+0	7.5
MAT530	Introduction to the Theory of Nonlinear Optimization	3+0	7.5
MAT531	Tensor Analysis	3+0	7.5
MAT533	Differentiable Manifolds	3+0	7.5
MAT534	Selected Topics in Algebra	3+0	7.5
MAT535	Hyperbolic Geometry	3+0	7.5
MAT539	Fractal Geometry	3+0	7.5
MAT542	Game Theory	3+0	7.5
MAT545	Integral Equations I	3+0	7.5
MAT546	Integral Equations II	3+0	7.5
MAT547	Asymptotic Methods in Analysis	3+0	7.5
MAT548	Numerical Solutions of Ordinary Differential Equations	3+0	7.5
MAT549	Introduction to Graph Theory	3+0	7.5
MAT551	Ring and Module Theory	3+0	7.5
MAT552	Introduction to Mathematical Elasticity	3+0	7.5
MAT553	Fuzzy Set Theory	3+0	7.5
MAT554	Integral Transforms and Their Application	3+0	7.5
MAT555	Introduction to Chaotic Dynamical Systems	3+0	7.5
MAT556	Linear Programming	3+0	7.5
MAT558	Vector Analysis	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMT701	Research in Area of Specialization	3+0	4.5
UMT702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF ARCHITECTURE

Head :

### DOCTORATE DEGREE (PH.D)

#### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	MiM692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
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			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	MiM890-0	Thesis (Thesis Proposal)	0+1	30.0
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			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
MiM890	Thesis	0+1	30.0	MiM890	Thesis	0+1	30.0

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			30.0				30.0
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			30.0				30.0

**Elective Courses**

MiM890	Thesis	0+1	30.0	MiM890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
KOR610	Conservation of Rural Architectural Heritage					3+0	7.5
KOR611	Accessibility of Historic Places and Buildings					3+0	7.5
KOR612	Cultural Landscapes					3+0	7.5
KOR613	New Touches to The Historical Texture					3+0	7.5
KOR614	Typological Readings in the Historical Environment					3+0	7.5
KOR615	Tangible and Intangible Cultural Heritage					3+0	7.5
KOR616	Cultural Heritage and Tourism					3+0	7.5
KOR617	Cultural Heritage Consciousness, Awareness and Participatory Approaches					3+0	7.5
MiM601	Architectural Studio Research I					3+0	7.5
MiM602	Architectural Studio Research II					3+0	7.5
MiM603	Architectural Research Methods					3+0	7.5
MiM604	Architecture: Art, Science and Technology					3+0	7.5
MiM605	Sustainable Architecture					3+0	7.5
MiM606	Urban Space Design Quality					3+0	7.5
MiM607	The Tools and Quality Measurement Methods for Design					3+0	7.5
MiM613	Civic Space and Buildings					3+0	7.5
MiM614	Health Impact Assessment of Space					3+0	7.5
MiM615	Spatial Relationships and Architecture					3+0	7.5
MiM616	Bounderies of the House and Modernity					3+0	7.5
MiM617	Architecture and the Morphological Study					3+0	7.5
MiM618	History and Criticism of Contemporary Architecture					3+0	7.5
MiM619	Contemporary PProjects in Sustainable					3+0	7.5
MiM620	Universal Design					3+0	7.5
MiM621	Architecture and Housing					3+0	7.5
MiM622	Urban Acoustic Comfort					3+0	7.5
MiM623	Integrated Design Studio in Architectural Education					3+0	7.5
MiM624	Integrated Design Studio in Architectural Education II					3+0	7.5
MiM625	Current Issues in Contemporary Architecture					3+0	7.5
MiM626	Contemporary Approaches Inarchitectural Design					3+0	7.5
MiM627	Integrated Conservation of Tangible and Intangible Cultural Heritage					3+0	7.5
MiM628	Architecture and Intertextuality					2+0	7.5
PSi606	Psychology in Architecture Design					3+0	7.5
TAÇ801	Thesis Research Study Course					3+0	7.5
UMi901	Research in Area of Specialization					5+0	7.5
UMi902	Research in Area of Specialization					5+0	7.5

**MASTER OF SCIENCE (MS) DEGREE**

**PROGRAM IN BUILDING DESIGN**

**PROGRAM**

**I.Semester**

**II.Semester**

MİM531	Architectural Design Methods	3+0	7.5	MİM562	Architectural Design Studio II	2+2	7.5
MİM533	Methodologies in Architectural Design Research	3+0	7.5	MİM592	Seminar	3+0	7.5
MİM561	Architectural Design Studio I	2+2	7.5		<i>Seçmeli Dersler</i>	--	15.0
MİM569	Environment Factor on Architectural Design	3+0	7.5				
	<i>Seçmeli Dersler</i>	--	7.5				
			-----				-----
			37.5				30.0

### III.Semester

MİM790	Thesis	0+1	30.0
			-----
			30.0

### IV.Semester

MİM790	Thesis	0+1	30.0
			-----
			30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KOR504	Architectural History and Concepts	3+0	7.5
KOR506	Technics of Documentation	3+0	7.5
KOR517	History of Modern Turkish Architecture	3+0	7.5
KOR518	History of Anatolian Architecture	3+0	7.5
KOR519	Construction Techniques and Conservation Problems of Ottoman Architecture	3+0	7.5
KOR521	World Heritage Sites in Turkey	3+0	7.5
KOR534	Special Topics in Preservation	3+0	7.5
KOR536	Preservation Management	3+0	7.5
KOR538	Memory - Space Relations in Conservation of Cultural Heritage	3+0	7.5
KOR547	Modernization And Architecture in Eskişehir	3+0	7.5
KOR549	Disaster Risks and Management In Cultural Heritage Areas	3+0	7.5
KOR551	Current Topics and Approaches in Conservation	3+0	7.5
MİM501	Analysis in Architecture	3+0	7.5
MİM502	Criticism in Architecture	3+0	7.5
MİM503	Housing Problems and Policies	3+0	7.5
MİM504	Qualitative Values of Housing Areas	3+0	7.5
MİM505	Ecological Planning and Design	3+0	7.5
MİM509	Legal Aspects of Urban Planning	3+0	7.5
MİM511	Building Material Failures	3+0	7.5
MİM512	Administrative and Legal Aspects of Planning	3+0	7.5
MİM513	Computer Programming and Introduction to Architectural Practices	3+0	7.5
MİM514	User Interface Design	3+0	7.5
MİM516	Building Shell Design in Energy Efficient Buildings	3+0	7.5
MİM517	Architectural Precast	3+0	7.5
MİM518	Structure in Architecture	3+0	7.5
MİM519	Housing Architecture	3+0	7.5
MİM520	Architectural Steel	3+0	7.5
MİM521	Environmental Design	3+0	7.5
MİM523	Contemporary Interpretation of Traditional Turkish Houses	3+0	7.5
MİM525	Culture, House and Identity	3+0	7.5
MİM526	Computer Aided Architectural Analyses Techniques	3+0	7.5
MİM528	Using of Space around House and House Environment	3+0	7.5
MİM529	Urban Space and Handicapped People	3+0	7.5
MİM530	National and International Aspects of Urban Conservation and Renewal	3+0	7.5
MİM532	Urban Regeneration	3+0	7.5
MİM534	Designing of Housing Areas	3+0	7.5
MİM535	Urban Design Theory	3+0	7.5
MİM536	Rationalism in Architecture	3+0	7.5
MİM543	Building Material Experiments	3+0	7.5
MİM544	Architectural Design and Criticism	3+0	7.5
MİM545	Architecture Sociological Readings	3+0	7.5

MİM546	Readings of Modernity in the Context of Architecture	3+0	7.5
MİM547	Architecture Communication	3+0	7.5
MİM549	Accessibility	3+0	7.5
MİM553	Auditorium Acoustics	3+0	7.5
MİM554	Digital Design and Production in Architecture	3+0	7.5
MİM555	Immaterial Architecture and its Elements	3+0	7.5
MİM557	Design Principles of Room Acoustics	3+0	7.5
MİM558	Introduction to Artificial Intelligence Applications in Architecture	4+0	7.5
MİM565	21st Century Approaches in Architectural Design	3+0	7.5
MİM567	Architectural Design Process Approaches	3+0	7.5
MİM571	Advanced Human Factors in Aviation	3+0	7.5
MİM573	Design Process Approaches in Intersection of Architecture and Architecture Education	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMİ701	Research in Area of Specialization	3+0	4.5
UMİ702	Research in Area of Specialization	3+0	4.5

## PRESERVATION OF ARCHITECTURE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
KOR523	Conservation Project I	2+2	7.5	KOR524	Conservation Project II	2+2	7.5
KOR525	Conservation History and Theories	3+0	7.5	MİM592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
MİM790	Thesis	0+1	30.0	MİM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KOR504	Architectural History and Concepts	3+0	7.5
KOR506	Technics of Documentation	3+0	7.5
KOR517	History of Modern Turkish Architecture	3+0	7.5
KOR520	The Management of Cultural Heritage	3+0	7.5
KOR522	Housing During Republic Period	3+0	7.5
KOR527	Research and Documentation Methods in Protection	3+0	7.5
KOR528	Conservation of Modern Cultural Heritage	3+0	7.5
KOR530	Cultural Heritage Buildings and Their Adaptations to Contemporary Museum Function	3+0	7.5
KOR531	Typological Readings in Conservation	3+0	4.5
KOR535	Special Topics in Conservation	3+0	7.5
KOR536	Preservation Management	3+0	7.5
KOR539	Construction Techniques and Conservation Problems of Ottoman Architecture	3+0	4.5
KOR541	History of Anatolian Architecture	3+0	4.5
KOR543	World Heritage Sites in Turkey	3+0	4.5
MİM501	Analysis in Architecture	3+0	7.5
MİM502	Criticism in Architecture	3+0	7.5
MİM503	Housing Problems and Policies	3+0	7.5
MİM504	Qualitative Values of Housing Areas	3+0	7.5
MİM505	Ecological Planning and Design	3+0	7.5
MİM509	Legal Aspects of Urban Planning	3+0	7.5
MİM511	Building Material Failures	3+0	7.5
MİM512	Administrative and Legal Aspects of Planning	3+0	7.5

MİM513	Computer Programming and Introduction to Architectural Practices	3+0	7.5
MİM514	User Interface Design	3+0	7.5
MİM516	Building Shell Design in Energy Efficient Buildings	3+0	7.5
MİM517	Architectural Precast	3+0	7.5
MİM518	Structure in Architecture	3+0	7.5
MİM519	Housing Architecture	3+0	7.5
MİM520	Architectural Steel	3+0	7.5
MİM521	Environmental Design	3+0	7.5
MİM523	Contemporary Interpretation of Traditional Turkish Houses	3+0	7.5
MİM525	Culture, House and Identity	3+0	7.5
MİM526	Computer Aided Architectural Analyses Techniques	3+0	7.5
MİM528	Using of Space around House and House Environment	3+0	7.5
MİM529	Urban Space and Handicapped People	3+0	7.5
MİM530	National and International Aspects of Urban Conservation and Renewal	3+0	7.5
MİM532	Urban Regeneration	3+0	7.5
MİM534	Designing of Housing Areas	3+0	7.5
MİM535	Urban Design Theory	3+0	7.5
MİM536	Rationalism in Architecture	3+0	7.5
MİM543	Building Material Experiments	3+0	7.5
MİM544	Architectural Design and Criticism	3+0	7.5
MİM545	Architecture Sociological Readings	3+0	7.5
MİM546	Readings of Modernity in the Context of Architecture	3+0	7.5
MİM547	Architecture Communication	3+0	7.5
MİM553	Auditorium Acoustics	3+0	7.5
MİM554	Digital Design and Production in Architecture	3+0	7.5
MİM555	Immaterial Architecture and its Elements	3+0	7.5
MİM557	Design Principles of Room Acoustics	3+0	7.5
MİM565	21st Century Approaches in Architectural Design	3+0	7.5
MİM567	Architectural Design Process Approaches	3+0	7.5
MİM571	Advanced Human Factors in Aviation	3+0	7.5
MİM573	Design Process Approaches in Intersection of Architecture and Architecture Education	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMİ701	Research in Area of Specialization	3+0	4.5
UMİ702	Research in Area of Specialization	3+0	4.5

## PROGRAM IN BUILDING CONSTRUCTION

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MİM559	Noise Control I	3+0	7.5	MİM560	Noise Control II	3+0	7.5
MİM569	Environment Factor on Architectural Design	3+0	7.5	MİM562	Architectural Design Studio II	2+2	7.5
MİM599	Term Project	3+0	0.0	MİM592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				37.5
<b>III.Semester</b>				<b>IV.Semester</b>			
MİM790	Thesis	0+1	30.0	MİM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
KOR504	Architectural History and Concepts	3+0	7.5



KOR506	Technics of Documentation	3+0	7.5
KOR517	History of Modern Turkish Architecture	3+0	7.5
KOR518	History of Anatolian Architecture	3+0	7.5
KOR519	Construction Techniques and Conservation Problems of Ottoman Architecture	3+0	7.5
KOR521	World Heritage Sites in Turkey	3+0	7.5
KOR534	Special Topics in Preservation	3+0	7.5
KOR536	Preservation Management	3+0	7.5
KOR538	Memory - Space Relations in Conservation of Cultural Heritage	3+0	7.5
KOR547	Modernization And Architecture in Eskişehir	3+0	7.5
KOR549	Disaster Risks and Management In Cultural Heritage Areas	3+0	7.5
KOR551	Current Topics and Approaches in Conservation	3+0	7.5
MİM501	Analysis in Architecture	3+0	7.5
MİM502	Criticism in Architecture	3+0	7.5
MİM503	Housing Problems and Policies	3+0	7.5
MİM504	Qualitative Values of Housing Areas	3+0	7.5
MİM505	Ecological Planning and Design	3+0	7.5
MİM509	Legal Aspects of Urban Planning	3+0	7.5
MİM511	Building Material Failures	3+0	7.5
MİM512	Administrative and Legal Aspects of Planning	3+0	7.5
MİM513	Computer Programming and Introduction to Architectural Practices	3+0	7.5
MİM514	User Interface Design	3+0	7.5
MİM515	Solar Energy in Architecture	3+0	7.5
MİM516	Building Shell Design in Energy Efficient Buildings	3+0	7.5
MİM517	Architectural Precast	3+0	7.5
MİM518	Structure in Architecture	3+0	7.5
MİM519	Housing Architecture	3+0	7.5
MİM520	Architectural Steel	3+0	7.5
MİM521	Environmental Design	3+0	7.5
MİM523	Contemporary Interpretation of Traditional Turkish Houses	3+0	7.5
MİM525	Culture, House and Identity	3+0	7.5
MİM526	Computer Aided Architectural Analyses Techniques	3+0	7.5
MİM528	Using of Space around House and House Environment	3+0	7.5
MİM529	Urban Space and Handicapped People	3+0	7.5
MİM530	National and International Aspects of Urban Conservation and Renewal	3+0	7.5
MİM531	Architectural Design Methods	3+0	7.5
MİM532	Urban Regeneration	3+0	7.5
MİM533	Methodologies in Architectural Design Research	3+0	7.5
MİM534	Designing of Housing Areas	3+0	7.5
MİM535	Urban Design Theory	3+0	7.5
MİM536	Rationalism in Architecture	3+0	7.5
MİM541	Architectural Design Studio I	2+4	7.5
MİM543	Building Material Experiments	3+0	7.5
MİM544	Architectural Design and Criticism	3+0	7.5
MİM545	Architecture Sociological Readings	3+0	7.5
MİM546	Readings of Modernity in the Context of Architecture	3+0	7.5
MİM547	Architecture Communication	3+0	7.5
MİM549	Accessibility	3+0	7.5
MİM553	Auditorium Acoustics	3+0	7.5
MİM554	Digital Design and Production in Architecture	3+0	7.5
MİM555	Immaterial Architecture and its Elements	3+0	7.5
MİM557	Design Principles of Room Acoustics	3+0	7.5
MİM558	Introduction to Artificial Intelligence Applications in Architecture	4+0	7.5
MİM561	Architectural Design Studio I	2+2	7.5
MİM562	Architectural Design Studio II	2+2	7.5
MİM565	21st Century Approaches in Architectural Design	3+0	7.5
MİM567	Architectural Design Process Approaches	3+0	7.5
MİM571	Advanced Human Factors in Aviation	3+0	7.5
MİM573	Design Process Approaches in Intersection of Architecture and Architecture Education	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UMİ701	Research in Area of Specialization	3+0	4.5
UMİ702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF FASHION AND TEXTILE DESIGN

Head :

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

I.Semester				II.Semester			
MOD503	Fashion Theories and Trends	3+0	7.5	MOD523	Philosophy of Design	3+0	7.5
MOD536	Research Methods and Applications in Textile and Fashion Design	3+0	7.5	MOD592	Seminar	3+0	7.5
-----				-----			
15.0				15.0			
III.Semester				IV.Semester			
MOD790	Thesis	0+1	30.0	MOD790	Thesis	0+1	30.0
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30.0				30.0			

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MOD511	Intelligent Textiles and Clothing	3+0	7.5
MOD525	Experimental Printing Design	3+0	7.5
MOD526	Cultural Approaches in Fashion and Textile Design	3+0	7.5
MOD527	Wearable Art	1+2	7.5
MOD528	Youth Subcultures and Fashion	3+0	7.5
MOD530	Creativity in Clothing Design	3+0	7.5
MOD531	Textile Surface Applications in Wearable Art	1+2	7.5
MOD532	Sustainability in Textile and Fashion Design	3+0	7.5
MOD534	Natural Printing Applications in Wearable Art	1+2	7.5
MOD535	Digital Technologies for Textile and Garment Design	3+0	7.5
MOD537	Fiber Art	3+0	7.5
MOD538	Fashion Sociology	3+0	7.5
MOD539	Fashion Design Presentation and Graphic Design Relation	1+2	7.5
MOD541	Textile and Garment Comfort	3+0	7.5
MOD543	Applied Studies on Natural Dyeing	2+1	7.5
MOD545	Art and Fashion Concept in Design	3+0	7.5
MOD701	Research in Area of Specialization	3+0	4.5
MOD702	Research in Area of Specialization	3+0	4.5
TAÇ701	Thesis Research Study Course	3+0	7.5

## DEPARTMENT OF FLIGHT TRAINING

Head :

## MASTER OF SCIENCE (MS) DEGREE

## PROGRAM

I.Semester				II.Semester			
PLT501	Aircraft Performance and Operation Analysis	3+0	7.5	PLT509	Advanced Flight Mechanics	3+0	7.5
PLT503	Aviation Research <i>Seçmeli Dersler</i>	3+0	7.5	PLT592	Seminar <i>Seçmeli Dersler</i>	3+0	7.5
		--	15.0			--	15.0
			----				----
			30.0				30.0
III.Semester				IV.Semester			
PLT790	Thesis	0+1	30.0	PLT790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
HTK505	Multi-Criteria Decision-Making	3+0	7.5
PLT504	Aviation Safety Cases	3+0	7.5
PLT505	Statistical Methods in Aviation	3+0	7.5
PLT506	Airlines	3+0	7.5
PLT508	Aircraft Performance Optimization	3+0	7.5
PLT511	Aircraft Icing	3+0	7.5
PLT512	Data Science in Aviation	2+1	7.5
PLT513	Mathematical Calculations in Aviation	3+0	7.5
PLT515	Aircraft Sequencing and Scheduling Modelling	3+0	7.5
PLT516	Introduction to Unmanned Traffic Management	3+0	7.5
PLT517	Forecasting Methods in Aviation Operations	3+0	7.5
PLT519	Machine Learning in Aeronautics	2+1	7.5
PLT521	Operations Research in Aviation	3+0	7.5
PLT523	Introduction to Data Science with Python	2+1	7.5
PLT525	Navigation in Aviation	3+0	7.5
SHA535	Helicopter Theory and Flight Principles	3+0	7.5
SHA538	Flight Procedures And Airspace Design	3+0	7.5
SHA539	Advanced Aerodynamics	3+0	7.5
SHY508	Air Traffic Management	3+0	6.0
SHY517	Aviation Safety Management	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UPL701	Research in Area of Specialization	3+0	4.5
UPL702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF RAIL TRANSPORT ENGINEERING

Head :

### MASTER OF SCIENCE (MS) DEGREE

## PROGRAM

I.Semester				II.Semester			
MAT517	Applied Mathematics	3+0	7.5	RYL536	Introduction to Railway Systems II	3+0	7.5

RYL535	Introduction to Railway Systems I	3+0	7.5	RYL592	Seminar	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0

### III.Semester

RYL790	Thesis	0+1	30.0
			----
			30.0

### IV.Semester

RYL790	Thesis	0+1	30.0
			----
			30.0

### Elective Courses

RYL502	Entity in Charge of Maintenance and Certification for Railway Vehicles	3+0	7.5
RYL503	Certification of Railway Vehicles	3+0	7.5
RYL504	Energy Management in Rail Systems	3+0	7.5
RYL505	Introduction to Railway Vehicle and Track Interaction	3+0	7.5
RYL506	Urban Rail Transit System Design and Livable Cities II	3+0	7.5
RYL507	Dynamics of Railway Systems	3+0	7.5
RYL508	Design of Experiment	3+0	7.5
RYL509	Diagnostics and Monitoring in Railway Systems	3+0	7.5
RYL510	Air Conditioning and Ventilation	3+0	7.5
RYL511	Urban Rail Transit System Design and Livable Cities I	3+0	7.5
RYL512	System Identification in Railway Systems	3+0	7.5
RYL513	Numerical Methods in Optimization	3+0	7.5
RYL514	Safety Management Systems	3+0	7.5
RYL515	Selected Topics in Vehicle Design I	3+0	7.5
RYL516	Special Topics in Fluid Mechanics	3+0	7.5
RYL517	Vehicle Suspension System Design	3+0	7.5
RYL518	Selected Topics in Vehicle Design II	3+0	7.5
RYL519	Traction Control in Rail Vehicles	3+0	7.5
RYL520	Vibration and Noise in Rail Systems	3+0	7.5
RYL521	Shell Structures	3+0	7.5
RYL522	Image Processing Applications in Rail Systems	3+0	7.5
RYL523	Tractive Systems	3+0	7.5
RYL524	Sensors and Actuators in Railway System	3+0	7.5
RYL525	Signal Processing in Railway Systems	3+0	7.5
RYL526	Corrosion and Surface Treatment	3+0	7.5
RYL527	Optimization in Railway Systems	3+0	7.5
RYL528	Durability of Railway Materials	3+0	7.5
RYL530	Transportation of Dangerous Goods on Railways	3+0	7.5
RYL531	Tribology of Wheel - Rail	3+0	7.5
RYL532	Electric Machines in Railway Systems	3+0	7.5
RYL533	Data Analysis and Machine Learning in Rail Systems	3+0	7.5
RYL534	High Voltage Technique	3+0	7.5
RYL537	Soil Improvement and Seismic Slope Stability Analysis	3+0	7.5
RYL538	Infrastructure and Soil Dynamics in Rail Systems	3+0	7.5
RYL539	Soil Investigation and Soil Mechanics in Risky Fields	3+0	7.5
RYL540	Transportation Economics	3+0	7.5
RYL541	Condition Assessment of Railway Ballast by Ground Penetratin Radar (GPR) Method	3+0	7.5
RYL542	Historical Development of Railways	3+0	7.5
RYL543	Field and Laboratory Tests of Soils Under Dynamic Loading	3+0	7.5
RYL544	Investigation of Railway Infrastructure by Nondestructive Condition Monitoring Methods	3+0	7.5
RYL545	Introduction to Finite Element Analysis	3+0	7.5
RYL546	Detection Methods of Railway Infrastructure Deformations, Maintenance and Renewal Methods	3+0	7.5
RYL547	Disaster Risks and Disaster Management in Rail Systems	3+0	7.5
RYL548	Business Management in Railway Systems	3+0	7.5
RYL549	Risk Analysis and Management	3+0	7.5
RYL550	Integrated Logistics Management	3+0	7.5
RYL551	Railway Electrification	3+0	7.5
RYL552	Elastic Stability Analysis of Shells and Plates	3+0	7.5
RYL553	Deep Learning and Artificial Neural Networks	3+0	4.0
RYL554	Energy Efficiency in Railway Systems	3+0	7.5

RYL555	Decision Making Techniques	3+0	7.5
RYL556	Cost Analysis in Railway Systems	3+0	7.5
RYL557	Selected Topics in Railway Design	3+0	7.5
RYL558	High Speed Railways	3+0	7.5
RYL559	Transportation Legislation	3+0	7.5
RYL560	Strategic Communication and Management in Railway	3+0	7.5
RYL562	Sustainable Engineering Structures in Rail Systems	3+0	7.5
RYL564	Advanced Finite Element Analysis	3+0	7.5
RYL566	Sustainable Construction Materials in Rail Systems	3+0	7.5
RYL701	Research in Area of Specialization	3+0	4.5
RYL702	Research in Area of Specialization	3+0	4.5
TAÇ701	Thesis Research Study Course	3+0	7.5

## DEPARTMENT OF RECREATION

Head :

### DOCTORATE DEGREE (PH.D)

#### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
	<i>Seçmeli Dersler</i>	-	30.0	REK692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			-----				-----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	REK890-0	Thesis( Thesis Proposal)	0+1	30.0
			---				-----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
REK890	Thesis	0+1	30.0	REK890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
REK890	Thesis	0+1	30.0	REK890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

#### Elective Courses

BES657	Physical Education and Sports far Individuals with Special Needs	3+0	7.5
REK 629	Urban Life and Recreation	3+0	7.5
REK611	Rekreation Policies	3+0	7.5
REK613	Psycho-Social Issues In Leisure Research	3+0	7.5
REK615	Experimental Practicies in Recreation and Leisure Research	3+0	7.5
REK617	Technology Based Leisure	3+0	7.5
REK619	Risk Management in Recreation	3+0	7.5
REK621	Human Resource Management in Recreation	3+0	7.5

REK623	Leisure Experience Design and Management	3+0	7.5
REK625	Leisure Consumer Psychology and Behavior	3+0	7.5
REK627	Sustainability and Recreation	3+0	7.5
REK631	Health and First Aid	3+0	7.5
REK633	Qualitative Data Analysis	3+0	7.5
REK901	Research in Area of Specialization	5+0	7.5
REK902	Research in Area of Specialization	5+0	7.5
SYR601	New Trends in Recreation	3+0	7.5
SYR612	Modern Sport Marketing Applications	3+0	7.5
SYR617	Measuring Tool Development	3+0	7.5
SYR618	Recreational Leadership	3+0	7.5
SYR619	Leisure Economics and Applications	3+0	7.5
SYR629	Management in Therapeutic Recreation Services	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
REK511	Academic Writing, Publishing and Presentation Techniques	3+0	7.5	REK512	Statistical Decision Making and Data Analysis in Leisure Research Seminar	3+0	7.5
SYR513	Leisure and Recreation Analysis	3+0	7.5	REK592		3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
REK790	Thesis	0+1	30.0	REK790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

BES528	Planning and Evaluation in Physical Education Teaching	3+0	7.5
BES563	Health and Exercise	3+0	7.5
PZL532	Sport Marketing Management	3+0	7.5
REK513	Project Management Techniques	3+0	7.5
REK514	Commercial Recreation Industry	3+0	7.5
REK515	Recreation Research in Local Governments	3+0	7.5
REK516	Quality Management in Recreation	3+0	7.5
REK517	Gender and Sport	3+0	7.5
REK518	Employee Recreation Studies	3+0	7.5
REK519	Recreation and Brand Management	3+0	7.5
REK520	Body Composition and Wellness	3+0	7.5
REK521	Customer relationship strategies in recreation	3+0	7.5
REK523	Motor Development and Physical Fitness in Individuals with Special Needs	3+0	7.5
REK525	E-sports Management	3+0	7.5
REK527	Qualitative Research Methods	3+0	7.5
REK701	Research in Area of Specialization	3+0	4.5
REK702	Research in Area of Specialization	3+0	4.5
SPY502	Sports Economy and Analysis	3+0	7.5
SYR516	Leisure Education in Theory and Practice	3+0	7.5
SYR517	Theoretical Approaches on Leisure	3+0	7.5
SYR519	Therapeutic Recreation Program and Practices	3+0	7.5
SYR520	The Therapeutic Recreation Leadership	3+0	7.5
SYR522	Leisure and Ageing	3+0	7.5
SYR523	Leisure and Consumer Culture	3+0	7.5

SYR525	Leisure and Healthy Living	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5

## DEPARTMENT OF CERAMIC ENGINEERING

Head :

### DOCTORATE DEGREE (PH.D)

<b>PROGRAM</b>							
<b>I.Semester</b>				<b>II.Semester</b>			
	<i>Seçmeli Dersler</i>	-	30.0	SRM692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
DYS000	Qualifying Exam	0+0	0.0	SRM890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
<b>V.Semester</b>				<b>VI.Semester</b>			
SRM890	Thesis	0+1	30.0	SRM890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>VII.Semester</b>				<b>VIII.Semester</b>			
SRM890	Thesis	0+1	30.0	SRM890	Thesis	0+1	30.0
			----				----
			30.0				30.0
<b>Elective Courses</b>							
CAM601	Ionic Diffusion in Oxide Based Glasses					3+0	7.5
CAM602	Glass Science and Technological Improvements					3+0	7.5
FBE510	Ethics of Science and Research Techniques					2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
MLZ601	Scanning Electron Microscopy and Chemical Analysis Techniques					3+0	7.5
MLZ602	Transmission Electron Microscope and Chemical Analysis Techniques					3+0	7.5
MLZ603	Special X-Ray Techniques and Their Applications					3+0	7.5
MLZ604	Inorganic Powder Synthesis Technologies					3+0	7.5
MLZ605	Sintering of Particulate Materials					3+0	7.5
MLZ606	Phase Transformation Reactions of Metals					3+0	7.5
MLZ607	Alloy Development-Principles, New Horizons and Extreme Applications					3+0	7.5
MLZ610	Kinetics					3+0	7.5
MLZ611	Diffusion in Solids					3+0	7.5
MLZ612	Ferroelectric Materials and Devices					3+0	7.5
MLZ613	Crystal Anisotropy					3+0	7.5
MLZ614	Spintronic and Applications					3+0	7.5
MLZ615	Material and Energy Balance in Production					3+0	7.5
MLZ616	Colloid Chemistry and Rheological Behaviour					3+0	7.5

MLZ617	Inorganic Pigments and Pigments Interactions	3+0	7.5
MLZ618	The Relationship between Structure and Properties in Industrial Glazes	3+0	7.5
SRM604	Ceramic Sensors	3+0	7.5
SRM606	Structural Advanced Ceramics	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
USM901	Research in Area of Specialization	5+0	7.5
USM902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MLZ501	The Structure-Property Relationships in Materials	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
SRM501	Ceramic Forming Techniques	3+0	7.5	MLZ502	Thermodynamic Applications in Material Science	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0	SRM592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
SRM790	Thesis	0+1	30.0	SRM790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

CAM513	Metallic Glasses	3+0	7.5
CAM514	Chemical Durability of Glasses	3+0	7.5
CAM515	Engineering Glasses	3+0	7.5
ENM501	Design and Analysis of Experiments	3+0	7.5
FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MLZ504	Fracture Mechanics of Materials	3+0	7.5
MLZ509	Advanced Composite Materials	3+0	7.5
MLZ510	Thin Film Production and Vacuum Technologies	3+0	7.5
MLZ511	Dielectric Materials and Devices	3+0	7.5
MLZ512	Applications of Crystallography	3+0	7.5
MLZ513	Raw Materials and Mineral Processing	3+0	7.5
MLZ514	The use of Glass Materials in Industry	3+0	7.5
MLZ515	Refractory Technology	3+0	7.5
MLZ516	Coating Techniques	3+0	7.5
MLZ517	X-Ray Diffraction Techniques in Materials Characterisation	3+0	7.5
SRM502	Rheological Behavior of Ceramics	3+0	7.5
SRM510	High Temperature Properties of Ceramic Materials	3+0	7.5
SRM513	Making of Heavy-Clay Products	3+0	7.5
SRM517	Ceramic Body and Glaze	3+0	3.0
SRM520	Ceramic Tiles and Sanitary ware Production	3+0	7.5
SRM526	Ceramic-Metallic Thin Films and Coatings	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
USM701	Research in Area of Specialization	3+0	4.5
USM702	Research in Area of Specialization	3+0	4.5

## (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE



## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
MLZ501	The Structure-Property Relationships in Materials	3+0	7.5	MAT517	Applied Mathematics	3+0	7.5
SRM501	Ceramic Forming Techniques	3+0	7.5	MLZ502	Thermodynamic Applications in Material Science	3+0	7.5
	<i>Seçmeli Dersler</i>	--	15.0	SRM599	Term Project	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
			-----				-----
			30.0				30.0

### Elective Courses

CAM513	Metallic Glasses	3+0	7.5
CAM514	Chemical Durability of Glasses	3+0	7.5
CAM515	Engineering Glasses	3+0	7.5
ENM501	Design and Analysis of Experiments	3+0	7.5
MLZ504	Fracture Mechanics of Materials	3+0	7.5
MLZ509	Advanced Composite Materials	3+0	7.5
MLZ510	Thin Film Production and Vacuum Technologies	3+0	7.5
MLZ511	Dielectric Materials and Devices	3+0	7.5
MLZ512	Applications of Crystallography	3+0	7.5
MLZ513	Raw Materials and Mineral Processing	3+0	7.5
MLZ514	The use of Glass Materials in Industry	3+0	7.5
MLZ515	Refractory Technology	3+0	7.5
MLZ516	Coating Techniques	3+0	7.5
MLZ517	X-Ray Diffraction Techniques in Materials Characterisation	3+0	7.5
SRM502	Rheological Behavior of Ceramics	3+0	7.5
SRM510	High Temperature Properties of Ceramic Materials	3+0	7.5
SRM513	Making of Heavy-Clay Products	3+0	7.5
SRM517	Ceramic Body and Glaze	3+0	3.0
SRM520	Ceramic Tiles and Sanitary ware Production	3+0	7.5
SRM526	Ceramic-Metallic Thin Films and Coatings	3+0	7.5

## DEPARTMENT OF CIVIL AVIATION

Head :

### DOCTORATE DEGREE (PH.D)

## PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
	<i>Seçmeli Dersler</i>	-	30.0	SHA692	Seminar	3+0	7.5
		-			<i>Seçmeli Dersler</i>	--	22.5
			-----				-----
			30.0				30.0

**III.Semester**

**IV.Semester**

DYS000	Qualifying Exam	0+0	0.0	SHA890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
SHA890	Thesis	0+1	30.0	SHA890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
SHA890	Thesis	0+1	30.0	SHA890	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MLZ651	Materials Science and Advanced Materials Technology	3+0	7.5
MLZ652	Fatigue and Creep Behaviour of Aircraft Materials	3+0	7.5
SHA601	Airline Management	3+0	7.5
SHA602	Aircraft Dynamics	3+0	7.5
SHA604	Engineering Economic Analysis	3+0	7.5
SHA608	Optimization Methods in Flight Mechanics	3+0	7.5
SHA614	Airport Design	3+0	7.5
SHA615	Advanced Mechanical Vibrations	3+0	7.5
SHA617	Sliding Mode Control Theory	3+0	7.5
SHA618	Fault Tolerant Flight Control System Design	3+0	7.5
SHA619	Cogeneration -Combined Heat Power Systems	3+0	7.5
SHA620	Aircraft Performance and Operational Analysis II	3+0	7.5
SHA621	Advanced Gas Thermodynamics	3+0	7.5
SHA625	Fatigue of Thermal Barrier Coating Systems	3+0	7.5
SHA626	Genetic Algorithms and Applications of Control Systems	3+0	7.5
SHA627	Sizing of Propeller-Driven and Jet-Powered Aircraft	3+0	7.5
SHA628	Airspace Management	3+0	7.5
SHA629	Non-Destructive Inspection Methods for Aircraft Maintenance	3+0	7.5
SHA630	Current Issues in Gas Turbine Engine Combustion Systems	3+0	7.5
SHA631	Aerothermodynamic Optimization of Aircraft Propulsion Systems	3+0	7.5
SHA632	Free Flight Concept and Analysis	3+0	7.5
SHA633	Operational Risk Management in Aviation	3+0	7.5
SHA634	Project Management in Aviation	3+0	7.5
SHA635	Trending Topics in Unmanned Aerial Vehicle Technology	3+0	7.5
SHA636	New Approaches in Air Traffic Management	3+0	7.5
SHA637	Performance Analysis of Aero Engines	3+0	7.5
SHA638	Network, Fleet and Schedule Planning in Aviation	3+0	7.5
SHA639	Leadership and Change Management	3+0	7.5
SHA640	Single Score Life Cycle Assessment (LCA)	3+0	7.5
SHA642	ICT Project Management for Airports	3+0	7.5
SHA644	Gas Turbine Engine Theory and Systems	3+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
USI901	Research in Area of Specialization	5+0	7.5
USI902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

#### I.Semester

#### II.Semester

SHA557	Multidisciplinary Research Topics in Aviation	3+0	7.5	SHA556	Mathematical Programming in Air Transportation	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	SHA558	Current Issues in Sustainable Aviation Seminar	3+0	7.5
				SHA592	<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0

	<b>III.Semester</b>				<b>IV.Semester</b>		
SHA790	Thesis	0+1	30.0	SHA790	Thesis	0+1	30.0
			----				----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MAT517	Applied Mathematics	3+0	7.5
SHA511	Aircraft Performance And Operation Analysis I	3+0	7.5
SHA539	Advanced Aerodynamics	3+0	7.5
SHA555	Airport Information and Communications Technology Service Management	3+0	7.5
SHA559	Human Factors in Aviation Operations	3+0	7.5
SHA560	Aerospace Materials	3+0	7.5
SHA561	Human Computer Interaction in Aviation	3+0	7.5
SHA562	Airline Management	3+0	7.5
SHA564	Mechanical Properties of Materials	3+0	7.5
SHA565	Urban and Advanced Air Mobility	3+0	7.5
SHA566	Human Factors in Aviation Operations	3+0	7.5
SHA568	Business Analytics and Data Analysis	3+0	7.5
SHA572	Safety Management in Aviation Operations	3+0	7.5
SHA576	Simulation for Airline and Airport Operations	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
USI701	Research in Area of Specialization	3+0	4.5
USI702	Research in Area of Specialization	3+0	4.5

## DEPARTMENT OF SPORTS MANAGEMENT

Head :

### DOCTORATE DEGREE (PH.D)

### DOCTORATE DEGREE (PH.D)

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
<i>Seçmeli Dersler</i>	-	30.0	SYR692	Seminar	3+0	7.5	
	-			<i>Seçmeli Dersler</i>	--	22.5	

			-----				-----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	SYR890-0	Thesis (Thesis Proposal)	0+1	30.0
			---				-----
			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
SYR890	Thesis	0+1	30.0	SYR890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
SYR890	Thesis	0+1	30.0	SYR890	Thesis	0+1	30.0
			-----				-----
			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5				
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5				
SYR601	New Trends in Recreation	3+0	7.5				
SYR610	Event Planning and Project Management	3+0	7.5				
SYR611	Contemporary Approaches in Sport Management	3+0	7.5				
SYR612	Modern Sport Marketing Applications	3+0	7.5				
SYR614	Risk Management in Sport Organizations	3+0	7.5				
SYR615	Strategic Sport Communication	3+0	7.5				
SYR617	Measuring Tool Development	3+0	7.5				
SYR618	Recreational Leadership	3+0	7.5				
SYR619	Leisure Economics and Applications	3+0	7.5				
SYR621	Psycho-Social Issues In Leisure Research	3+0	7.5				
SYR623	Strategic Human Resources Management and Applications	3+0	7.5				
SYR625	Sustainability in Sport Management and Recreation	3+0	7.5				
SYR627	Customer Relationship Management Strategies and Applications	3+0	7.5				
SYR629	Management in Therapeutic Recreation Services	3+0	7.5				
SYR631	Sociology of Body	3+0	7.5				
SYR633	Sports Betting and Behavioral Researches	3+0	7.5				
SYR635	Academic Writing and Critical Thinking	3+0	7.5				
TAÇ801	Thesis Research Study Course	3+0	7.5				
USY901	Research in Area of Specialization	5+0	7.5				
USY902	Research in Area of Specialization	5+0	7.5				

## MASTER OF SCIENCE (MS) DEGREE

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>		
SPY501	Sport Management Approaches	3+0	7.5	PZL532	Sport Marketing Management	3+0	7.5
SYR518	Research Methods and Applications in Sports	3+0	7.5	SYR592	Seminar	3+0	7.5

Management and Recreation						
<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	--	15.0
		----				----
		30.0				30.0

	<b>III.Semester</b>				<b>IV.Semester</b>	
SYR790	Thesis	0+1	30.0	SYR790	Thesis	0+1 30.0
			----			----
			30.0			30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
FİN528	Sport Finance	3+0	6.0
İŞL508	Human Resources Strategies and Applications	3+0	7.5
İŞL578	Sport and Facility Business	3+0	6.0
PZL533	Integrated Marketing Communications in Sport	3+0	7.5
SPY502	Sports Economy and Analysis	3+0	7.5
SYR512	Customer Relationship in Sport	3+0	7.5
SYR513	Leisure and Recreation Analysis	3+0	7.5
SYR514	Brand Management and Sports	3+0	7.5
SYR515	Recreation Project Management	3+0	7.5
SYR516	Leisure Education in Theory and Practice	3+0	7.5
SYR517	Theoretical Approaches on Leisure	3+0	7.5
SYR519	Therapeutic Recreation Program and Practices	3+0	7.5
SYR520	The Therapeutic Recreation Leadership	3+0	7.5
SYR522	Leisure and Ageing	3+0	7.5
SYR523	Leisure and Consumer Culture	3+0	7.5
SYR524	Organizational Behavior In Sport Management	3+0	7.5
SYR525	Leisure and Healthy Living	3+0	7.5
SYR526	New Media and Digital Communication in Sports	3+0	7.5
SYR527	Academic Writing and Critical Thinking	3+0	7.5
SYR529	Current Approaches To Sports Fandom	3+0	7.5
SYR531	Data Analysis and Practices in Sport Management Research	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
USY701	Research in Area of Specialization	3+0	4.5
USY702	Research in Area of Specialization	3+0	4.5

## TEXTILE AND FASHION DESIGN DEPARTMENT

Head :

### MASTER OF SCIENCE (MS) DEGREE

#### PROGRAM

	<b>I.Semester</b>				<b>II.Semester</b>	
MOD503	Fashion Theories and Trends	3+0	7.5	MOD526	Cultural Approaches in Fashion and Textile Design Seminar	3+0 7.5
MOD536	Research Methods and Applications in Textile and Fashion Design	3+0	7.5	MOD592		3+0 7.5
	<i>Seçmeli Dersler</i>	--	15.0		<i>Seçmeli Dersler</i>	-- 15.0





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30.0-----

**Elective Courses**

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MLZ552	Materials Selection For Aircraft Structure	3+0	7.5
MLZ553	Mechanical Behavior of Composite Materials	3+0	7.5
MLZ554	Structure and Properties of Aircraft Materials	3+0	7.5
SHA513	Oil Analysis Program in Aircraft Maintenance	3+0	7.5
SHA515	The Effects of Construction Techniques Aircraft on Performances of Light	3+0	7.5
SHA531	Industrial Aerodynamics	3+0	7.5
SHA535	Helicopter Theory and Flight Principles	3+0	7.5
SHA537	Exergy Analysis	3+0	7.5
SHA539	Advanced Aerodynamics	3+0	7.5
SHA543	Parametric Cycle Analysis of Aircraft Propulsion System	3+0	7.5
SHA547	Flight Tests and Instrumentation	3+0	7.5
SHA548	Experimental Aerodynamics Analysis for Incompressible Flow	3+0	7.5
SHA549	Gas Turbine Combustion	3+0	7.5
SHA550	Preliminary Design of Unmanned Air Vehicle and Its Propulsion System	3+0	7.5
SHA551	Airline Operations and Scheduling	3+0	7.5
SHA552	Experimental Methods and Data Processing Techniques for Turbomachinery	3+0	7.5
SHA553	Air-conditioning Systems for Aircraft	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
TER501	Advanced Thermodynamics	3+0	7.5
UGM501	Advanced Human Factors in Aviation	3+0	7.5
UGM510	Failure Analysis of Aircraft Structures	3+0	7.5
UGM511	Mathematical Programming and Aviation Applications	3+0	7.5
UGM512	Electric - Hybrid Propulsion Systems and Aviation Applications	3+0	7.5
UGM513	Propeller and Windmill Aerodynamics	3+0	7.5
UGM515	Advanced Manufacturing and Assembly Technology for Aircraft Materials	3+0	7.5
UGM517	Sustainability Analysis at Airports	3+0	7.5
UGM519	Batteries and Battery Systems	3+0	7.5
UGM521	Momentum and Heat Transfer	3+0	7.5
UGM523	Physical Ergonomics in Aviation	3+0	7.5
UUG701	Research in Area of Specialization	3+0	4.5
UUG702	Research in Area of Specialization	3+0	4.5

**DEPARTMENT OF AIR FRAME AND POWERPLANT MAINTENANCE**

Head :

**DOCTORATE DEGREE (PH.D)**

**PROGRAM**

<b>I.Semester</b>				<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	-	30.0	UGM692	Seminar	3+0 7.5
	-			<i>Seçmeli Dersler</i>	-- 22.5
		-----			-----
		30.0			30.0
<b>III.Semester</b>				<b>IV.Semester</b>	
DYS000	Qualifying Exam	0+0	0.0	UGM890-0	Thesis (Thesis Proposal) 0+1 30.0





UGM790	Thesis	0+1	30.0	UGM790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
MLZ552	Materials Selection For Aircraft Structure	3+0	7.5
MLZ553	Mechanical Behavior of Composite Materials	3+0	7.5
MLZ554	Structure and Properties of Aircraft Materials	3+0	7.5
SHA513	Oil Analysis Program in Aircraft Maintenance	3+0	7.5
SHA515	The Effects of Construction Techniques Aircraft on Performances of Light	3+0	7.5
SHA531	Industrial Aerodynamics	3+0	7.5
SHA535	Helicopter Theory and Flight Principles	3+0	7.5
SHA537	Exergy Analysis	3+0	7.5
SHA539	Advanced Aerodynamics	3+0	7.5
SHA543	Parametric Cycle Analysis of Aircraft Propulsion System	3+0	7.5
SHA547	Flight Tests and Instrumentation	3+0	7.5
SHA548	Experimental Aerodynamics Analysis for Incompressible Flow	3+0	7.5
SHA549	Gas Turbine Combustion	3+0	7.5
SHA550	Preliminary Design of Unmanned Air Vehicle and Its Propulsion System	3+0	7.5
SHA551	Airline Operations and Scheduling	3+0	7.5
SHA552	Experimental Methods and Data Processing Techniques for Turbomachinery	3+0	7.5
SHA553	Air-conditioning Systems for Aircraft	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
TER501	Advanced Thermodynamics	3+0	7.5
UGM501	Advanced Human Factors in Aviation	3+0	7.5
UGM510	Failure Analysis of Aircraft Structures	3+0	7.5
UGM511	Mathematical Programming and Aviation Applications	3+0	7.5
UGM512	Electric - Hybrid Propulsion Systems and Aviation Applications	3+0	7.5
UGM513	Propeller and Windmill Aerodynamics	3+0	7.5
UGM515	Advanced Manufacturing and Assembly Technology for Aircraft Materials	3+0	7.5
UGM517	Sustainability Analysis at Airports	3+0	7.5
UGM519	Batteries and Battery Systems	3+0	7.5
UGM521	Momentum and Heat Transfer	3+0	7.5
UGM523	Physical Ergonomics in Aviation	3+0	7.5
UUG701	Research in Area of Specialization	3+0	4.5
UUG702	Research in Area of Specialization	3+0	4.5

## NON-THESIS MASTER'S PROGRAM

### DEPARTMENT OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS

Head :

### DOCTORATE DEGREE (PH.D)

#### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>		
<i>Seçmeli Dersler</i>	-	30.0	UCS692	Seminar	3+0	7.5
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					<i>Seçmeli Dersler</i>	--	22.5
			----				----
			30.0				30.0
	<b>III.Semester</b>				<b>IV.Semester</b>		
DYS000	Qualifying Exam	0+0	0.0	UCS890-0	Thesis (Thesis Proposal)	0+1	30.0
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			--				30.0
	<b>V.Semester</b>				<b>VI.Semester</b>		
UCS890	Thesis	0+1	30.0	UCS890	Thesis	0+1	30.0
			----				----
			30.0				30.0
	<b>VII.Semester</b>				<b>VIII.Semester</b>		
UCS890	Thesis	0+1	30.0	UCS890	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
TAÇ801	Thesis Research Study Course	3+0	7.5
UCS601	Use of GIS in Earth Sciences	3+0	7.5
UCS602	Earth Systems	3+0	7.5
UCS603	Advanced Photogeology	3+0	7.5
UCS604	Environmental Hydrogeology	3+0	7.5
UCS606	Hydraulics in Porous Media	3+0	7.5
UCS607	Advanced Technology Supported Archaeological and Architectural Documentation	3+0	7.5
UCS608	Multiple Criteria Stable Support System Applications in Disaster Management	3+0	7.5
UCS609	Use of Geographic Information Systems in the Applications of Seismic Microzoning and Urban Transformation	3+0	7.5
UCS610	Application of High Speed Ground Penetrating Radar to Ballast and Subsoil Inspections of Runways, Highways and Railways	3+0	7.5
UCS611	Use of Geographic Information Systems in the Planning of Earthquake Origin Risk/Damage Mitigation	3+0	7.5
UCS612	Modern Approaches to the City Planning	3+0	7.5
UCS613	Urban Conservation-Restoration	3+0	7.5
UCS614	Urban Regeneration	3+0	7.5
UCS615	Resource Inventory and Analysis	3+0	7.5
UCS616	Physical Principles of Energy and Matter Interactions in Remote Sensing	3+0	7.5
UCS617	Special Subject at Remote Sensing	3+0	7.5
UCS618	Network Analysis in Geographic Information Systems	3+0	7.5
UCS619	Spatial Hydrology	3+0	7.5
UCS620	Remote Sensing and Geographic Information Systems Applications for Mine Reclamation	3+0	7.5
UCS621	Mixed Methods Research in Geographic Information Systems	3+0	7.5
UCS622	Basic Programming and Geometric Problems	3+0	7.5
UCS623	GIS Applications with R	3+0	7.5
UCS624	Airborne Laser Scanning (LIDAR) Systems	3+0	7.5
UCS626	Logistics Optimization	3+0	7.5
UCS628	National Standards, Legislations and Public Applications	3+0	7.5
UCS630	Geographical Information Applications for Water Resources Planning	3+0	7.5
UCS632	Government Projects and Spatial Relations in Turkey	3+0	7.5
UCS634	Property Law and Introduction to Land Survey Applications	3+0	7.5
UCS635	Satellite Image Processing	3+0	7.5
UCS636	Project Management in Geographic Information Systems	3+0	7.5
UCS637	Remote Sensing and Geographic Information Systems Studio I	6+4	7.5
UCS638	Remote Sensing and Geographic Information Systems Studio II	6+4	7.5
UCS639	Remote Sensing with Google Earth Engine Remote Sensing	3+0	7.5
UCS640	Gis Applications in Agriculture	3+0	7.5

UCS641	Deep learning in Remote Sensing	3+0	7.5
UCS642	Machine Learning Applications in Geographic Information Systems and Remote Sensing	3+0	7.5
UCS643	Advanced Geographic Information System Applications in Urban Climate Research	3+0	7.5
UCS645	Remote Sensing of Natural Disaster	3+0	7.5
UCS901	Research in Area of Specialization	5+0	7.5
UCS902	Research in Area of Specialization	5+0	7.5

## MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

<b>I.Semester</b>				<b>II.Semester</b>			
UCS533	Fundamentals of Mapping and Geographical Information Systems	3+0	7.5	UCS508	Interpretation and Analysis Techniques on Geographic Information Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	UCS555	Theoretical Basics of Remote Sensing	3+0	7.5
				UCS592	Seminar	3+0	7.5
					<i>Seçmeli Dersler</i>	--	7.5
			----				----
			30.0				30.0
<b>III.Semester</b>				<b>IV.Semester</b>			
UCS790	Thesis	0+1	30.0	UCS790	Thesis	0+1	30.0
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			30.0				30.0

### Elective Courses

FBE510	Ethics of Science and Research Techniques	2+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)	2+0	7.5
iST533	Fundamentals Statistics	3+0	7.5
TAÇ701	Thesis Research Study Course	3+0	7.5
UCS506	Methods of Numerical Analysis	3+0	7.5
UCS511	Remote Sensing and Geographic Information Systems Techniques in Disaster Management	3+0	7.5
UCS512	Special Topics in the Natural Resources Management with the Use of GIS	3+0	7.5
UCS513	Special Topics on City Information Systems	3+0	7.5
UCS514	Environmental Management and Integration With Geographical Information Systems	3+0	7.5
UCS519	Automated Mapping and Facility Management Systems	3+0	7.5
UCS527	Multicriteria Decision Making Methods	3+0	7.5
UCS534	Geostatistics	3+0	7.5
UCS535	Integration of Geographic Information Systems and Global Positioning Systems	3+0	7.5
UCS536	Remote Sensing	3+0	7.5
UCS537	Geographic Information Systems in Social Sciences	3+0	7.5
UCS538	Geographic Information Systems and Health	3+0	7.5
UCS542	Raster and Grid Modeling on Remote Sensing	3+0	7.5
UCS543	Applications of New Technologies in Geographic Information Systems	3+0	7.5
UCS544	Seismic Data Acquisition Techniques and Quality Control	3+0	7.5
UCS545	Bore-Hole Seismic Methods and Professional Software	3+0	7.5
UCS546	Seismic Tomography and Professional Software	3+0	7.5
UCS547	Seismic Surface Waves	3+0	7.5
UCS548	Data-Processing in Seismic Refraction Methods and Professional Software	3+0	7.5
UCS549	Data-Processing in Seismic Reflection Methods and Professional Software	3+0	7.5
UCS550	Seismic Interpretation and Professional Software	3+0	7.5
UCS551	Seismic Stratigraphy and Tectonics	3+0	7.5
UCS552	Satellite Technologies and Communication	3+0	7.5
UCS553	Satellite Managership	3+0	7.5
UCS554	Geodatabase	3+0	7.5

UCS557	Microzoning	3+0	7.5
UCS559	Spatial Statistics	3+0	7.5
UCS574	Map Production and Use	3+0	7.5
UCS576	Data Mining in Remote Sensing	3+0	7.5
UCS577	Basic Programming and Introduction to Python Language	3+0	7.5
UCS578	Digital Elevation Models and Applications	3+0	7.5
UCS596	Internet-Based Geographic Information Systems Applications	3+0	7.5
UCS701	Research in Area of Specialization	3+0	4.5
UCS702	Research in Area of Specialization	3+0	4.5

## (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

I.Semester				II.Semester			
UCS533	Fundamentals of Mapping and Geographical Information Systems	3+0	7.5	UCS508	Interpretation and Analysis Techniques on Geographic Information Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	UCS555	Theoretical Basics of Remote Sensing	3+0	7.5
				UCS599	Term Project	3+0	15.0
					<i>Seçmeli Dersler</i>	--	7.5
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			30.0				37.5

### Elective Courses

iST533	Fundamentals Statistics	3+0	7.5
UCS506	Methods of Numerical Analysis	3+0	7.5
UCS511	Remote Sensing and Geographic Information Systems Techniques in Disaster Management	3+0	7.5
UCS512	Special Topics in the Natural Resources Management with the Use of GIS	3+0	7.5
UCS513	Special Topics on City Information Systems	3+0	7.5
UCS514	Environmental Management and Integration With Geographical Information Systems	3+0	7.5
UCS519	Automated Mapping and Facility Management Systems	3+0	7.5
UCS527	Multicriteria Decision Making Methods	3+0	7.5
UCS534	Geostatistics	3+0	7.5
UCS535	Integration of Geographic Information Systems and Global Positioning Systems	3+0	7.5
UCS536	Remote Sensing	3+0	7.5
UCS537	Geographic Information Systems in Social Sciences	3+0	7.5
UCS538	Geographic Information Systems and Health	3+0	7.5
UCS542	Raster and Grid Modeling on Remote Sensing	3+0	7.5
UCS543	Applications of New Technologies in Geographic Information Systems	3+0	7.5
UCS544	Seismic Data Acquisition Techniques and Quality Control	3+0	7.5
UCS545	Bore-Hole Seismic Methods and Professional Software	3+0	7.5
UCS546	Seismic Tomography and Professional Software	3+0	7.5
UCS547	Seismic Surface Waves	3+0	7.5
UCS548	Data-Processing in Seismic Refraction Methods and Professional Software	3+0	7.5
UCS549	Data-Processing in Seismic Reflection Methods and Professional Software	3+0	7.5
UCS550	Seismic Interpretation and Professional Software	3+0	7.5
UCS551	Seismic Stratigraphy and Tectonics	3+0	7.5
UCS552	Satellite Technologies and Communication	3+0	7.5
UCS553	Satellite Managership	3+0	7.5
UCS554	Geodatabase	3+0	7.5
UCS557	Microzoning	3+0	7.5
UCS559	Spatial Statistics	3+0	7.5
UCS574	Map Production and Use	3+0	7.5
UCS576	Data Mining in Remote Sensing	3+0	7.5
UCS577	Basic Programming and Introduction to Python Language	3+0	7.5
UCS578	Digital Elevation Models and Applications	3+0	7.5
UCS596	Internet-Based Geographic Information Systems Applications	3+0	7.5

**PROGRAM IN REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS (DISTANCE LEARNING)**

**PROGRAM**

<b>I.Semester</b>			<b>II.Semester</b>		
<i>Seçmeli Dersler</i>	-	30.0	UCS599	Term Project	3+0 15.0
	-			<i>Seçmeli Dersler</i>	-- 30.0
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		30.0			45.0

**Elective Courses**

UCS556	Use of Geographic Information Systems in Planning	3+0	7.5
UCS558	Use of Geographic Information System in Local Governments	3+0	7.5
UCS560	Database Usage in Geographic Information Systems	3+0	7.5
UCS563	Geographical Information Standards and Basic Legislation	3+0	7.5
UCS564	Disaster Management	3+0	7.5
UCS565	Introduction to Geographic Information Systems	3+0	7.5
UCS566	Geographical Information System Applications in Disaster Management	3+0	7.5
UCS567	Introduction to Remote Sensing	3+0	7.5
UCS568	Statistical Applications in Geographical Information Systems	3+0	7.5
UCS569	Computer Aided Mapping	3+0	7.5
UCS571	Open Source Geographic Information Systems Applications	3+0	7.5
UCS573	Open Source Remote Sensing Applications	3+0	7.5
UCS575	Spatial Analysis	3+0	7.5
UCS581	Smart City Transformation and Data Management in Local Governments	3+0	7.5
UCS582	Evaluation of Climatic Factors and Bioclimatic Comfort	3+0	7.5
UCS584	Introduction to Google Earth Engine	3+0	7.5
UCS586	Remote Sensing and Geographical Information System Applic. in Urban Climate Res.	3+0	7.5
UCS588	Machine Learning in Geographic Information Systems and Remote Sensing	3+0	7.5
UCS594	National Geographic Information System Data Themes and Institutional Applications	3+0	7.5
UCS598	Identification of Field Components by Spectral Band Analysis	3+0	7.5

**DEPARTMENT OF GEOSCIENCES**

Head :

**MASTER OF SCIENCE (MS) DEGREE**

**PROGRAM**

<b>I.Semester</b>			<b>II.Semester</b>		
YBL501	Earth Sciences	3+0 7.5	YBL512	Earth Systems	3+0 7.5
	<i>Seçmeli Dersler</i>	-- 22.5	YBL524	Introduction to Earthquake Engineering	3+0 7.5
			YBL592	Seminar	3+0 7.5
				<i>Seçmeli Dersler</i>	-- 7.5
		----			----

30.0 30.0

	<b>III.Semester</b>				<b>IV.Semester</b>		
YBL790	Thesis	0+1	30.0	YBL790	Thesis	0+1	30.0
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			30.0				30.0

**Elective Courses**

ARK555	Geophysical Methods in Archeology: Archeogeophysics						
FBE510	Ethics of Science and Research Techniques					3+0	7.5
FBE510-O	Ethics of Science and Research Techniques (Online)					2+0	7.5
TAC701	Thesis Research Study Course					3+0	7.5
UCS508	Interpretation and Analysis Techniques on Geographic Information Systems					3+0	7.5
UCS511	Remote Sensing and Geographic Information Systems Techniques in Disaster Management					3+0	7.5
UCS525	Digital Photogrametry					3+0	7.5
UCS527	Multicriteria Decision Making Methods					3+0	7.5
UCS533	Fundamentals of Mapping and Geographical Information Systems					3+0	7.5
UCS534	Geostatistics					3+0	7.5
UCS551	Seismic Stratigraphy and Tectonics					3+0	7.5
UCS555	Theoretical Basics of Remote Sensing					3+0	7.5
UCS601	Use of GIS in Earth Sciences					3+0	7.5
UCS604	Environmental Hydrogeology					3+0	7.5
UCS609	Use of Geographic Information Systems in the Applications of Seismic Microzoning and Urban Transformation					3+0	7.5
UCS611	Use of Geographic Information Systems in the Planning of Earthquake Origin Risk/Damage Mitigation					3+0	7.5
UCS617	Special Subject at Remote Sensing					3+0	7.5
UYB701	Research in Area of Specialization					3+0	4.5
UYB702	Research in Area of Specialization					3+0	4.5
YBL502	Geotechnical Earthquake Engineering					3+0	7.5
YBL503	Geophysical Methods in Civil and Environmental Engineering					3+0	7.5
YBL504	Shallow Marine Geophysics					3+0	7.5
YBL505	In-situ Testing and Evaluation					3+0	7.5
YBL506	Geosynthetics					3+0	7.5
YBL507	Experimental Soil Mechanics					3+0	7.5
YBL508	Theoretical Soil Mechanics and Soil Models					3+0	7.5
YBL509	Engineering Properties of Soils					3+0	7.5
YBL510	Groundwater Hydraulics					3+0	7.5
YBL511	Geological and Hydro-meteorological Hazard Analysis					3+0	7.5
YBL513	Project Preparation and Management					3+0	7.5
YBL514	Sustainability of Cities					3+0	7.5
YBL516	Geomorphology					3+0	7.5
YBL518	Soft Computing and Data Mining in Earth Sciences					3+0	7.5
YBL519	Introduction to Data Science with Python for Earth Sciences					3+0	7.5
YBL520	Spectral Analysis of Earthquake Waves					3+0	7.5
YBL521	Geotechnical Earthquake Engineering					3+0	7.5
YBL522	Numerical Methods in Geotechnical Engineering					3+0	7.5
YBL523	Active Faults of Turkey and Their Earthquake Potential					3+0	7.5
YBL525	Engineering Geology and Construction in Earth Sciences					3+0	7.5
YBL526	Hydrogeochemistry					3+0	7.5
YBL527	Advanced Applied Hydrogeology I					3+0	7.5
YBL528	Seismology					3+0	7.5
YBL529	System Identification and Structural Health Monitoring					3+0	7.5
YBL530	Structural Earthquake Engineering					3+0	7.5
YBL531	Potential Theory in Geophysics					3+0	7.5
YBL532	Geological Disasters					3+0	7.5
YBL533	Laboratory Methods in Earth Engineering I					3+0	7.5
YBL534	Geology for Civil and Environmental Engineers					3+0	7.5
YBL535	Laboratory Methods in Earth Engineering II					3+0	7.5
YBL536	Paleoseismology					3+0	7.5
YBL537	Advanced Volcanology					3+0	7.5
YBL538	Injection Applications in Earth Sciences					3+0	7.5
YBL539	Sustainable Building Materials in Earth Sciences					3+0	7.5
YBL540	The Earth's Physics and Lithosphere Dynamics					3+0	7.5

YBL542	Landslide Investigations and Mitigation	3+0	7.5
YBL544	Advanced Applied Hydrogeology II	3+0	7.5
YBL546	The Solution of the Inverse Problem in Geophysical Modelling	3+0	7.5

## (NON-THESIS) MASTER OF SCIENCE (MS) DEGREE

### PROGRAM

I.Semester				II.Semester			
YBL501	Earth Sciences	3+0	7.5	YBL512	Earth Systems	3+0	7.5
	<i>Seçmeli Dersler</i>	--	22.5	YBL524	Introduction to Earthquake Engineering	3+0	7.5
				YBL599	Semester Project	3+0	0.0
					<i>Seçmeli Dersler</i>	--	15.0
			----				----
			30.0				30.0

### Elective Courses

ARK555	Geophysical Methods in Archeology: Archeogeophysics	3+0	7.5
UCS508	Interpretation and Analysis Techniques on Geographic Information Systems	3+0	7.5
UCS511	Remote Sensing and Geographic Information Systems Techniques in Disaster Management	3+0	7.5
UCS527	Multicriteria Decision Making Methods	3+0	7.5
UCS533	Fundamentals of Mapping and Geographical Information Systems	3+0	7.5
UCS534	Geostatistics	3+0	7.5
UCS551	Seismic Stratigraphy and Tectonics	3+0	7.5
UCS555	Theoretical Basics of Remote Sensing	3+0	7.5
UCS601	Use of GIS in Earth Sciences	3+0	7.5
UCS604	Environmental Hydrogeology	3+0	7.5
UCS609	Use of Geographic Information Systems in the Applications of Seismic Microzoning and Urban Transformation	3+0	7.5
UCS611	Use of Geographic Information Systems in the Planning of Earthquake Origin Risk/Damage Mitigation	3+0	7.5
UCS617	Special Subject at Remote Sensing	3+0	7.5
YBL502	Geotechnical Earthquake Engineering	3+0	7.5
YBL503	Geophysical Methods in Civil and Environmental Engineering	3+0	7.5
YBL504	Shallow Marine Geophysics	3+0	7.5
YBL505	In-situ Testing and Evaluation	3+0	7.5
YBL506	Geosynthetics	3+0	7.5
YBL507	Experimental Soil Mechanics	3+0	7.5
YBL508	Theoretical Soil Mechanics and Soil Models	3+0	7.5
YBL509	Engineering Properties of Soils	3+0	7.5
YBL510	Groundwater Hydraulics	3+0	7.5
YBL511	Geological and Hydro-meteorological Hazard Analysis	3+0	7.5
YBL513	Project Preparation and Management	3+0	7.5
YBL514	Sustainability of Cities	3+0	7.5
YBL516	Geomorphology	3+0	7.5
YBL518	Soft Computing and Data Mining in Earth Sciences	3+0	7.5
YBL519	Introduction to Data Science with Python for Earth Sciences	3+0	7.5
YBL520	Spectral Analysis of Earthquake Waves	3+0	7.5
YBL521	Geotechnical Earthquake Engineering	3+0	7.5
YBL522	Numerical Methods in Geotechnical Engineering	3+0	7.5
YBL523	Active Faults of Turkey and Their Earthquake Potential	3+0	7.5
YBL525	Engineering Geology and Construction in Earth Sciences	3+0	7.5
YBL526	Hydrogeochemistry	3+0	7.5
YBL527	Advanced Applied Hydrogeology I	3+0	7.5
YBL528	Seismology	3+0	7.5
YBL529	System Identification and Structural Health Monitoring	3+0	7.5
YBL530	Structural Earthquake Engineering	3+0	7.5
YBL531	Potential Theory in Geophysics	3+0	7.5



YBL532	Geological Disasters	3+0	7.5
YBL533	Laboratory Methods in Earth Engineering I	3+0	7.5
YBL534	Geology for Civil and Environmental Engineers	3+0	7.5
YBL535	Laboratory Methods in Earth Engineering II	3+0	7.5
YBL536	Paleoseismology	3+0	7.5
YBL537	Advanced Volcanology	3+0	7.5
YBL538	Injection Applications in Earth Sciences	3+0	7.5
YBL539	Sustainable Building Materials in Earth Sciences	3+0	7.5
YBL540	The Earth's Physics and Lithosphere Dynamics	3+0	7.5
YBL542	Landslide Investigations and Mitigation	3+0	7.5
YBL544	Advanced Applied Hydrogeology II	3+0	7.5
YBL546	The Solution of the Inverse Problem in Geophysical Modelling	3+0	7.5

## PROGRAM IN URBAN DEVELOPMENT RISK MANAGEMENT (DISTANCE LEARNING)

### PROGRAM

<b>I.Semester</b>		<b>II.Semester</b>	
<i>Seçmeli Dersler</i>	-	30.0	KRY599
	-		Semester Project
			3+0 0.0
			<i>Seçmeli Dersler</i>
			-- 30.0
		----	----
		30.0	30.0

### Elective Courses

KRY501	Introduction to Urban Risk Management	3+0	7.5
KRY502	Emergency and Disaster Regulations	3+0	7.5
KRY503	GIS and RS in Risk Management	3+0	7.5
KRY504	Microzonation for Municipalities	3+0	7.5
KRY505	Map Information and GIS	3+0	7.5
KRY506	Flood and Drought Hydrology	3+0	7.5
KRY507	Risk Evaluation During Urban Renewal Process	3+0	7.5
KRY508	Environmental Geology and Hydrogeology	3+0	7.5
KRY509	Risk Determination of Underground Structures	3+0	7.5
KRY510	Global Climate Change and Meteorological Disasters	3+0	7.5
KRY511	GIS Use in Resource Inventory and Analyses	3+0	7.5
KRY512	Urban Transformation Law	3+0	7.5
KRY513	Advanced Technologies in Disaster and Emergency Management	3+0	7.5
KRY514	Disaster Law	3+0	7.5
KRY515	Spatial Analysis in Urban Risk Management	3+0	7.5
KRY516	Earthquake Risk Determination in Reinforced-Concrete Buildings	3+0	7.5
KRY520	Disaster Hazard and Risk Factors of Turkey	3+0	7.5
KRY522	Disaster Regulation for Local Governments	3+0	7.5
KRY523	Disaster Logistics	3+0	7.5
KRY524	Sustainable Urban Resilience	3+0	7.5
KRY525	Urban Planning and Geology	3+0	7.5
KRY526	Rapid Seismic Performance Assessment Methods and Building Inventory Studies	3+0	7.5
KRY527	Combating and Adapting to Global Climate Change	3+0	7.5
KRY528	Combating and Adapting to Climate Change in Cities	3+0	7.5
KRY529	Building Inspection Practices in Disaster Risk Areas	3+0	7.5
KRY530	Artificial Intelligence Applications in Urban Risk Management	3+0	7.5
KRY531	Geophysical Methods in Determining Earthquake Hazards	3+0	7.5

### COURSE CONTENTS

<b>ANA501</b>	<b>Functional Anatomy</b>	<b>3+0 7.5</b>
Basic Terminology of Kinesiology and Anatomy; Terms Related to Movement; Basic Anatomic Positions; Axis; Platform; Range of Motion; Tissue Mechanics; Neck Mechanics; Shoulder Mechanics; Thoracic Mechanics; Lumbar Mechanics; Hip		





- BES504 Sport Medicine 3+0 7.5**  
The history of sport medicine and its importance; Assessment of athletes and general principles of measurement, Assessment of athletes in different sports and disabled persons and measurement methods ,Nutrition of athletes, Doping and doping control of athletes. Health knowledge and its education, Inspection of athlete's health, Game rules, Equipment of sport, Field of sports, Warming, Cooling and Stretching activities.
- BES505 Protection Sport Accidents and Treatment Approaches 3+0 7.5**  
Reason of sport accidents, sport accidents according to sport branches, classification of sport accidents according to their reasons, First aid, Treatment of sport accidents, Education of returning in sport and its erections, Recovering in flexible tissue accidents, Flexible and strength Education, Rehabilitation in Racquet and ballistic sports, Accident in swimming, Accident in scuba, Accident in body building.
- BES508 Exercise Physiology 3+0 7.5**  
Starting in Exercise Physiology, Acute Physiological conclusion of exercise, Chronic physiological adaptation to education, Basic education principles, Muscular Control of movement, Neurological control of movement, Neuromuscula radaptation to resistant education, Basic energy systems and metabolism, Hormonal responses toexercise, Metabolic adaptations to education, Hearth and Circulatorycontrolling in exercise, Respiration control and its organization, Heart and circulatory adaptations to education.
- BES517 Sport Physiology 3+0 7.5**  
Exercise and thermoregulation; Hypobaric, Exercise in hyperbaric and microgrative setting, Boundaries of exercise education, Performance and ergojenic supplements, Nutrition, Optimal body weight for performance, Growing, Improvement and young athletes, Elderly and elderly athletes, Women athlete and gender difference, Exercise recipe, Obesity, Diabetic and Physical activity.
- BES518 Physical Appropriateness 3+0 7.5**  
Definition of physical appropriateness and historical development, Physical appropriateness and education, Physical appropriateness criteria for general health, Physical appropriateness criteria for performance, Physical appropriateness for children, Physical appropriateness for elderly, Physical appropriateness criteria for disabilities person and physical appropriateness tests, European physical appropriateness norms and physical appropriateness tests, American physical appropriateness norms and physical appropriateness tests.
- BES520 Experimental Applications in Sportive Performance 3+0 5.0**  
Experimental approach to sportive performance. Measurement and assessment of somatotype and body fat percentage. Measurement and assessment of speed performance, isokinetic strength, squat, countermovement and drop jump power. Use of photocell, anemometer and thermo-anemometer. Wingate test and use of Peak Bike. Conconi test and use of Polar heart rate monitor. Use of Lactate threshold field test and YSI lactate analyzer. Use of VO2max field test and K4b2 O2 analyzer. Motion analysis through image and use of SIMI motion analysis programme.
- BES522 Experimental Approach to Exercise Neurophysiology 3+0 7.5**  
Elective: The Concept of Motor Unit. Functions of different motor units. Electromyography (EMG). Filtering and absolute values. Integration and normalization. Assessments of muscular fatigue, contraction and relaxion through EMG data. Assessment of reflexive muscular activity by EMG. Methods in brain research and measurement of electrical activity of the brain. Stimulated brain potentials: Assessment of attention and cognitive processes. Assessment of central fatigue by EEG.
- BES526 Motivational Orientations in Sport 3+0 7.5**  
Motivational Orientations in Sports: The Dynamics of Motivation in Physical Activity; Motivation in Children's Development; Success in Sports and Target Research; Goal Setting in Sport and Physical Activity; As A Determinant of Exercise Self-Efficacy; Intrinsic and Extrinsic Motivation in Exercise and Sport; Motivational Strategies in Team and individual Sports; Fitness in the Perceptual Control.
- BES528 Planning and Evaluation in Physical Education Teaching 3+0 7.5**  
Planning and Evaluation of Teaching Physical Education: Basic Concepts Related To Education; Teaching-Learning Process and Components: Teaching Purposes, The Selection of Content and Regulation, State Regulation of Education, Teaching Methods and Techniques, Instructional Strategies, Teaching Models, Teaching Tools and Materials, Evaluation of Student Achievement, Classroom Management.
- BES530 Antioxidants and Athletics Performance 3+0 7.5**  
Concept of Free Radical: Structures and properties of free radicals, Production and metabolism of free radicals; Exercise and Oxidative stress: The effect of aerobic and anaerobic exercises on radical production and oxidative stress; The Antioxidant Defense System: Production of free radicals and cellular defense, Enzymatic and non-enzymatic antioxidants,

Vitamins as antioxidants, Reversible and irreversible reactions of antioxidants, Nutrient source of antioxidants; Antioxidants Supplementations and Performance: Positive and negative effects of antioxidant supplements on athletic performance, Pro-oxidant effect of antioxidants.

**BES531 Exercise and Sport Psychology 3+0 7.5**

Exercise and Sport Psychology: The Emergence of the Concept of Sport and Exercise Psychology; Sports Psychology Related Concepts; Exercise and Sport Psychology of Relationships With Each Other; Of The Stages of Sport and Exercise Psychology; Exercise and Sport Psychology Has Undergone An Evolutionary Process of Knowledge; Affecting the Performance of Exercise and Sport Psychology Psychic Elements; Applications in Order To Increase Performance.

**BES533 Introduction to Research Methods and Technics in Sports 3+0 7.5**

Introduction to Research Methods and Technics in Sports: Methods and Techniques of Scientific Research in Sport; Should Be in A Scientific Research on the Content and Format of Knowledge, Skills, Attitudes and Behaviors; Research Problems, Objectives and Sub-Objectives, Importance and Assumptions; Research Models Frequently Used in the Field of Sports; To Be Considered in the Research Process, Ethical Principles, Rights and Responsibilities.

**BES536 Evaluation of Physical and Motor Fitness in School 2+1 7.5**

Physical Fitness: Health-related physical fitness, The cardio-respiratory component, The musculoskeletal component, The morphological component, The motor component; Relationship Between BMI, Physical Fitness and Motor Skills; Assessment of Physical Activity Levels; Assessment of Physical Fitness: Existing field-based physical fitness test batteries for children and adolescents, EUROFIT battery of tests, FITNESSGRAM battery of tests, the ALPHA-FIT battery of tests, Brockport battery of tests.

**BES538 Laboratory Experiences in Functional Evaluation of Skeletal Muscle 2+1 7.5**

Anthropometry Applications; Electromyography (EMG) Applications; Kinematic Analysis Applications; Vibration Applications; Electromyostimulation (Electro-muscle stimulation) (EMS) Applications; Force Plate Measurement Applications; Pedobarography Measurement Applications; Hand Grip Pressure Applications; Isokinetic Dynamometer Applications; Hand Dynamometer Applications; Back Leg Chest Dynamometer Applications; Wingate Test Applications; Treadmill and Bicycle Ergometer Exercise Test Applications (Cardiopulmonary Exercises).

**BES539 Motor Control of Human Movement 3+0 7.5**

Basic Concepts of Motor Control; Perspectives of Neuroscience: Components of the nervous system, Nervous System, Neurons and Synapses as an Elaborate Communications Network; Sensory and effector systems for movement, Motor control functions of the spinal cord and brain, Integrative brain mechanisms for movement; Basic Concepts of Motor Control: Cognitive Science Perspectives, models Used for motor control Studies, Motor Control Changes throughout the Life Span: Changes in observable motor Performance, neurophysiological and information processing, Motor Control Adaptations to Training: Factors affecting the learning of motor skills.

**BES540 Physical Activity and Health in Schools 3+0 7.5**

Physical Activity: Determination of the level of physical activity, Recommendations on physical activity; The Effects of Physical Activity on Health at Different Levels; Physical Fitness: Components of Physical Fitness; Nutrition Level and Body Composition; Physical Activity and Physical Fitness for Schoolchildren and Adolescents; Physical Activity in Special Groups; Physical Fitness Through Physical Education and the Establishment of Physical Activity.

**BES541 Comparative Physical Education 3+0 7.5**

Historical Development of Physical Education in Turkey; Physical Education Concepts, Standards and Practices in Schools and Higher Education Institutions in Turkey; The Structure and Functioning of Physical Education Practices in Various Countries; The Similarities and Differences Between Physical Education Practices of Various Countries by Comparing/Contrasting them with Our Country; General Aspects and Evaluations.

**BES544 Recreation Programs in Schools 3+0 7.5**

Curriculum Development in Education: Types of education, Teaching, Learning, Education and teaching program, Curriculum Development in Historical View, Curriculum development in the scope of needs of society and individuals; Types of education; Recreational Activities in Schools: Classification of recreation activities according to different approaches, Recreational sports: Club sports, Extramural sports, Intramural sports, Informal sports, Instructional sports; Programming Concept in Recreation: History, Philosophy, Service Systems; Relationship Between Education and Leisure: History of leisure education, Leisure education need in society.

**BES546 Recreation and Sport Practices for the People with Disabilities 3+0 7.5**

The Meaning and Importance of Recreation and Sport for the People with Disabilities; Variety, Reasons and Classification of the People with Disabilities; The Effects of Recreative Activities and Sport for the People with Disabilities; Sport and Recreative Activities: Recreation and sport practices for the people with intellectual disabilities, Recreation and sport



persons, Dance activities for disability persons, Adapted sport activities for different disability persons, Sport accident and rehabilitation for disability athletes, Doping for disability athletes, Specific Olympic.

**BES565                      Electrophysiological Training Methods in Sports                      2+1    7.5**

Basic concepts of electricity and current terminology related to human physiology, The use of sportive performance of electrophysiology, Electrical muscle stimulation techniques and applications, Basic mechanisms of electrical muscle stimulation: Chemical mechanism: Action potential, Intensity-duration curve of electrical currents, Physiological mechanism, Neural mechanism, Electrical muscle stimulation parameters and regulations: Amplitude, Amplitude increase and decrease time, Frequency, Pulse duration, Work time, Electrodes.

**BES566                      Practical Application to the Study of VO<sub>2</sub> Kinetics                      2+1    7.5**

Mechanistic Bases of VO<sub>2</sub> kinetics: Model Characterization of VO<sub>2</sub> kinetics, Mean Response Time, Oxygen Consumption During Resting, Time Constant of Oxygen Consumption, Explanation via Exponential Function of Slow Component of Oxygen Consumption, Data Modeling; Test Protocols of Constant Sub-threshold, Test Protocols of Constant Supra-threshold, Effects of Training with Different Intensities on VO<sub>2</sub> Kinetics.

**BES567                      Oxygen Uptake Kinetics                      2+1    7.5**

Aerobic Energy Metabolism: Maximal Oxygen Consumption, Exercise Economy, Running Economy, Oxygen Debt; Oxygen Uptake Kinetics, VO<sub>2</sub>, VO<sub>2</sub> Kinetics Concept; Constant Load Exercises: Sub-Threshold Exercises, Supra-threshold exercises, Phases of VO<sub>2</sub> Kinetics: First Phase (Cardiodynamic Phase), Phase II (Basic Phase), Phase III (Steady State Phase), Slow component of VO<sub>2</sub>, Physiological Basis of Oxygen Transport and Use.

**BES568                      New Approaches and Models in Physical Education and Sports                      3+0    7.5**

Physical Education Curriculum and Constructivism: Constructivist approach, Constructivist game teaching, Tactical Game Approach Teaching: TOYA model components, TOYA teaching and learning at elementary level, Individual and Social Responsibility Model: Individual and social responsibility teaching themes, Strategies, Sports Education Model: Basic features of SEM, Issues to be considered in SEM curriculum, Classroom management and behavior development, Field Applications of Models.

**BES569                      Acute and Chronic Adaptation to Exercise at High Altitude                      2+1    7.5**

Physiological Effects of High Altitude: Acute Effects of Altitude on Maximal Oxygen Consumption, Heart Rate, Stroke Volume, Cardiac Output, Acute Effects of Altitude on Exercise Economy, Running Economy and Oxygen Debt; General Altitude Training Concepts; Live High Train Low, Live High Train High, Live Low Train High, Intermittent Hypoxia Training, Physiological Responses to Normobaric Normoxia and Normobaric Hypoxia.

**BES570                      Academic Writing in Social Sciences: Movement Education, Physical Activity and Sedentary Behaviour                      3+0    7.5**

Academic Writing as a Text; Field Specific Writing; Ethics of Academic Writing; IMRAD Technique: Introduction, Methods, Results, Discussion; Introduction Writing in Movement Education; Method Writing in Movement Education; Presentation of Results in Movement Education; Discussion of Findings in Movement Education; Tables and Graphs for Qualitative and Quantitative Data; Reference Writing Styles; Software for References: Mendeley, EndNote; Quality Journal Selection Process; Communication with the Editor and the Referee; The Importance of Learning the Referee Process as a Researcher.

**BES571                      Model Based Physical Education Teaching                      3+0    7.5**

Basic Concepts in Physical Education Teaching: Definition and importance of physical education, Definition and elements of curriculum, Instruction models, Direct teaching model: Theoretical foundations of direct teaching model, Direct teaching model features and applications, Individualized teaching model: Theoretical foundations of individualized teaching model, Individualized teaching model properties and applications, Cooperative Teaching Model: Theoretical foundations of cooperative teaching model, Cooperative teaching model features and applications, Peer Teaching Model: Peer teaching model theoretical foundations, Peer teaching model properties and applications, Field Applications of Models. 706

**BES572                      Sedentary Behaviour Epidemiology                      3+0    7.5**

Introduction to Sedentary Behaviour; Measurement of Sedentary Behaviour; The Descriptive Epidemiology of Sedentary Behaviour; Physiological Responses to Sedentary Behaviour; Sedentary Behaviour and Adiposity; Sedentary Behaviour, Diabetes, and the Metabolic Syndrome; Sedentary Behaviour and Cancer; Sedentary Behaviour and Depression; Sedentary Behaviour and Ageing; Sedentary Behaviour and Mortality; Models for Understanding Sedentary Behaviour; Understanding Sedentary Behaviour in Individual Level; Sedentary Behaviour Among Overweight and Obese People; Sedentary Behaviour and the Social and Physical Environment.

**BES573                      Psychology for Physical Education and Sport                      3+0    7.5**





- BES587 Psychology of Coaching 1+2 7.5**  
 Psychology Of Coaching: Concepts and Relationships; Understanding The Athlete; Understanding The Sport Environment; Coach-Athlete Relationship; Psychosocial Foundations Of Coaching: Athlete Motivation, Motivational Climate; Communication Skills And Leadership Behaviors; Mental Skills: Goal Setting, Self-Talk, Imagery, Coping With Stress, Arousal Regulation, Attention Management; Performance Routines.
- BES589 Research and Statistics in Sport Psychology 1+2 7.5**  
 Basic Concepts; Application Areas; Introduction To R Software: Lavaan Package And Semtools Packages; Introduction To Jamovi Software; Confirmatory Factor Analysis: Goodness Of Fit, Modifications, Estimators, Optimization Methods; Measurement Models: Unidimensional Factor Model, Correlated Factors Model, Bi-Factor Model, Hierarchical Factor Model; Path Analysis; Structural Equation Modeling: Direct Effects, Indirect Effects; Application.
- BES591 Team Processes in Sport Psychology 3+0 7.5**  
 Team Formation: Dynamic Formation, Cyclical Elements; Team Adaptation: Temporal Considerations; Team Environment: Roles, Norms; Team Processes: Effective Communication, Teamwork, Facilitators and Constraints; Team Emergent Properties: Team Cohesion, Motivational Climate, Shared Mental Models, Social Identity, Transactive Memory Systems; Motivation In Teams: Group Effectiveness, Collective Efficacy, Self-Determination Theory; Socio-Environmental Issues: Cultural Diversity, Gendered Social Dynamics.
- BES592 Seminar 3+0 7.5**
- BES593 Individual Differences in Adapted Physical Education 2+1 7.5**  
 Physical Education and Activity in Individuals with Special Needs: Types of special needs, Individualized physical education program, Inclusion in physical education environment, Developmental perspective; Physical Education According to Special Needs Types: Mental disability, Autism spectrum disorder, Learning disability, Attention-deficit and hyperactivity disorder, Visual impairment, Hearing impairment, Physical disability; Physical Education and Activity Curriculum Planning in Individuals with Special Needs.
- BES595 Autism Spectrum Disorder and Exercise 2+1 7.5**  
 Autism Spectrum Disorder: Classification, Characteristics; Scientifically Based Applications in Autism: Autism and premise-based practices, Autism and exercise; Effects of Exercise Practices in Individuals with Autism: Effects of exercise on problem behaviors, Effects of exercise on academic participation; Exercise Prescription in Individuals with Autism; Use of Exercise in Schools: Adapted physical education and sport in individuals with autism, Use of exercise as a premise-based practice in individuals with autism.
- BES601 Teaching Methodology in Physical Education and Sports 3+0 7.5**  
 Education and Teaching; Learning and Teaching; Basic Concepts about General and Special Teaching Methods; Principles, Aims, Content, Learning and Teaching Processes of Physical Education and Sports Teaching; Planning and Performing Physical Education and Sports Activities; Writing Overall and Behavioural Objectives; Organization of Content; Teaching Strategies, Methods and Techniques in Physical Education and Sports; Selection and Evaluation of Course Materials in Physical Education and Sports Teaching; Assessment of Students Success in Physical Education and Sports Teaching; Micro-Teaching Practices and Evaluation.
- BES607 Sports for the Disabled 3+0 7.5**  
 Program Organization and Management in Adapted Physical Education and Sports; Individualized Education Programs; Testing and Evaluation; Sports Organizations; Instructional Strategies for Adapted Physical Education; Disabled People: Mental retardation, Learning difficulties and attention deficiency, Behavioural disorders, Visual impairment and Deafness, Cerebral palsy, Traumatic brain injury, Amputations, Spinal cord disabilities; Developmental Considerations; Activities for the Disabled: Physical fitness, Rhythm and dance, Aquatics, Team sports, Winter sports activities; Enhancing Wheelchair Sports Performance.
- BES612 Neuromuscular Adaptation and Fatigue 3+0 7.5**  
 Introduction to Nervous System; Introduction to Muscle Physiology; Skeletal-Muscle Mechanisms; Muscle Physiology of Strength, Speed, Power and Endurance Performance; Definitions of Strength, Speed, Power and Endurance; Differences Among Muscular Strength, Endurance, and Power; Neural Activation in Strength, Speed and Power Performance; Motor Units; The Effect of Contraction Type on Motor Unit Activation; The Effect of Contraction Speed on Motor Unit Activation; Neuromuscular Adaptation in Physical Work; Definition of Fatigue; Causes of Fatigue; Fatigue in Strength, Speed and Power Performance; Recovery.
- BES616 Medical Subjects in Sports and Health Organizations for Athletes 3+0 7.5**

Health Care System for Athletes: Roles, Relationships and Organizations; Epidemiology of Sports Injuries; Injury Prevention: Environmental factors, Equipment, Condition; Evaluation and Rehabilitation in Sports Injury; Special Considerations: Diabetic athletes, Blood pressure disorders, Sudden death; Participation into Exercises in Different Groups; Risks and Benefits of Exercise; Contraindications; Pre-Exercise Evaluation Methods and Exercise Prescriptions; Pharmacology and Drug Taking; Child and Adolescent Athletes; General Health Condition and Environmental Injuries.

**BES619 Training Theory I 3+0 7.5**

The Concept of Training; Loading and Recovery; The Structure of Efficiency; The Concept of Performance; Performance Follow-Up, Evaluation of Performance, Factors Affecting Performance; Basic and Secondary Principles of Training; The Relationship between Loading and Resting; Recovery and Planning; Periodization; Structure of Microcycle; Structure of Mesocycle; Structure of Macrocycle; Single- and Multi-Periodization; Children and Training; Stages of Development and Training; Biomotor Characteristics and Training; Talent Selection and Talent Orientation; Anthropometry; Endurance Development; Physiology of Endurance; Maximal Oxygen Consumption; Anaerobic Threshold; Running Economy; Training Methods in Endurance Development .

**BES620 Training Theory II 3+0 7.5**

Strength Development: Physicomechanical bases of strength, Various types of strength, Measurement of Strength, Periodization of Strength, Strength in Various Sports; Speed Development; Physicomechanical Structure of Speed, Factors affecting Speed, Speed training exercises, Speed tests, Anaerobic strength and capacity; Flexibility Development: Flexibility and its physicomechanical characteristics, Various types of flexibility, Flexibility training; Training and Children; Training and Stages of Development; Biomotor Characteristics and Training; Talent Selection and Talent Orientation; Anthropometry, Training and Fatigue; Loading/Recovery/Fatigue; Control of Fatigue: Planning the training process; Control of Fatigue: Active/passive rest; Control of Fatigue: Nutrition and periodization; Form Training: Volume, intensity and frequency relations, Planning form training; Altitude Training and Periodization; Women Athletes and Training; Menstruation, repose and sleep.

**BES626 Contemporary Approaches in Sport and Exercise Psychology 3+0 7.5**

Contemporary Approaches in Sport and Exercise Psychology: Exercise Psychology: Definition, Emergence and Development; Sports Psychology: Definition, Emergence and Development; Differences in Exercise and Sport Psychology; Traditional and Contemporary Approaches To Exercise and Sport Psychology; Exercise and Sport Psychology Knowledge of How To Follow A Path That; What Suggestions As To What Cases Brought; Describes the Definition of Sports Psychologist.

**BES627 Social Psychology of Sport 3+0 7.5**

Social Psychology of Sport: Sociology, Psychology, Attitudes, Behavior, Social Effects, Social Cognition and Perception: Social Psychology and Social Psychology of Sport; Group Dynamics and Team Dynamics; Group Integrity; Social Loafing and Social Acceleration Theory Theory; Success in Sports and Target Research; Leadership, Groups and Group Communication in Leadership and Leadership Models and Their Properties.

**BES628 Arousal Theories in Sport 3+0 7.5**

Arousal Theories in Sport: Arousal Concepts and Definitions; Arousal in Sports Media; Stress and Coping in Sport; Anxiety in Sport: Anxiety Theories and Measurements; Competition; Relationship Between Anxiety and Performance in Sport; Relationship Between Anxiety and Attention in Sport; Relationship Between Anxiety and Burnout in Sport; Anxiety Control; Fear And Anxiety in Top-Level Athletes Training Arrangements.

**BES629 Research Methods and Techniques in Sports 3+0 7.5**

Research Methods and Techniques in Sports: Sports Scientific Research Process Stages; Research Problem, Purpose and Sub-Objectives, Importance and Assumptions Literature To Be Aware of Specifications, The Research Model, The Universe and Sample, Data Collection Methods and Research Data Gathered in The Sports Field Is A Problem Scientific Research, According To The Methods and Techniques To Solve Advanced Proficiency.

**BES630 Exercise Approaches for Special Groups 3+0 7.5**

Exercise Approaches for Specific Groups: Exercise Management; Exercise As A Treatment; Children and Teenagers Exercise; Women in the Exercise; Exercise in the Elderly; Metabolic Syndrome and Exercise; Obesity and Exercise; Anemia and Exercise; Asthma and Exercise; Diabetes and Exercise; Hypertension and Exercise; Fibromyalgia and Exercise; Hyperlipidemia and Exercise; Chronic Fatigue Syndrome and Exercise.

**BES631 Instructional Models for Physical Education 3+0 7.5**

Basic Concepts About Teaching and the Relationship Between Learning and Teaching; Main Features of Teaching Models; Direct Instruction; Personalized System for Instruction (PSI); Cooperative Learning; Sports Education; Peer Teaching; Inquiry Teaching; Tactical Games; Teaching for Personal and Social Responsibility; Comparison of the Instructional Models.

- BES632 In Biological Systems Methods of Analysis of Reactive Oxygen Species 3+0 7.5**  
 In Biological Systems Methods of Analysis of Reactive Oxygen Species: Reactive Oxygen Species and Free Radicals Resources; The Effects of Free Radicals; Quantitative Analysis of Reactive Oxygen Species in Biological Systems, Methods; Analysis of Markers of Lipid Peroxidation; Analysis of Protein Oxidation Reagent; Analysis of DNA Damage Markers; Antioxidant Enzyme Analysis; Pro-Oxidant Effect of the Antioxidant Added.
- BES633 Exercise Prescription 3+0 7.5**  
 Exercise Prescription: Activity Models of Guidance and Risk Levels; Exercise and Quality of Life; Exercise Tests and General Principles; Assessment and Exercise Prescription Principles; VO<sub>2</sub> Based Exercise Prescription; By Cardiorespiratory Fitness Exercise Prescription; Exercise Prescription Based on Perceived Exertion; According To the Load of Exercise Prescription; Prescribing Exercise To Lose Weight; By Cardiovascular Endurance Exercise Prescription; Exercise Prescription for Muscle Strength; Exercise Prescription for Flexibility and Balance; Individual Evaluation and Testing.
- BES635 Anti-Aging and Exercise 3+0 7.5**  
 Anti-Aging and Exercise: Age Period and the Classification of the Aging Process; Theories Related To the Aging Process; Aging Physiology; Aging in the Process of Cardiopulmonary, Skeletal Muscle and Nervous System Changes: Old Age and the Effects of Exercise; Old Age, Illness And Exercise; In Old Age the Basic Principles of Exercise and Exercise Prescription; Cardiovascular Exercise Programs for Older Individuals; Aged for Muscle Strength Exercise Programs for Individuals; For Elderly Individuals for Flexibility and Balance Exercise Programs; Old Age, Risk Factors and Mesasures of Exercise in the Process Are Explained.
- BES636 Pedobarographic Applications During Various Motor Tasks 2+1 7.5**  
 Anatomy of the Foot and Ankle; Structure and Function of the Foot; Technology for Recording Kinetic Variables: Position transducer, Accelerometers, Force plates, Pressure insoles; Foot Plantar Pressure Measurement Systems: Platform systems, In-Shoe systems; Requirements for Foot Plantar Pressure Measurement: Target implementation requirements; Recent Trends in Foot Plantar Pressure Measurement: Wired system application, General wireless systems application.
- BES637 Exercise and Oxidative Stress 3+0 7.5**  
 Exercise and Oxidative Stress: Reactive Oxygen Species and Free Radical Concept; Antioxidant Defense System; Oxidative Stress; Mechanism of Free Radical Production During Aerobic and Anaerobic Exercise; Reactive Oxygen Species and Skeletal Muscle Function; Fatigue Mechanism and Delayed Muscle Pain Syndrome; Antioxidant Defense System in Response To Acute and Chronic Exercise; Exercise, Oxidative Stress and Antioxidant Supplementary.
- BES638 Sportive Technical Analysis Applications 2+1 7.5**  
 Kinetic and Kinematic Analysis Methods: Angle, Velocity, Acceleration, Angular and linear velocity, Joint moment and power; Organizing Three Dimensional Analyzing Environment: Camera placement, Marker placement, Volume calibration, Collecting and analyzing data; The Use of Surface Electromyography: Skin preparation, Normalization techniques, Collecting data and analyzing data.
- BES646 Global Positioning System (GPS) and Sport Specific Testing 1+2 7.5**  
 Basic Principles of Global Positioning Systems; Metabolic Power; Indoor and Outdoor Tests; Data Collection; Data Processing; Reporting; Theoretical and Practical Applications; Training Record; Physical Demand; Low Moderate High Intensity Activity; Injury Risk Index; Real Time Player Tracking; Applications of Different Sport Branches; Location; Acceleration Deceleration; Change of Direction; Hotspot Plots; Jump; Player Load; Collisions; Repeat High Intensity Efforts.
- BES648 Assessment of Reaction Analyses with Neuro-Physiological and Physiological Variables 2+1 7.5**  
 Stress and Stages: Internal and external stress sources; Stress and its effects: Physiological effects of stress, Psychomotor (behavioral) effects of stress; Measurement of stress, Measurement of stress through neural changes and eye-movement changes, Advantages of EEG, Signal of EEG, Brain waves, Excitation potentials (UP), EEG and stress evaluations; Eye Movement Behavior: Gazing, Saccadic eye movements, Smooth pursuit eye movements, Eye tracking and sports performance.
- BES649 Performance Monitoring in Sport 2+1 7.5**  
 Basic Concept of Athlete Monitoring: Body Stress, Fatigue, Biochemical markers; Current Technologies in Monitoring Athlete: GPS technology, Heart rate telemetries, Questionnaires' based on computer technology; Measures of Fitness and Fatigue; Monitoring Different Conditioning Features; Athlete Monitoring and Evaluation Guidelines for Individual Sports; Athlete Monitoring and Evaluation Guidelines for Team Sports.
- BES651 Training Load Monitorization and Field Test in Team Sports 1+2 7.5**

Time Motion Analysis Via Global Positioning Systems: Sprint analysis (number and duration), Running speed analysis (max, min, avr), Physical activity record, Total running, Distance, Total running time, Load percents, Exertion points, Speed calculations; Training units calculations: F.I.T.T. principle, Metabolic power; Field Tests: Indoor and outdoor tests, Data collection, Data processing, Reporting, Theoretical and practical applications, Training record, Physical demand, Low-Moderate-High intensity activity, Injury risk index, Different pitch size trainings, Real-time player tracking, Applications of different sport branches, Location, Force, Angle, Direction, Dista

**BES652                      Physical Fitness in Individuals with Special Needs                      3+0   7.5**

Evaluation and Prescribing Principles: Physical fitness tests, Program design, Exercise program preparation; Cardiorespiratory Physical Fitness Measurements: Terms, Maximal and submaximal measurements; Preparing Cardio-respiratory Exercise Program; Muscular Physical Fitness Measurements: Terms, Muscular strength and endurance measurements, Muscular measurements in children and adults; Preparing Muscular Exercise Program; Evaluation of Body Composition; Weight and Body Composition Management; Flexibility Measurements; Flexibility Exercise Program Planning.

**BES654                      Fundamentals of Electroencephalography (EEG) and Signal Processing                      2+1   7.5**  
**Methods**

**BES655                      Use of Eye Tracking Technology in Different Sports Branches                      3+0   7.5**

Anatomy and Physiology of the Oculo-Motor System: The structure of eye, The function of eye structure, The muscles of eye, The nerves of eye; Brain and Vision; The Eye Tracking System: What is eye tracking and how does it work?, The history of eye tracking researches; Eye Movements: Saccadic eye movements, Neurophysiology of saccadic eye movements, Fixations, Neurophysiology of visual fixation, The theoretical infrastructure of the quite eye and the quite eye, The quite eye in cognitive psychology / neuroscience; Eye Tracking Research in Different Sports Branches; An Evaluation of Eye Tracking in Computer Games and e-Game; The Eye-tracking in Sports Skills Training and Performance Analysis.700

**BES657                      Physical Education and Sports far Individuals with Special Needs                      3+0   7.5**

Motor Development and Learning: Concepts, Motor development theories, Motor learning; Evaluation of Physical Fitness and Motor Development; Body Awareness and Posture; Physical Education and Adaptation: Adapted physical education, activities and sports, Aquatic activities; Teaching Approaches in Physical Education: Basic learning principles; Methods of Reducing Problem Behaviors; Individualized Physical Education Program; Physical Education and Sports for Individuals with Special Needs.

**BES661                      Motivational Orientations in Sport                      3+0   7.5**

Basic Concepts Related to Physical Activities; Basic Concepts About Motivation; Relationship between Physical Activity and Motivation; Development Steps of Motivation; Developmental Stages of Motivation in Children; Success Surveys in Sport; Target Investigations in Sport; Intrinsic Motivation; External Motivation; Intrinsic and External Motivation in Exercise and Sport; Target Identification in Sport and Physical Activities; Self-efficacy as a determiner of exercise.

**BES663                      Program Development Models in Physical Education                      3+0   7.5**

Education, Philosophy and Educational Philosophy; Program Phenomenon in Physical Education and Scope of Program Development Concept; Program Development Theories in Physical Education; Program Development Models: Taylor model, Taba model, Oliva model, Schawab model; Mixed Models and Other Program Models in Physical Education; New Program Development Models in Physical Education.

**BES692                      Seminar                      3+0   7.5**

**BES790                      Thesis                      0+1   30.0**

**BES890                      Thesis                      0+1   30.0**

**BES890-0                      Thesis (Thesis Proposal)                      0+1   30.0**

**BiL503                      Object Oriented Programming                      3+0   7.5**











- BiL555                    Advanced Computer Networks                    3+0   7.5**  
Routing: Optimality Principle; Shortest Path Algorithm, Flooding; Distance Vector and Connection Statue Algorithms; Flow and Traffic Control: Approved and Threshold Flow Control; Traffic Shaping; Congestion Avoiding; Connecting Networks: Bridges; Routers; Tunneling; Routing In Internet: OSPF and BGF Protocols; Point to Point Connection: Connection Management and Flow Control; Multiplexing, TCP Protocol; Management: Management in OSI; ANSI Notation; CMIP Protocol; Management in Internet; SNMP Protocol; Network Security; Cryptography Principles; Public and Secret Key Methods; Decryption; Digital Signature.
- BiL556                    Computer Graphics                    3+0   7.5**  
Fundamental Concepts; Use of Computer Graphics in Engineering; Principles of Graphics; Polygons; Transformations; Segment Concept; 2D And 3D Graphics; Windowing Concept; Representation of Surfaces; Hidden Lines and Surfaces; Color; Shading and Lighting Methods; Curves and Surfaces; Graphical Databases; Graphics Standards; Texture Mapping; Controlled Deformations; Simulation; Animation.
- BiL557                    Internet Software                    3+0   7.5**  
Client/Server Mechanism; Programming Methods From Client Aspect; Application Development From Server Aspect: Basic Introduction to CGI, Perl and PHP; Introduction to XML; E-Commerce and XML; ASP: Using HTML in Web Pages; Response and Request Objects; Form Elements, Application Objects; Session Objects; Server Objects; Cookies; File Operations; Vb script; Java script; Database Connections; Search Techniques; Application Areas.
- BiL558                    Parallel Programming                    3+0   7.5**  
Parallel Programming Concept; Application Areas; Problems About Parallel Algorithms: Synchronization; Communication; Critical Sections; Synchronization Mechanisms: Semaphores; Monitors; and Others; Verification Methods and Application Examples; Communication Principles Based on Message Transmission; Rendez-Vous Structure; Parallel Programming Methods in Operating Systems; Parallel Programming Languages: CSP; OCCAM; ADA; and Others; Designing of Classic Parallel Programming Algorithms and Examining.
- BiL559                    Software Engineering                    3+0   7.5**  
Computer-Based System Engineering; Project Management; Requirements Analysis; System Models; Software Prototyping; Software Design: Architectural Design; Object-Oriented Design; Function-Oriented Design; Real-Time Systems Design; User Interface Design; Multilanguage Software Design Principles; CASE; Management: Managing People; Teaming; Socio-Psychological Analysis; Software Cost Estimation; Program Productivity; Quality Management; Process Improvement.
- BiL560                    Data Access Systems                    3+0   7.5**  
Increasing Scientific and Technical Information and Data Access Problem; Automation Data Access; Naming: Data Access (DA) Term, Information Science; Data Access System Concept: Main Concepts; Theoretical Bases; Elements; Approaches; Automation Text Processing: Automation Natural Language Analysis; Mechanic Dictionary; Automation Summarizing; Indexing Language and Embedded Systems: Definition and Structural Relations; Choosing Terms; Remembrance and Sensitiveness Devices; Synonymous Control; Word Forms Control; Classifying the Terms; United Terms and Idioms; Tasks and Roles; Term Measuring; Automation Classifying Approaches: Document-Defining Vectors; Measuring Similarity Among Documents; Heap Approaches.
- BiL561                    Fuzzy Neural Networks                    3+0   7.5**  
An introduction to fuzzy logic, Operations on fuzzy sets, Fuzzy relations, Fuzzy implications Linguistic variables, The theory of approximate reasoning, Defuzzification methods, Inference mechanisms, The perceptron learning rule, The delta learning rule, Winner-take-all learning, Integration of fuzzy logic and neural networks, Fuzzy neurons, Hybrid neural nets, ANFIS, Gradient based training algorithms, Trainable neural nets for fuzzy IF-THEN rules, Fuzzy rule extraction from numerical data, Neuro-fuzzy classifiers, Applications of fuzzy neural systems
- BiL562                    Network Security                    3+0   7.5**  
Introduction to Network Security; Problems; Terminology; Private Key Cryptography Techniques: DES, 3DES, AES, Public Key Cryptography Techniques: RSA, Diffie-Hellman, One-Way and Mutual Authentication Techniques; Message Integrity Techniques: MD-5, SHA-1, Digital Signatures; Network Security Standards: Secure-E-mail (PGP), S-MIME, SSL, TLS, IPsec.
- BiL563                    Fuzzy Logic                    3+0   7.5**  
Fuzzy Sets and Basic Operations on Fuzzy Sets; Fuzzy Relation and Extension Principle; Linguistic Variables; Fuzzy Logic and Approximate Reasoning; Fuzzy Rule Base; Fuzzy Inference Engine; Fuzzifiers and Defuzzifiers; Fuzzy System Design for Function Approximation, Fuzzy Systems as Nonlinear Mappings; Design of Fuzzy Systems from Input-Output Data; Table Look-Up Scheme; Gradient Descent Training; Fuzzy Clustering.

- BiL564 Data Acquisition and Mining 3+0 7.5**  
Data and knowledge representation, Data preprocessing, Data mining algorithms, Decision trees, Association rules, Clustering, Classification, Web mining, Text mining, Collaborative filtering, Privacy preserving data mining, Regression analysis
- BiL565 Rough Sets Theory 3+0 7.5**  
Rough Sets; Information Systems; Discernibility Set Approach; Reductions and Process of Reduction Algebra; Decision Rules and Synthesis; Data Gathering and Digitalization; Discernibility Matrix and Functions; Decision Based Discernibility Matrix; Decision Based Discernibility Functions; Reduction Algorithms; Reductions by Using ROSETTA and Evaluating of Decision; To Use Genetic Algorithms, Johnson, Holte 1 and RSES Extended Algorithms in Reduction Process.
- BiL566 Pattern Analysis 3+0 7.5**  
Mathematical and Statistical Foreknowledge; Pattern Types; Feature, Feature Extraction; Feature Selection, Optimal and Sub-Optimal Feature Selection Methods, Univariate and Multivariate Feature Selection Approaches, Classification and Classifier Types; Analysis of Recognition Performance; Various Pattern Analysis, Feature Selection and Classification Applications.
- BiL567 Introduction to Recommender Systems 3+0 7.5**  
Collaborative Recommendation: User- and item-based predictions, Ratings, Practical solutions; Content-Based Predictions: Content, Similarity-based retrieval; Knowledge-Based Predictions: Knowledge representation, Constraint- and case-based predictions; Hybrid Predictions: Hybridization opportunities, Monolithic and parallelized hybridization; Explanations in Recommender Systems: Explanations in constraint- and case-based predictions, Explanations in collaborative filtering; Evaluation: General evaluation, Popular evaluation, Evaluation data sets.
- BiL569 Big Data Systems 3+0 7.5**  
Big Data Infrastructure: Apache hadoop, MapReduce, Analysis tools, Interactive analysis tools, Scalable machine learning; Collecting and Transferring Big Data: Transferring bulk data from databases, Collecting streaming data; Storing Big Data: Apache HDFS, NoSQL and google bigTable, Apache HBase; Simple Data Processing: MapReduce framework, Implementing MapReduce applications; Big Data Analysis: SQL, Apache pig, Apache hive; Interactive Big Data Analysis: Google dremel, Dremel and impala; Machine Learning on Big Data: Scalable machine learning, Apache mahout, Machine learning algorithms, Evaluating models.
- BiL571 Advanced Neural Network Models 3+0 7.5**  
The Basic Perceptron and Linear Separability; Multilayer Perceptrons and the Backpropagation Algorithm; Optimization Methods: Gradient descent method, Conjugate gradient method; Least Squares; Weighted Least Squares; Radial Basis Function Networks; Wavelet Neural Networks; Fuzzy Neural Networks; Fuzzy Wavelet Neural Networks; Type-2 Fuzzy Neural Networks; Type-2 Fuzzy Wavelet Neural Networks.
- BiL572 (Eng) Big Data Systems 3+0 7.5**  
Big Data Infrastructure: Apache hadoop, MapReduce, Analysis tools, Interactive analysis tools, Scalable machine learning; Collecting and Transferring Big Data: Transferring bulk data from databases, Collecting streaming data; Storing Big Data: Apache HDFS, NoSQL and google bigTable, Apache HBase; Simple Data Processing: MapReduce framework, Implementing MapReduce applications; Big Data Analysis: SQL, Apache pig, Apache hive; Interactive Big Data Analysis: Google dremel, Dremel and impala; Machine Learning on Big Data: Scalable machine learning, Apache mahout, Machine learning algorithms, Evaluating models.
- BiL573 (Eng) Artificial Intelligence in Healthcare 3+0 7.5**  
Digital Transformation in Healthcare; Medical Data Analysis; Computational Model Development in Healthcare Problems and Tools: Tensorflow, Keras, Pytorch, Anaconda, NumPy, ScikitLearn, OpenCV; Computational Model Development Stages; Clinical problem definition, Data curation, Data annotation, Model development, Model evaluation; Deep Learning Techniques in Medical Data Analysis; Medical Data: Imaging data, Text data, Reports, Demographics, Data privacy; Medical Data Analysis Applications: Medical image segmentation, Clinical object detection and tracking, Lesion detection and classification, Prognosis.
- BiL574 (Eng) Advanced Neural Network Models 3+0 7.5**  
The Basic Perceptron and Linear Separability; Multilayer Perceptrons and the Backpropagation Algorithm; Optimization Methods: Gradient descent method, Conjugate gradient method; Least Squares; Weighted Least Squares; Radial Basis Function Networks; Wavelet Neural Networks; Fuzzy Neural Networks; Fuzzy Wavelet Neural Networks; Type-2 Fuzzy Neural Networks; Type-2 Fuzzy Wavelet Neural Networks.
- BiL576 (Eng) Human Computer Interaction 3+0 7.5**

Human Factors in Software Development; Use of Database Systems; Design of Interactive Systems; Science Bases: Theories, Models, Usability studies, Controlled experimentation; Software Engineering with User Interface Development Environments; Programming and command languages, Menus, Forms, Direct manipulation; Graphical User Interfaces; Computer-Supported Cooperative Work; Information Search and Visualization; Input/Output Devices; Display Design.

**BiL577 (Eng) Fuzzy Neural Networks 3+0 7.5**

An introduction to fuzzy logic, Operations on fuzzy sets, Fuzzy relations, Fuzzy implications Linguistic variables, The theory of approximate reasoning, Defuzzification methods, Inference mechanisms, The perceptron learning rule, The delta learning rule, Winner-take-all learning, Integration of fuzzy logic and neural networks, Fuzzy neurons, Hybrid neural nets, ANFIS, Gradient based training algorithms, Trainable neural nets for fuzzy IF-THEN rules, Fuzzy rule extraction from numerical data, Neuro-fuzzy classifiers, Applications of fuzzy neural systems.

**BiL578 (Eng) Data Mining 3+0 7.5**

Why Data Mining?: What is data mining?, Knowledge discovery process, Data mining applications; What is Data?: Types of datasets, Attributes, Basic statistical explanations of data, Similarity and difference; Data Preprocessing: Data cleaning, Data integration, Dimension reduction; Classification: Prediction problems, Model creation, Information gain, Classification algorithms; Clustering: Clustering analysis, Partitioning methods, Hierarchical methods, Evaluation of clustering; Frequent Pattern Analysis: Frequent patterns, Association rules, Apriori algorithm; Recommendation Systems: Basic concept, Algorithms, Experimental analysis.

**BiL591 Seminar 3+0 7.5**

**BiL592 Seminar 3+0 7.5**

**BiL599 Term Project 3+0 0.0**

**BiL604 Information Technology Management 3+0 7.5**

Information Technology Concept; ITM Resources: Manpower, Hardware, Software, Money and support systems, Management information systems, Computer networks; Internet, Intranet and Extranet Concepts; E-Society and Its Fundamental Properties; E-Government; E-Business: Intranet policies and strategies; Information Technologies and Applications; Database Management Systems: Concept, Analysis and Design; Decision Support Systems; Information Sharing Policies; Information Security Principles; Data Mining; Project Management: Concepts, Management software.

**BiL605 Distributed Computing Methods 3+0 7.5**

Distributed Computational Structures; Implementations of Different Algorithms in Popular Distributed Architectures; Shared Memory, Distributed Memory Implementations; Emphasis on Map and Reduce Algorithm As Made Popular by Its Recent Applications in Scientific Computing

**BiL606 Natural Language Processing 3+0 7.5**

General Introduction to Natural Language Processing Applications; Grammars and Parsing; Morphological Analysis; Semantic Notations; Entity Extraction and relations; Shallow Parsing; Syntactic and Semantic Analysis; Text Generation and Summarization; Ontology and Knowledgebase Creation; Sense Disambiguation; Statistical and Rule Based Approaches for NLP Using Machine Learning.

**BiL607 Advanced Information Retrieval Systems 3+0 7.5**

Information Retrieval Problem: Automation in information retrieval; Term Information Retrieval (IR); Information Science; Indexing and Searching Techniques; Advanced Query Optimizations; Focus on Ranking Functions and Using Machine Learning to Learn the Ranking Functions for the Specific Problems.

**BiL612 Data and Text Mining 3+0 7.5**

Data and Text Mining; Algorithms used in Data Mining; Application of Data Mining Applications to Text Mining; Classification and Clustering Algorithms; Rule-Based Systems.

**BiL613 Machine Learning 3+0 7.5**

Introduction to Learning Theory, Learning Algorithms and their Applications; Learning Theory; Estimation; Regression, Categorization with specific algorithms: Least squares, Maximum entropy, Hidden markov models, Artificial neural networks, Support vector machines.

**BiL615 Special Topics in Information Technologies 3+0 7.5**

Using Information Technologies in Distance Education Applications; Using Information Technologies in Medical Service Applications; Special Software Design Techniques for the Disabled People; Text-to-Speech, Speech-to-text conversion and applications.

**BiL616 Pattern Recognition Applications 3+0 7.5**

Mathematical Preliminaries; Pattern and Feature; Feature Extraction; Feature Selection; Classification; Linear and Quadratic Classifiers; Bayes Decision Theory; Subspace Methods; Principal Component Analysis (PCA); Linear Discriminant Analysis (LDA); Cluster Analysis; Combined Classifiers; Pattern Pre-Processing and Post-Processing; Recognition Performance Analysis; Various Pattern Recognition Applications.

**BiL617 Cryptology 3+0 7.5**

Classical Cryptography and Cryptoanalysis; Number Theory; Shannon Theory; Cryptographic Hash Functions; Iterative Hash Functions; Message Correction Codes; RSA and Prime Factorization Algorithms; Discrete Logarithm Method and Elgamal Crypto System; Elliptic Curves; Signature Methods.

**BiL619 Advanced Discrete Mathematics 3+0 7.5**

Linear Algebra; Subspace Fundamentals; Probability Theory and Random Variables; Principal Component Analysis; Nonlinear Optimization; Graphs; Trees; Path Problems; Planar Graphs; Pairing Problems; Coding Theory.

**BiL620 Multi Agent Systems 3+0 7.5**

Introduction to Intelligent Agents; Deductive Reasoning Agents; Practical Reasoning Agents; Reactive and Hybrid Agents; Multiagent Interactions; Communication; Working Together; Methodologies; Multiagent Decision Making; Applications of Multi Agent Systems.

**BiL621 Text Analytics 3+0 7.5**

Business Analytics; Text Analysis; Text Analytics; Text Representation: Preprocessing techniques, Feature extraction, Feature selection, Feature projection; Information Extraction from Text; Crawling; Indexing; Searching; Text Categorization; Text Clustering; Application of Text Algorithms over Big Data; Algorithm Selection and Evaluation; Multilingual Text Analytics; Semantic Analysis.

**BiL623 Advanced Engineering Mathematics 3+0 7.5**

Linear Equations; Laplace Transforms; Rectangular Systems and Echelon Forms; Matrix Algebra; Vector Spaces: Space, Subspace, Basis and dimensions, Linear transformations, Change of basis; Norms; Orthogonality; Gram-Schmidt Procedure; Discrete Time Signals; Fourier Analysis; Fourier Transforms; Time Frequency Analysis; Z-transforms and Filters; Determinants; Eigen Values; Eigenvectors; Probability: Combinatorics, Random variables, Conditional probability, Expectation, Limit theorems; Bayesian Learning Methods; Markov Chain; Monte Carlo; Optimization: Gradient descent algorithm, Newton method.

**BiL624 Deep Learning Theory and Applications 3+0 7.5**

**BiL692 Seminar 3+0 7.5**

**BiL790 Thesis 0+1 30.0**

**BiM890 Thesis 0+1 30.0**

**BiM890-0 Thesis (Thesis Proposal) 0+1 30.0**

- BiY501 Herbarium Techniques 3+0 7.5**  
 What is Herbarium? Collecting Plant Samples; Plant Drying Method; Sticking the Plant Samples on the Herbarium Cartons; Labeling the Plant Samples and Recording to Cartotext; Settling the Herbarium Material to Herbarium With a Specific Order; Herbarium Types; Preservation of the Plant Taxa; How Can We Benefit From the Herbarium?
- BiY502 Methods of Plant Identification 3+0 7.5**  
 Collecting Plants; Studying Plant Specimens in Herbarium; Herbarium Techniques; Necessities When Making Herbarium Materials; How to Use Flora of Turkey and the East Aegean Islands; Key Types For Determining Plant Taxa; Determining Comparison Material; Publication Process After Determining the Plant Specimens.
- BiY505 Bacteriology 3+0 7.5**  
 The Bacteria; What Are Bacteria; The Bacterial Cell; Growth and Reproduction; Differentiation; Metabolism; Energy Metabolism; Carbon Metabolism; Bacteria Genes; Bacteria Ophages; Bacteria in the Living World; Applied Bacteriology; Food-Bacteria; Feeding Animal; Biopol; Bacteria in Meolicine; Some Pratical Bacteri Ology; the Identification and Classification of Bacteria.
- BiY506 Enzymatic Regulation 3+0 7.5**  
 Enzymes; Description; Biochemical Structures; Classification; Factors That Are Affecting the Enzymes Activities; Enzymatic Inhibitors; Competitive and Non-Competitive Inhibition; Determination of the Active Center In Enzymes; Co-Factors and Co-Enzymes; Allosteric Enzymes and the Regulation of Allosteric Enzyme's Metabolic Pathways; Synthesis; Gaining of Tertiary Structure And Release of Enzymes Will Be Taught.
- BiY507 Biology of Lichens 3+0 7.5**  
 Historical Development of Lichenology; Anatomical and Morphological Features of Lichens: Cortex; Medulla; Algal Layer, Structure and Functions; Reproduction Mechanisms of Lichens; Sexual Reproduction; Types of Fructification; Vegetatif Reproduction; Isidia; Soredia; Blastidia; Physiological Features; Photosynthesis; Respiration; Unique Lichen Substances; Ecological Features; Biogeographical Features; Economical Usages of Lichens; Classification of Lichens.
- BiY509 Special Histology 3+0 7.5**  
 Cardiovascular System; Blood Vessels; Lymphatic System; Reticuloendothelial System; Endocrine System; Urinary System; Reproductive System; Male Reproductive System; Female Reproductive System; Respiratory System; Excretory Respiratory Organs; Lungs; Digestive System; Stomach; Intestines; Pancreas; Liver.
- BiY510 Flora of Turkey 3+0 7.5**  
 Historical Development on the Floristic Studies in Turkey: Algae; Liverworts; Fungi; Vascular Plants; What Is a Flora Element?; Floristic Regions in the World; Geographical Areas of Turkey: Their Topographic and Climatic Features; Composition of Flora of Turkey; Evaluation of Floristic Regions of Turkey (Euro-Sibirian, Mediterranean and Irano-Turanian): Their Features and Characteristic Taxa; Endemism: Endemic Taxa of Turkey and their Distribution Areas.
- BiY511 Gene Regulation 3+0 7.5**  
 Evidence For Gene Regulation in the Cell and Related Methods; Gene Regulation at DNA Level; Amount and Types of DNA in Different Cell Types; DNA Loss; DNA Amplification; DNA Rearrangement; Tissue-Specific Expression of Proteins and Mrnas; Regulation at Trancription Level: Chromatin Structure; DNA Sequence Elements; Transcription Factors; Post-Transcriptional Regulation; Mrna Splicing; Life of RNA; Regulation of Translation; Gene Regularion and Cancer; Genetic Regulation of Immune System; Regulation of Mating-Type in Yeast.
- BiY512 Principles of Zoological Nomenclature 3+0 7.5**  
 Zoological Nomenclature; Number of Words in Zoological Names; Criteria of Publication; Criteria of Availability; Date of Publication; Validty of Names; Formation and Emendation of Names; Taxa of the Family 'Group and Their Names; Taxa of The Genus 'Ggroup And their Names; Taxa of the Species 'Group and their Names; Authorship; Homonymy; the Type-Concept.
- BiY513 Advanced Cell Physiology 3+0 7.5**  
 Macromolecular Structures That are Forming Cellular Organelles; Biochemistry of Membrane and Membranal Transportation; Connective Complexes in-Between Cells And Cellular Communication; Function and Structure of the Golgi Complex; Mitochondria; Lysosome and Peroxisome; the Role of Camp in the Regulation of Cellular Physiology; the Functional Mechanisms of Calcium-Calmodulin; Mechanisms of Cellular Differentiation Will Be Taught.
- BiY514 The Harmful Insects 3+0 7.5**

Introduction; Living and Nutrition of Insects; Parasits of Fur and Pelt; Ceratine Consuming Insects; Predatory Insects; Water Insects; Plant Insects; Harmful Insects of Wood; the Poisonous Insects; Patogenic Insects; Insects as Vectors of Diseases; Groups of Harmful Insect and their Damages.

**BiY515 Forest Ecology 3+0 7.5**

Introduction; Basic Principles of Ecology; Definition of Factors Forming Forest Ecosystems; Reciprocal Effects and Relations Between Factors Forming Forest Ecosystems; Yield Power of Forest Ecosystems; Prediction and Classification of Yield Power; Investigation of Forest Community According to Sociological Principles.

**BiY516 Bioenergetics 3+0 7.5**

Principles of Bioenergetics, Glycdysis and the catabolism of Hexoses, The citric acid cycle and control of ATP production, Oxidation of Fatty Acidy, Amino Acid Oxidation and the production of urea, Oxidative Phosphorylation and Photophosphorylation. Carbohydrate Biosynthesis, Lipid Biosynthesis, Biosynthesis of AminoAcids, Nucleotides and Related Molecules Intey Integration and Hormonal Regulation of Mammalian Metabolism.

**BiY517 Water Pollution and Biological Effect 3+0 7.5**

The Factors That Cause Pollution in the Marine and Freshwater; the General Characteristics and Effects of Various Types of Pollutants on the Aquatic Environment; Chemical Pollution: Hydrocarbons, Pesticides; Detergents; Heavy Metals; Domestic Pollution; Aerobic and Anaerobic Mineralization; Radioactive Pollution; Red-Tide and Pollution; General Effects and Results of Eutrophication in the Standing Water; Bioaccumulation: Accumulation in Plants; Invertebrates and Vertebrates; Water Quality.

**BiY518 Signal Transduction in The Cell 3+0 7.5**

Types and Structure of Receptors Located on the Cell Membrane; Types and Structure of Ligands Bound Receptors; Mechanism of Signal Transduction Through the Cell Membrane; Mechanism of Signal Transduction in the Cell; Secondary-Messenger Molecules and Their Functions; Importance of Calcium Ion in Signal Transduction; SH2; SH3 and PH Domains of Proteins; MAP-Kinases; Termination of Signal; Signalling in he Nucleus; Nuclear Responses; Transcription Factors; the P53 Tumor Repressor; Cell Cycle Regulation; Cancer and Signalling Through Growth Factors.

**BiY519 Limnology 3+0 7.5**

Introduction to Limnology; Features of Freshwater and their Classification; Standing Water; Physical; Chemical and Biologic Features of the Standing Water; Thermal Stratification ünd Classification of Lakes; Running Water; Physical; Chemical and Biologic Features of the Running Water; Food-Chain Dynamics in the Water; the Major Groups of Organisms in Lakes and Streams; Pytoplankton; Zooplankt; Periphyton; Neuston; Nekton; Applied Limnology.

**BiY520 Bacterial Plant Diseases 3+0 7.5**

Introduction; Role of Bacteria in Plant Diseases; Classification of Plant Pathogenic Bacteria; Agrobacterium; Corynebacterium; Erwinia; Pseudomonas; Xanthomonas; Streptomyces; Symptoms of Bacterial Diseases; Identification of Plant Pathogenic Bacteria; Host-Pathogen Relations; Pahogenicity and Virulence Factors; Genetics of Bacterial Plant Diseases; Epidemiology of Bacterial Plant Diseases and Control of Disease.

**BiY521 Biophotography 3+0 7.5**

Variety of Photographic Cameras; Using Objectif for Photographic Cameras; Filters; Using Diafram; Obturator; Visor and Its Variety; Macro and Mikro Photography; Lighting and Periods; Arroneous Photography; Photographic Solutions; Films Developing; Card Developing; Measuring With Photograph; Photograph Reading.

**BiY522 Investigation Methods of Ecosystems 3+0 7.5**

Natural Selection and Speciation; Conditions for Life; Population Ecology; Community Organization and Structure; Ecosystem Dynamics; Diversity of Ecosystems; Definition of Genus and Characteristics of Elements Forming Ecosystem; Production of Organic Substance in Ecosystems; Energy and Material Flow and Their Depositions and Changes; Circulation of Food Substances; Investigation of Ecosystems.

**BiY523 Zootaxonomy 3+0 7.5**

The Principles of Animal Classification; Importance of Taxonomy; Category of Species; Categoriess of Subspecies; Taxonomy of Population; Teories of Classification; Aims of Classification; The High Categories; The High Taxa; Methods of Animal Classification; Taxonomic Collections; Methods of Identification; The Materials Point of Revision and Monography; Taxonomic Characters.

**BiY524 Fishery Biology and Population Dynamics 3+0 7.5**

The Factors that Effect on Efficiency of Fish Stocks in tThe Marine and Freshwater; Fish and Fisheries; Sampling and Statistical Methods for the Fishery Biology; Metric and Countable Features for the Fishery Biology; Studies of the Age;

Growth; Sexual Distinction and Spawning of the Fishes; the Relationships Between Length and Weight of the Fishes; Methods for Estimating the Potential Fish Population Dynamics of Aquatic Environment; Up Welling and Fish Production.

**BiY525                    The Collection Methods of Invertabrate Animals                    3+0   7.5**

Introduction; Biological Ecozones; Terrestrial Environment; Maritime Environment; Aquatic Environment; Collecting; Killing; Fixation; Preserving; Collections of the Main Invertabrate Animal Groups; Collection of Protozoa; Collection of Porifera; Collection of Coelenterata; Collection of Ctenophora; Collection of Plathelminthes; Collection of Rotifera; Collection of Nematoda; Collection of Annelida; Collection of Arthropoda; Collection of Mollusca; Collection of Echinodermata.

**BiY526                    Cytogenetics                    3+0   7.5**

Molecular Organization of Chromosome. Chromosome Morphology; Chromosome banding techniques. Structural and numerical chromosome mutations: Description and interpretation of mutations on chromosomes. Obtaining and Marking of the Prophase and Promethaphase Cells. Determination Prosedure about Number and Size of Ginosimes without the Use of Karyotype Analyze. Slide Preparation Procedures Invitro and In vivo Cytogenetic Investigations: Investigation and evaluation of mitosis and meiosis chromosome on plant; Investigation and evaluation of mitosis and meiosis chromosome on animal.

**BiY527                    Plant Microbiology                    3+0   7.5**

Introduction; Microorganisms as Saprotrophs and Plant Pathogens; Penetration of Pathogens Into Host; Mechanical and Chemical Barriers to Infection; The Hypersensitive Reaction; Microbiology of Flowers; Microbiology of Seeds; Microbiology of Fruits; Microbiology of Living Leaves; Microbiology of Stems; Microbiology of Roots and Mycorrhizas; Decomposition of Plant Litters; Industrial Fermentations of Plant Litter.

**BiY528                    DNA Repair Mechanisms                    3+0   7.5**

Mutations: Spontaneous v.s induced mutations, Gametic v.s somatic mutations, Other categories of mutations; Mutations arise in different ways: Tautomeric shifts, Base analogues, Alkylating agents, Apurinic sides and other lezions, UV Radiation and Thymine dimers; DNA Repair Systems: Photoreactivation repair, Excision repair, Proofreading and Mismatch repair, Double strand break repair in Mammals

**BiY529                    Landscape Ecology                    3+0   7.5**

Natural Ecological Factors Forming Structure of Landscape and Their Relation; Climatic Factors; Definition; Ecological Importance and Functions in Landscape; Soil Factor; Definition; Ecological Importance and Functions in Landscape; Relief Factor; Definition; Ecological Importance and Functions in Landscape; Biotic Factors and their Ecological Importance; Plant as Structure Element of Landscape; Definitions of Air Pollution; Water Pollution; Soil Pollution; Radiation Pollution and Noise Pollution; Ecological Importance and Reciprocal Relation of Landscape Elements; Basic Knowledge Concern to Ecological Need of Plants.

**BiY530                    Plant Tissue Culture                    3+0   7.5**

Culture of Plant Cells; Tissues and Organs; A Plant Tissue Culture Laboratory; Aseptic Techniques; Nutritional Components of Tissue Culture Media; Protoplast Fussion; Protoplast Isolation; Protoplast Culture; Callus Culture; Embryo and Ovul Culture; Meristem Culture; Anther and Pollen Culture; Secondary Products From Cultured Cells and Organs; Rekombinant DNA Isolation; Organogenesis.

**BiY531                    Immunology                    3+0   7.5**

Introduction; Cells and Organs of Immun System; Properties of Antigens; Immunglobulins; Polyclonal and Monoclonal Antibodies; Immun Response; The Complement System; Immune Tolerance and Autoimmunity; Antigen-Antibody Reactions; Serological Reactions; Agglutination; Precipitation; Immunolectrophoresis; Notralisation; Fluoresent Antibodies; Enzyme-Linked Immunosorbent Assay; Radioimmunoassays.

**BiY535                    Mineral Feeding Physiology in Plants                    3+0   7.5**

Element Concepts in Plants; Necessary Elements for Vascular Plants; Research Methods for Plant Nutrition; Types of Different Elements in Soil; Incoming the Mineral Elements to Plant and Transportation; Transportation of Mineral Elements in Plants; Circulation of Mineral Elements; Functions of Necessary Mineral Elements and Mineral Deficiency Symptoms; Köklerin Tuz Alinimini Etkileyen Faktörler; Temperature; Light; Airing Position; pH; Interactions Among Ions; Growing; Plant Nutrition From Leaves.

**BiY537                    Stress Physiology in Plants                    3+0   7.5**

Stress Terminology; Responses of Plants to Stress Factors; Levels of Expression; Submolecular Level; Free Radicals (FR) and Related Active Oxygen (AO) Species. Ual Functions of FR and AO; Protection; Amage; Signalling; Regulation of FR and AO; Molecular Level; Secondary Metabolits Involved in Stress; Polysaccharids; Stress Proteins; Normal Cell





Structure of macromolecules and their use in systematics; Electrophoretic separation of proteins; Electrophoresis of seed storage proteins; Enzyme electrophoresis, generation and analysis of data; The nuclear genome of plants: Genaral features and use in systematic studies; Nuclear ribosomal DNA: Structure and use in Systematics; The chloroplast genome and plant systematics

**BiY551 Stem Cell Biology 3+0 7.5**

What is a Stem Cell?; Embryonic Stem Cells; Adult Stem Cells; Similarities and Differences between Embryonic and Adult Stem Cells; Regulation of Stem Cell Function; Hematopoietic Stem Cells; Mesenchymal Stem Cells; Isolation of Stem Cells from Different Organs; Stem Cells and Cancer Treatment; Embryonic Stem Cells and Tissue Repair; Adult Stem Cells and Tissue Repair; Stem Cells and Gene Therapy; Development of Stem Cell Policy at World.

**BiY552 Plant Science 3+0 7.5**

Characteristics of Plant Cell: Characteristics of Plant Tissues; Characteristics of Plant Organs; Reproduction of Plants: Flower Structure, Fruit; Nutrition Intake in Plants; Plant Growth Conservation; Genetic Sources of Plant, Nomenclature in Plants: Taxonomic Systems; General Characteristics of Spermatophyte, Gymnospermae and Angiospermae; Environment and Adaptation in Plants: Relation Between Plant and Ecosystem: Ecological Life Cycle in Plants; Ecological Adaptation and Evolution: Floristic Plant Geography; Plant Groups and Their Dispersal; World flora Regions; Vegetation Formation and Classes; Ecological Conditions of Vegetation in Turkey; Phytogeographical Regions of Turkey.

**BiY553 The Ecology of Bird Communities 3+0 7.5**

The Foundation of Avian Community Ecology; The Assembly of Communities; Numbers of Species and Their Abundances; Niche Theory; Ecomorphological Patterns of Communities; Distributional Patterns of Species; Habitat Distributions of Species; Resources and Their Use; Convergence of Species and Communities; Bioenergetic Approaches to Communities; Competition; Other Factors Influencing Community Structure; Temporal Variation of Communities; Future Directions In Avian Community Ecology.

**BiY555 Birds of Turkey 3+0 7.5**

Basic Characteristics of Birds; Threats to Bird Populations; Extinctions of Bird Species; Red Lists for Birds; Red List Categories and Criteria; Important Bird Regions in Turkey; Nonpasseriformes Species: Status, Distribution and Ecology of Species and Threats; Passeriformes Species: Status, Distribution, Ecology of Species and Threats.

**BiY556 Transmission Electron Microscopy and its Applications I 3+0 7.5**

History of Microscopes; Light Microscopes and their Varieties; Stereo Microscopes; Dark Field Microscopes; Polarisation Microscopes; Scanning Electron Microscope and Transmission Electron Microscope; Functions of Light and Electron Microscopes their Differences and Similarities; Systems of Electron Microscopes; Trimming and Ultramicrotome Techniques; Staining; Other Techniques; Enzyme Histochemistry; Electron Immunocytochemistry; Cryofixation; Ultracyotomy; Preparation of Several Samples for the Transmission Electron Microscope; Preparation of Biological and Metal Samples; Microtomes and Knives.

**BiY557 Transmission Electron Microscopy And its Applications II 3+0 7.5**

Preparation Techniques in Transmission Electron Microscopy; Handlig of Specimens and Fixation; Fixative Solutions; Dehydration; Dehydration Transitional Fluids; Embedding Media; Epoxy Resing; Araldite Embedding Mixture; Araldite Embedding Schedules; Epon Embedding Schedules; Epon Embedding Mixture; Three Hour Embedding Schedule for Biopsies; Non-Urgent Biopsies; Sectioning and Staining; Staining of Thin Sections; Lead Staining Methods; Knives; Block Trimming; Sectioning; Toluidine Blue Staining; Preparation of Blocks For Ultramicrotomy; Ultramicrotomy Techniques; Collection of Ultrathin Sections; Staining of Material For Electron Microscopy.

**BiY560 Instrumental Analyses in Biochemistry 3+0 7.5**

Risk Factors in Laboratory and Precautions: Risk Sources, Precautions (R ve S indicators) ; Measurement Units, Weight, Balances: Units, Weight measurement and balances; Volume Measurements: Equipments, Calibration; Quality of the Laboratory Water: Quality of the water and its usage, Distillation methods, Test of water purity; Sterilization: Dry and wet heat method; Centrifugation: Usage in clinic laboratory, Types, Theory, Usage, Care; Spectrophotometer: Structure of light, Beer Law, Components of spectrophotometer, Performance parameters, Multiple wavelength readings; pH meter: H+ Consantrations and pH concept, Working principles of pH meter, Usage, Applications; Electrophoresis: Theory, General method, Types of electrophoresis; Choromatographic Methods: Gas and Liquid chromatography, HPLC.

**BiY561 Animal Cell Culture 3+0 7.5**

Introduction; Advantages and Limitations of Tissue Culture; Biology of Cultured Cells; Planning and Layout of The Lab, Requirements of a Tissue Culture Laboratory, Aseptic Technique, Safety; Culture Vessels; Media; Preparation and Sterilization; Primary Culture; Cell Lines; Cloning and selection; Cell Separation and Characterization; Differentiation and Transformation; Contamination; Cryopreservation; Quantitation; Cytotoxicity; Specialized Cells; Tumor Cells; Molecular Techniques.

**BiY562                    Molecular Biotechnology                    3+0   7.5**

Introduction to Recombinant DNA technology, Molecular biological systems, Manipulation of prokaryotic gene expression, gene expression from strong and regulable promoters, expression of fusion proteins, types of expression vectors, Protein Engineering; Methods of directed mutagenesis in protein engineering, addition of disulphide bonds, Molecular Diagnostics of human diseases based on DNA and DNA sensors; polyclonal and monoclonal antibody production, PCR based diagnostics; Diagnosis of Malaria and sickle cell anemia, Fundamentals of microbial production of therapeutic human proteins, Human gene therapy, patents and patent analysis in Biotechnology.

**BiY563                    Halophilic Microorganisms and Their Potential in Biotechnology                    3+0   7.5**

Definition of Halophilic organisms; Halophilic Archaea; Halophilic Bacteria; Halophilic Eucarya; Isolation and cultivation of halophilic microorganisms; Microbial biotechnology; Halophilic Archaea in biotechnology; Halophilic Bacteria in biotechnology; Halophilic Eucarya in biotechnology; General Overview.

**BiY565                    Extremophiles                    3+0   7.5**

Extremophile Microorganisms and Techniques Used to Handle Them; Thermophiles; Psychrophiles; Alkaliphiles; Acidophiles; Halophiles; Barophiles; Radiation-Resistant Microorganisms; Applications with Extremophiles; General Overview.

**BiY567                    In-Vitro Techniques                    3+0   7.5**

Cell line techniques, cell adhesion, Cell proliferation, Cell differentiation, Energy metabolism of cell, In-vitro cell proliferation techniques, Cytotoxicity techniques, Mutagenicity and toxicity techniques, Flow-cytometry, In-situ hybridization, Cell dye and preparation techniques, Fluorescent- immunofluorescent dye techniques, apoptosis techniques.

**BiY571                    Taxonomy                    3+0   7.5**

Taxonomy and Systematic: Development of species concept, Classification systems, Rules of nomenclature; Viruses, Viroid and Prions; Diagnostic Characters and their classification of Archaea and Bacteria: Techniques and applications; Classification of Eucarya: Current methods and classification systems of microorganisms Algae, Fungi, Plants.

**BiY572                    Molecular Biology Methods                    3+0   7.5**

Methods in Protein Analyses: Micro methods in protein chemistry, Qualitative protein methods, Protein purification, Affinity chromatography, Spectrophotometric methods, Electrophoretic methods; Methods in Nucleic Acid Analyses: DNA analysis, DNA isolation and purification, RNA analysis and purification, PCR methods, Hybridisation methods, Cloning and genetic transfer; Serological Methods: Antibody production, Antibody-antigen reactions, ELISA, radio immune and fluorescence assays; Microbial Methods.

**BiY574                    Foodborn Pathogen Microorganisms                    3+0   7.5**

Aeromonas; Bacillus Cereus; Brucella; Camplobacter Fefuni; Clostridium Perfringens; Clostridium Botulinum; Pathogenic Escherichia Coli; Listeria Monocytopenes; Pseudomonas; Yersinia Enterocolitica; Salmonella; Shigella; Staphylococcus Aureus; Streptococcus; Other Pathogenic and Toxigenic Bacteria; Toxigenic Fungi and their Mycotoxins; Protozoan and Helminthic Parasites; Selective Isolation Techniques.

**BiY575                    Microorganisms and Biotechnology                    3+0   7.5**

Isolation of Cultures; Screening for Activities; Culture Preservation and Inoculum Development; Small-Scale Liquid and Solid-State Fermentations; Cell and Enzyme Immobilization; Continuous Culture; Methods for Biocatalysts and Biotransformation; Raw Materials Selection and Medium; Development for Industrial Fermentation Processes; Purification and Characterization of Proteins; Biological Biocontrol; Polyhydroxyalkanoates; Antibiotic Resistance Mechanism of Bacterial Pathogens; Genetics of Bacteriocins Produced by Lactic Acid Bacteria and their Use in Novel Industrial Applications.

**BiY577                    Enzyme Technology                    3+0   7.5**

Structure and functions of the enzymes, catalysis mechanisms of the enzymes and enzyme kinetics, enzyme activity units and fundamental of activity measurements, classification of the enzymes and characteristic enzyme reactions, inactivation and control of the enzymes. Sources of the enzymes, principles of the enzyme production from microorganisms, enzyme extraction, isolation from different sources and industrial applications.

**BiY578                    Arachnology                    3+0   7.5**

Taxonomy of Arachnida; Scorpionida: Taxonomy, Morphology, Anatomy, Biology, Ecological specifications: Solifugae: Taxonomy, Morphology, Anatomy, Biology, Ecological specifications: Acarina: Taxonomy, Morphology, Anatomy, Biology, Ecological specifications, Struggle methods; Opiliona: Taxonomy, Morphology, Anatomy, Biology, Ecological

specifications: Pseudoscorpionida: Taxonomy, Morphology, Anatomy, Biology, Ecological specifications: Araneae: Taxonomy, Morphology, Anatomy, Biology, Ecological specifications: Arachnida venoms and effects.

**BiY579 Plant Bacteriology 3+0 7.5**

Plant associated bacteria: Molecular phylogeny and genomics; beneficial bacteria: Rhizobium-legume symbioses, nitrogen fixing bacteria, epiphytic bacteria, bacterial endophytes; Rhizosphere bacteria: plant growth promoting rhizobacteria, systemic resistance and root colonization; Plant pathogenic bacteria: Agrobacterium, Clavibacter, the soft rot Erwinia, Pseudomonas, Xanthomonas, Ralstonia, Burkholderia, Acidovorax and Herbaspirillum.

**BiY581 Permaculture 3+0 7.5**

Introduction to Permaculture (Ecological Design): The philosophy of permaculture, Ethics, Concepts and themes in permaculture, Methods in Permaculture: Analysis, Observation, Data overlay, Flow charts, Zone and sector analyses, Design: Ecological systems and their characteristics, usage of ecosystem principles in design, design of sustainable agroecosystems, Ecological Cycling in Design; Usage of Biotic and Abiotic Factors in Permacultural Applications: Climatic factors, Plants, Water factor, Soil factor, Strategies for Different Ecological Environments: Humid Areas, Drylands, Wetlands, The Strategies of an Alternative Global Nation.

**BiY582 Cyanobacteria and Biotechnological Applications 3+0 7.5**

Cyanobacteria and Morphological Diversity, Biodiversity of Marine Cyanobacteria, Biodiversity of Freshwater Cyanobacteria, Cyanobacteria of Extreme Environments, Cyanobacterial Associations, Molecular Identification Methods of Cyanobacteria, Potential Applications of Cyanobacteria in Biotechnology, Cyanobacterial Bioactive Compounds, Cyanobacterial Bioplastics, Cyanobacterial Consortia for Bioremediation Purposes, Cyanobacterial Alternative Energy Sources, Cyanobacteria as Biofertilizers, Cyanobacteria as a Healthy Food Source, Cyanobacterial Emulsifiers

**BiY583 Methods of Ecological Analysis 3+0 7.5**

Introduction to Ecological Analysis: Basic Principles, Importance and necessity of ecological analyses; Quantitative Ecology; Application Related to Climatic Factors, Application Related to Plant and Soil Factors; Determination of Biological Diversity and Species Richness: Simpson index, Shannon diversity index, McIntosh diversity index; Floristic Quality Index: Basic principles and methods, Relationships between ecological factors and floristic quality index; Water Quality Index; Conservation Priority Areas; Analysis and evaluation; Applications Related to Classification Methods of Vegetation; Evaluation of the Data.

**BiY584 Advanced Microbial Physiology 3+0 7.5**

Introduction to Microbial Physiology, Macromolecular Synthesis and Processing: DNA, RNA, and protein synthesis, cell structure and function, bacterial growth, environmental effects and strategies, Genetic Adaptation I: Bacterial genomes, plasmids and mutations, Genetic Adaptation II: Transposable elements and genetic exchange, Regulation of Enzyme Activity and Gene Expression, Energy and Metabolism: Carbohydrate metabolism, Energy production and metabolite transport, metabolism of substrates other than glucose, Fermentation pathways, photosynthesis and inorganic metabolism, bacterial cell division, Microbial Stress Responses, Bacterial Differentiation, Host-Parasite Interactions.

**BiY585 Advanced Biochemistry and Metabolism 3+0 7.5**

Metabolism of Carbohydrates: Energy metabolism of glucose, Pyruvate metabolism, Biosynthesis of carbohydrates, Regulation of metabolism; Production of NADH and NADPH: Citric acid, glyoxylate and phosphogluconate cycles; Electron Transport Chain: Mitochondrial electron transport, Oxidative phosphorylation, Photosynthetic electron transport; Metabolism of Fatty Acids: Catabolism and biosynthesis of fatty acids, Regulation of metabolism; Metabolism of Amino Acids: Nitrogen cycle, Biosynthesis and catabolism of amino acids, Urea cycle; Integration and Coordination in Metabolism: Overall strategies of metabolism, Metabolic control by hormones.

**BiY586 Systematics of Lichens 3+0 7.5**

Taxonomic Classification of Lichens; Important Taxonomical Characteristics Used for the Identification of Lichens; Classical, Chemotaxonomic and Molecular Methods Used for the Identification of Lichens; Collection of Lichens: Field study and collection methods; Use of Different Keys in Lichen Identification; Identification of Crustose, Foliose and Fruticose Lichens; Designing Different Types of Identification Keys; Describing Lichens, and Defining Diagnostic Characteristics of Lichens; Lichens Used as Herbarium Samples: Entry into database and use of preservation techniques.

**BiY591 Advanced Molecular Biology and Genetics 4+0 7.5**

Cell Chemistry: Chemical equilibrium, Biochemical energetics; Proteins: Biosynthesis, Folding, Post-modifications after folding, Functions and regulation of proteins; Nucleic Acids: Organizations, Functions and regulation of nucleic acids; Cell Structure and Function: Transport of molecules, Signal transduction, Organization and movement of the cell; Cell Growth and Development: Cell cycle and regulation; Genetic Mechanisms: Genome replication, gene mutations and recombination mechanisms, DNA repair; Applications of Molecular Genetics: Physical and genetic mapping, Identification of genes, DNA sequencing techniques, Transcriptome and the proteome studies.

<b>BiY592</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>BiY593</b>	<b>Toxicology</b>	<b>3+0 7.5</b>
Introduction to Toxicology: Description, History and classification; The Effects of Toxic Substances; Entrance Ways of Toxic Substances to the Organism, Their Distribution and Excretion; The Metabolism of Toxic Substances; Toxicokinetics; Mechanisms of Toxic Action; Genetic Toxicology; Chemical Carcinogenesis; Teratogenesis; Systemic Toxicology: Neurotoxins, Liver toxins, Renal toxins, Respiratory toxins, Haematotoxicity, Immunotoxicity; Drug Toxicity; Environmental Toxic Substances.		
<b>BiY594</b>	<b>Nanomedicine and Application Fields</b>	<b>3+0 7.5</b>
<b>BiY599</b>	<b>Term Project Course</b>	<b>3+0 0.0</b>
<b>BiY601</b>	<b>Microbial Laboratory Techniques</b>	<b>3+0 7.5</b>
General Information, Cultural Counting Methods, Microscopic Counting Methods, Standard Based Counting Methods, Metabolism Based Counting Methods, Other Counting Methods, Biochemical Tests, Media and Sterilization; Indicator Microorganisms, Taking Sample for Analysis and Preparation of Samples for Analysis; Hydrophobic Grid Membrane Filter Technique; Direct Epifluorescence Microscopy Technique; Electric Impedance Method; Bioluminescence Method.		
<b>BiY602</b>	<b>Water Microbiology</b>	<b>3+0 7.5</b>
Microbiology of Source Water; Freshwater Microbiology; Marine Microbiology; Microbiology of Drinking Water; Waste Water Microbiology Deep-Sea Microbiology Hydrothermal Vents; Methods in Water Microbiology; Sampling Methods; Determination of Biomass; Isolation Methods; Identification; Viability Using Staining Techniques; Microbial Activity Measurements; Radio Isotopes and Microelectrodes.		
<b>BiY603</b>	<b>Environmental Pollution and Plants</b>	<b>3+0 7.5</b>
Evaluation of Environmental Pollution; Morphological; Anatomical and Physiological Effects of Air Pollution on Plants; Morphological; Anatomical and Physiological Effects of Water Pollution on Plants; Physiological; Morphological and Anatomical Effects of Soil Pollution on Plants; Description of Biomonitor and Bioindicator Organisms; Their Features and Uses for Determination of Environmental Pollution; Databanks; Their Purposes and Methods.		
<b>BiY604</b>	<b>Recombinant DNA Technology</b>	<b>3+0 7.5</b>
What is Gene Cloning; What are used for Gene Cloning; Purification of Fragments by Restriction Enzymes; Analyzes of Fragments; Ligation; Transformation; Selection of the Cell Having Recombinant DNA; Why is the Gene Cloning is Important; What are the Areas That Recombinant DNA can be used for.		
<b>BiY605</b>	<b>Animal Tissue Culture</b>	<b>3+0 7.5</b>
Advantage and Disadvantage of Tissue Culture; Using Technical Materials of Tissue Culture; Investigation Techniques of Tissue and Cell Culture; Peculiarity of Cel Culture Laboratory; Interactions of Cell; Cell and Human Interactions; Damaging for Tissue and Cell Culture; Some Special Solutions for Cell Culture; Serums for Cell Culture; Isolation of Tissue and Cell; Primer Cell Culture; Cell Lines; Keeping and Storing Cells; Investigation Techniques of Cultured Cells.		
<b>BiY606</b>	<b>Yeast Science</b>	<b>3+0 7.5</b>
Introduction and History of Yeast; History of Yeast Classification; The Architecture of Yeast Cell; Nutrition and Metabolism of Yeast; Nutritional Requirements; Regulation of Metabolism; Cell Biology of Yeast; Cell Growth and Division in Yeast; Cell Cycle; Sexual Reproduction in Yeast; Isolation and Identification of Yeast; Yeast Genetics and Genetic Manipulation; Yeasts in Industry.		
<b>BiY607</b>	<b>Oceanology</b>	<b>3+0 7.5</b>
Historical Development of Oceanology; Biological Oceanography: Classification of Marine Environment; Classification of Marine Organisms; Organic Matter Yields of Marines. Marine Resources and Their Benefits: Biological Resources; Chemical Resources; Geological Resources; Physical Resources. Chemical Oceanography; Physical Oceanography; Geological Oceanography; Some Subjects from Practical Biological Oceanography; Fouling and Boring Organisms; Main Tools Needed in Oceanographic Research.		

- BiY608**                    **Advanced Endocrinology**                    **3+0 7.5**  
Hormones; Description and Classification; Synthesis and Secretion of Hormones; the Effects Mechanisms of Hormones; Control of Hormonal System By Hypothalamus; Hormones of Pituitary Gland; Hormones of Thyroid; Hormones of Parathyroid Glands; Hormones of Pancreas; Hormones of Adrenal Glands; Hormones of Gonadal (Sexual) Glands and Hormones of Gastrointestinal Glands Will Be Taught.
- BiY609**                    **Parasite Plants**                    **3+0 7.5**  
Nutrition and Living Types among Plants: Symbiosis, Parasitism, Definition of Parasite Plant: Evolution of Parasite Plants, Parasite Plants, Semi-Parasite Plants, General Ecological Characteristics of Parasite Plants: Host Plant-Parasite Plant Relationship, Host Specificity of Parasite Plants, Adaptations in Parasite Plants, Classification of Parasite Plants: Some Parasite Plant Group in Turkey, Damages Caused by Parasite Plants.
- BiY611**                    **Genomics**                    **3+0 7.5**  
What is the Genome? Structure Prokaryotic and eukaryotic Genomes, Comparative Genome Sizes of Living things, Packing Stills of Genomes, Genomes of Organelles, Organization of Genes and the Rest of the Genome, Modifications of Genomes, Re-organizations of Genomes, DNA Technology and the Development of Genomics, Genomic Manipulations, Types and Formations of Genomic Libraries, Classic and High-Throughput DNA Sequencing Techniques, Ordering of Genomic DNA Sequences; Bioinformatics, Study of the Published Genomic Projects, the Use of the Produced Genomic Information: Comparative Genomics and Introduction to Proteomics, Influences of the Genomics on Other Sciences, Use and Construction of the DNA Chips and Nanotechnology, The possibility of Developing a High Through Put Machine That Will Evaluate the Genomic Information in Protein Level?
- BiY612**                    **Microbial Physiology**                    **3+0 7.5**  
Metabolic Reactions; Enzymes; Role of ATP and Synthesis of ATP; Oxidation and Reduction Reactions; Electron Transport System; Energy Conservation From Electron Transport; Aerobic Respiration; Anaerobic Respiration; Fermentation; Metabolic Diversity in Microorganisms; Photosynthesis; Oxygenic and Anoxygenic Photosynthesis; Chlorophyll and Bacteriochlorophyll; Nutrition and Sugar Metabolism.
- BiY613**                    **Modern Mycology**                    **3+0 7.5**  
Introduction: Define of Fungi; Growth Forms of Fungi; Activities of Fungi; Fungi in Biotechnology; the Major Taxonomic Groups of Fungi; Structure and Ultra Structure; Fungal Growth; Differentiation; Nutrition; Metabolism; Environmental Conditions for Growth; Genetics; Spores and their Structures; Spore Dormancy and Spore Dispersal; Fungal Decomposer Communities; Fungal Interactions; Fungi as Plant Parasites; Fungal Parasites of Humans; Insects and Nematodes; Prevention and Control of Fungal.
- BiY614**                    **Basic Bioinformatics**                    **3+0 7.5**  
Introduction To Bioinformatics; Basic Molecular Biology; The Evaluation of Nucleotide Sequencing Results; Gene Banks and Their Use; Genomic Databases and Their Use; Protein Expression Databases And Their Use; Cdna And Est Databases and Their Use; Working With Multiple DNA and Amino Acid Sequences By Alignment; Assembly And Phylogenetic Analyses; The Use Of Various Packet Bioinformatics Programs Such As Web Cutter, Primer Dizayn, Genetool, Petool, BLAST, Entrez, Webphylyp, Clustalx, Electronic PCR, Orffinder, and Homologene.
- BiY616**                    **Biogeography**                    **3+0 7.5**  
Physiological Reaction of the Living Things and Adaptation to Habitat; Factors Affecting Spread of the Living Things and Classification of Habitats; Principal Flora Regions of World and Classification of Floristic Unit; Plant Formations and Classes; Biogeography Ecological and Field Relationship; Biological Richness of Turkey; Ecological Comment on Near Geologic Periods.
- BiY617**                    **Cellular Signal Transduction Pathways**                    **3+0 7.5**  
Overview of Plants; Bacterial, Animal and Mammalian Signaling Mechanisms and their Origins; Basic Concepts of Cell Surface Receptors; Heptahelical Receptors and Heterotrimeric G Proteins; Receptor-G Protein-Adenylyl Cyclase Coupling; Protein Kinase A; Receptor-G Protein-Phospholipase C-Coupling; Synthesis of Polyphosphoinositides And heir Regulation; Protein Kinase C; Calcium Signaling Via Calmodulin; Growth Factor Receptor Protein Tyrosine Kinases; Ras Signalling; PI 3-Kinase And MAP Kinase Cascades; Cytokine Receptors and JAK/STAT Signaling, Receptor Ion Channels; Two Component Pathways In Prokaryotes.
- BiY618**                    **Phylogenetic Systematics**                    **3+0 7.5**  
The Position of Systematics Among the Biological Sciences; General Concepts of Systematics; The Phylogenetic System and Its Position Among the Possible and Necessary System in biology; Tasks and Methods of Taxonomy: Taxonomic Tasks in the Area of the Lower Categories; The species Category in the Time Dimension; The Species Concept and Paleontology, Taxonomic Tasks in the Area of the Higher Group Categories; The Methods of Phylogenetics: The concepts.

- BiY620 Forest Vegetation of Turkey 3+0 7.5**  
 Three Phytogeographical Areas of Turkey, Climates and Other Characteristics of these Three Areas of Turkey, Floristical and Syntaxonomic Analyses of Plant Associations Belong to Forest Vegetation Under the Influence of Climate; Main Rock; Soil and Biotic Factors Affected By Oceanic; Black Sea and Central Anatolia Region.
- BiY621 Advanced Molecular Genetics 3+0 7.5**  
 Heredity and the phenotype: An Introduction to Genetics, Mendelian an Genetics: The Molecular Basis of Heredity, DNA Structure and Analysis, Translation and proteins; Genomics: Chromosome structure and DNA sequence organization, Organization of Genes in Chromosomes; Genetics of organisms and populations, Developmental Genetics, Genetics and Behavior, Population Genetics
- BiY622 Soil Biology 3+0 7.5**  
 Soil ecosystem and properties; Soil organisms; Soil bacteria Actinomycetes, fungi, algae, lichens, viruses Soil fauna, protozoa, worms, pot worms, arthropods, vertebrates; Microbial interactions, competition; The opposite interaction, hunting, co-existence; Mutual benefit Enzyme properties and soil functions; Soil ecosystem development; Decomposition of soil; Organic matter and carbon cycle; Soil nitrogen cycle; Microbiological fertilizer and biocontrol; Soil phosphorus cycle; Soil sulfur cycle, Some trace elements; Microbial transformations
- BiY624 Use of Bioindicators in Environment 3+0 7.5**  
 Determination of Environmental Conditions by Using Plants and Animals: Which kind of organisms are useful for this purpose?; Physiological and Morphological Effects of Pollutants on Living Organisms: Changes on the distribution patterns of organisms due to environmental pollution, Some methods and their application on the determination of sulphurdioxide and heavy metal; Determination and Monitoring of Special Habitats of Living Organisms: Lichens and Algae.
- BiY625 Special Microscopic Techniques 3+0 7.5**  
 Introduction of High Technology Observation Tools For Biological Studies; Technical Preparation of Microscope, Special Fitness of Microscope; Using a Microscope and Study Principles; Preparation of Biological Materials For Fluorescence Microscope; Co focal Microscope and Scanning Microscope; Techniques of Single and Double Immunochemical Staining; Techniques of Biological Macro graphing; Using Special Microscopic Techniques for Observation And/Or Results; Techniques of Discussions For Microscopy.
- BiY626 Enviromental Microbiology 3+0 7.5**  
 Soil Microbiology and Environmental Microbiology Biogeochemical Cycles; Aquatic Microbiology; Air Microbiology; Microorganisms and some novel pollution problems; Xenobiotia molecule; Recalcitrant halocarbons; Poly chlorinateol biphenyl and dioxins; Synthetic polymers; Alkyl benzyl sulfonates; Oil pollution; Crude oil Biodegradation; Pesticides; Microbial Accumulation of Heavy Metals and Radio Nualides Bioremediation.
- BiY627 Ecophysiology 3+0 7.5**  
 Introduction; Ecological Factors and their Effects on Plants; Metabolism Physiology in Plants; Translocation in Plants; Biochemical Explanation of Photosynthesis and Respiration in Plants; Nutrition Methods in Plants; Growth; Growth Substances and Their Functions in Plants; Functions of Hormones During Seed Growth; Germination and Germination Types of Plant Seeds; Conditions of Seed Germination and Eliminating the Germination Obstacle; Seed Germination Properties of Economically Important Plants.
- BiY628 Genetic Regulation of Development 3+0 7.5**  
 Introduction; Differentiation and Proliferation: Regulation of cell cycle and related molecules; Genetic control of Nematode development: Control Genes And Cell Behavior; Genetic Control Of Drosophila Development: Regional differentiation during embryogenesis, Neurogenesis, Homologous of Drosophila in mammals; Neurogenesis in Mice; Myogenesis in Mammals: Transcription factors and their functions; Oncogenesis.
- BiY629 Molecular Taxonomy 3+0 7.5**  
 The Past and Future of Taxonomy; Methods of Systematic; Molecular Taxonomy; Molecular Systematic in Classification of Species; Partial Evolutionary Changes of Local Populations; Variation at DNA Level; Recognition With DNA (DNA Fingerprint); Satellite's DNA in Molecular Taxonomy; Sequences of Ribosomal RNA; Molecular Taxonomy Studies in Various Species.
- BiY630 Modern Methods in Plant Taxonomy 3+0 7.5**  
 Cytotaxonomy; Concept and Application Methods; Chemotaxonomy; Concept and Application Methods on the Different Plant Groups; Molecular Biological Methods in Plant Classification: Algae, Mosses and Vascular Plants; Numerical Methods in Taxonomy; Descriptions and Geometric Models; Grouping; Ordination and Discrimination Functions; Pyhlogenetic (Cladistic) Systematic; Introduction of Phylogenetic Methods and their Applications.

- BiY631 Ecological Economics 3+0 7.5**  
What is Ecological Economics?: Basic principles and concepts; The history of ecological economics; Analytic vision for ecological economics; Valuation and Decision-Making Process in Ecological Economics: Ecosystem services, their function and evaluations; Relationship Between Ecological Conservation and Economy; Sustainability in Nature: Indicators of sustainability; Carrying capacity; Human impacts on nature: Ecological footprint and its importance; Calculation; Consumption; Relationships Between Economic Development and Sustainability of Natural Sources: Ecological macroeconomics; Economics of resources; Cost-benefit analyses in nature; Environmental Economy; Environmental Politics; Environmental Planning.
- BiY632 Biochemistry of Cancerogens and Mutanges 3+0 7.5**  
Enzymatic Activation of Polycyclic Aromatic Hydrocarbons; Monoxygenases, Arylhydrocarbon Hydrolases, Cytochrome P-450 Mechanism, NADPH- Cytochrome P450 Reductase System; Epoxide Hydrolases; (Mechanisms, Inductions Etc.); Conjugation Enzymes; Glutathione-S Transferases; Sulfotransferases; UDP-Glucuronil Transferases, Conjugation Reactions; and Carcinogenity Relations; Nucleosid and Nucleotid Alkylating; Invitro Alkylating of Nucleic Acids; in Vivo Alchylation of Nucleic Acids; Bifunction; Alkylating Agents; Circular Alchylation Agents.
- BiY633 Economic Botany 3+0 7.5**  
Classification of Economic Botany; Nutritive Plants; Grain Plants; Vegetables; Plants With Edible Roots; Stems; Leafs; Fruits and Seeds; Plants Having Oil; Seeds Having Oil; Fruits; Fleshy Fruits; Baccate Fruits; Drupe Fruits; Aggregate Fruits; Dry Fruits; Plants That Contain Sugar; Starch and Oil; Flavoring Plants; the Stimulation Plants; Industrial Plants; Pharmacologic and Ornamental Plants.
- BiY634 Evolution of Microbial Pathogens 3+0 7.5**  
Origin of life and earth as a microbial habitat; General concepts of microbial evolution: Studying evolution using genome sequence data; Population dynamics of bacterial pathogens; Microbial adaptation; Pathogenicity islands and evolution; Evolution of microbial pathogens and environment; Evolution of soil pathogens; Evolution of bacterial toxins; Evolution of bacterial resistance; Evolution of enteric pathogens; Evolution of human fungal pathogens.
- BiY635 Characteristic Behaviour of Animal Groups 3+0 7.5**  
The Science of Behavior; Etholoji; Hereditary Behavior; Learned Behavior; Social Behavior; Nest-Building Behavior of Invertebrate Animals; Nest-Building and Mating Behavior of Pisces; Migration Behavior of Pisces; Characteristic Nest-Building Behavior of Birds; Dating Behavior of Birds; Characteristic Feeding Behavior of Birds; Community Behavior in Mammals.
- BiY636 Biochemistry of Free Radicals 3+0 7.5**  
Free Radicals and Reactive Oxygen; Super oxide Radicals; Peroxide Radicals; Biochemical Mechanisms of Free Radicals; Free Radical Enzymes; Glutathione Peroxides; Catalase; Glutathione Reductase; Glutathione-S-Transferase; Free Radicals and Cancer; Free Radicals and Antioxidant Defense Mechanism.
- BiY637 Aquatic Entomology 3+0 7.5**  
Classification of Aquatic Insects; Aquatic Insect Orders and Their Morphologic and Biologic Features: Collembolan; Ephemeroptera; Odonata; Plecoptera; Orthoptera; Hemiptera; Megaloptera; Neuroptera; Coleoptera; Diptera; Lepidoptera; Trichoptera; Hymenoptera; Define Methods of Aquatic Insects; Biological Features of Temporary and Permanent Water; Morphological and Physiological Adaptations of Aquatic Insects; Sampling Techniques; Economic and Ecologic Importance of Aquatic Insects.
- BiY638 Archaeobacteria 3+0 7.5**  
Cell Biology; Euryarchaeota; Extreme Hemophilic Archae, Archae Producing Methane; Thermoplasmates, Hyper thermopilic Euryarchaeota; Crenarchaeota; Habitat and Energy Metabolism; Sulfolobales and Thermoproteales, Desulfurococcales; Living in High Temperature; Isolation Methods of Archaeobacteria.
- BiY640 Basic Virology 3+0 7.5**  
Virology and Viral Diseases; General Properties of Viruses and Their Classification; The Virus Host; Quantification and Visualization of Viruses; Host Response to Viral Infection; Replicating and Measuring Biological Activities of Viruses; Characterization of viral genomes; Manipulation of viral genomes; Bacteriophages; Lytic viruses; Lysogeny and Phage Lambda; Animal viruses; Plant viruses; Viroids and Prions.
- BiY641 Soil Science 3+0 7.5**

Topics and Aim of Soil Science; Main Structure of Soil; Formation and Factors in This Matter; Rocks and Minerals Forming Soil; Decomposition Events Forming Soil; Physical Properties of Soil; Physicochemical Properties of Soil and Soil Organic Material; Chemical Properties of Soil; Biological Properties of Soil; Soil Yield; Main Soil Properties Affecting Yield.

**BiY642 Protein and Nucleic Acid Analysis Techniques 3+0 7.5**

Molecular analysis of nucleic acids, Restriction enzymes, Restriction and modification of nucleic acids, Marking and identifying nucleic acids, DNA sequence analyses, Micro-array and super-array techniques, Protein purification, Purification techniques, electrophoretic techniques, proteomix.

**BiY644 Intracellular Traffic 3+0 7.5**

Biosynthetic pathways; Transport of newly synthesized proteins; Vesicular and tubular clusters; Trans- golgi network (TGN); Secretory vesicles; Endocytic pathway; Endosomes and peroxisomes.

**BiY645 Biochemistry of Nucleic Acids 3+0 7.5**

Biological Functions of Nucleic Acids; Discovery of Nucleic Acids; and Biochemical Formation of Nucleic Acids; Isolation and Characterization of Nucleic Acids; Structures of RNA; Viral Nucleic Acids; Nuclease and their Relationship to Enzymes; Biosynthesis of Mononucleotides; Replication and Biosynthesis of DNA and Biosynthesis of RNA: Transcription; Translation (Biological Function of RNA to Produce Proteins); Catabolism of Nucleic Acids Will Be Taught.

**BiY646 Eutrophication in Lakes 3+0 7.5**

What is the Eutrophication?; Cultural Eutrophication; Natural Eutrophication; Sources of Nutrients; Prediction in Lake Eutrophication; Importance of Phosphorus as a Limiting Nutrient; General Effects of Eutrophication on the Aquatic Ecosystem and the Problems to Man Associated With These Effects; Community Interactions and Eutrophication; Controlling Eutrophication: Biological Control in Lakes; Chemical Control in Lake;s Mechanical Control in Lakes.

**BiY647 Human Biochemistry 3+0 7.5**

Constituents of Cells; Functions of These Chemicals; Proteins; Lipids; Carbohydrates; Nucleic Acids; Dissolved Materials; Membranes; Metabolism and It's Control Mechanism; Mitochondria; Bioenergetics; Thermodynamic; Electron Transport; Nucleus; Gene Expression; Plasma Membranes; Synthesis of Proteins; Surface of Cell; Transport; Specification of Cells; Jessel System; Digestion System; Nutrition; Digestion an Absorption; Function of Liver; Amino acid; Lipid and Carbohydrate Metabolisms; Hormonal System; Immune System; Immune Response; Preservation; Sensitivity; Cell System; Illness of Immune Systems; Nervous System and It's Properties; Structure of Nerve Cells; Chemical Flow; Illness of Nervous System.

**BiY648 Applied Mycology and Biotechnology 3+0 7.5**

Fungi; Applied Mycology and Biotechnology; Applied Mycology and Biotechnology for Agriculture; Applied Mycology and Biotechnology for Food; Filamentous Fungi Biotechnology; Fungal solid state fermentation; Fungal enzymes; Organic acids; Secondary metabolites; Yeast Biotechnology; Strain improvement in fungi; Detection of toxigenic molds.

**BiY649 Plant Genetic Resources 3+0 7.5**

Biodiversity; Its Disappearances and Importance; Conservation of Ecosystems; Factors Threatening Plants; Natural Factors; Artificial Factors; Plant Gene Resources; Its Importance; In-Situ (In Natural Habitats) Conservation; Ex-Situ (Out Of Natural Habitats) Conservation; Endemic Plants; Botanical Garden; Seed Banks; Plant Reproduction Techniques; Main Principles in Plant Growth.

**BiY651 Vegetation Research Methods 3+0 7.5**

Floristic Methods; Braun-Blanquet Method; Calculation of Contans Degree; Finding the Differential Species; Position of Plant Associations Which Sociological Units Were Not Described; Describing the Plant Species and Charasteric Plants; Importance of Alliance; Different Sampling Methods Using for Vegetation Studies; Statistical Methods; the Concept of Ecologic Group; the Nomenclature Code of Plant Association; Counting Methods for Environmental Vegetation Researc; Mapping Natural Environment and Vegetation.

**BiY652 Microbiyal Genomics 3+0 7.5**

What Is The Genome and Genomics - Principles of Genomic Molecular Structure; Role of Other Related Scientific Fields Such as Proteomics and Bioinformatics; Methods And Techniques Used In Genomics; Alternative Approaches In Genome Projects; Evaluation of Results From Genome Projects; Observation and Study of Microbial Projects Already Finished Such As E. Coli O157:H7, E.Coli K-12, Deinococcus Radiodurans, Enterococcus Faecalis and Bacillus Subtilus.

**BiY653 Advanced Molecular Biology 3+0 7.5**

Genes: Genes are DNA, The interrupted gene, The content of the genome, Clusters and repeats; Proteins: Messenger RNA, Protein synthesis, Using the genetic code, Protein localization; Gene expression: Transcription, The operon, Regulatory



circuits, Phage strategies, DNA: The replicon, DNA replication, Recombination and repair, Transposons, Retroviruses and retrotransposons, Rearrangement of DNA; The Nucleus: Chromosomes, Nucleosomes, Promoters and enhancers, Activating transcription, Controlling chromatin structure, RNA splicing and processing, Catalytic RNA, Immune diversity; Cells: Protein trafficking, Signal transduction, Cell cycle and growth regulation, Oncogenes and cancer, Gradients, Cascades, and signaling pathways.

**BiY654 Ecological Genetics 3+0 7.5**

Ecological Genetics: Why does ecological genetics work?; Markers and Sampling in Ecological Genetics: Methods of data generation, Principles of sampling, Within-population sampling, Among-population sampling, Power analysis; Genetic Diversity and Differentiation: Factors influencing diversity and differentiation, Use of genetic diversity statistics; Gene Flow and Mating System: Factors governing gene flow, The importance of biological and environmental factors on gene flow; Intraspecific Phylogenies and Phylogeography: Homology, gene trees, and species trees, Speciation and hybridization.

**BiY655 Natural Antimicrobial Agents and Food 3+0 7.5**

Introduction; Nisin; Bacteriocins; Natamycin; Organic Acids; Antimicrobials from Plants; Natural Antifungal Agents; New Food Additives.

**BiY656 Chemotaxonomy 3+0 7.5**

Importance of Taxonomy, Classification methods, Classic Taxonomic Methods, Taxonomic Characters, Biogenetic Classification of Plant Constituents, Classification Methods According to Chemical Constituents, Chemotaxonomy and Biochemical Systematics, Correlation between Chemo and Classic Taxonomy, Affinity of Chemotaxonomic Parameters with Systematics.

**BiY657 Food, Human Health and Probiotics 3+0 7.5**

Introduction to Probiotics and Prebiotics; Development of Probiotic Food Ingredients; Taxonomy and Biology of Probiotic; Primary Sources of Probiotic Cultures; Genetic Engineering of Probiotic Bacteria; Immunochemical Methods for Detection of Probiotics; Genetically Modified Probiotics; Use of Probiotics in Food; Probiotics as Biopreservatives for food; Probiotics in Cancer Prevention.

**BiY658 Cell Regulation 3+0 7.5**

Introduction; Cell Cycle and Function; Regulation of Cell Cycle and Function; Differentiation Mechanisms of Cell According to Their Structure and Function; Occurrence of Cell Types During Developmental Stage; Cell Death and Apoptosis.

**BiY659 Cancer Genetics 3+0 7.5**

The Genetic Bases of Cancer: Regulation of gene expression, Genetic controls of cell cycle, Tumor suppressor genes, Proto-oncogenes and oncogenes, Genes for metastasis, Genes related apoptosis; The Causes of Carcinogenesis: Epigenetic changes, The role of chromosome and gene mutations, Carcinogens, Inheritance of familial cancer; Cancer Cytogenetics; New Development and Approaches to Cancer Genetics.

**BiY660 Medical Genetics 3+0 7.5**

Introduction to Human Genetics; Genetic Mechanisms for Humans: Mendelian inheritance, Sex-linked inheritance, Gene linkage, Multiple allelic inheritance, Multifactor inheritance, Maternal inheritance; Chromosomal Disorders: Autosomal disorders, Gonosomal disorders; Single Gene Inheritance: Autosomal dominant and recessive gene diseases, X-linked diseases; Multifactorial Diseases; Investigation Methods of Medical Genetics: Cytogenetics and molecular analysis, Prenatal diagnosis; Genetic Counseling.

**BiY661 The Molecular Basis of Cell Differentiation 3+0 7.5**

Definition of Cells Differentiation; Fundamental Factors in Cell Differentiation; Growth Factors and Signal Molecules: Cell membrane receptors and proliferate response, Ligand receptor relations, Phosphorylation of growth factors; The Cell Differentiation in Early Embryonic Stage: The molecules involved in the Process of Development and Differentiation; Mechanism of Gene Activation in Cell Differentiation: The gene expression in differentiated cells, Constancy of the Genome in differentiated cells; Differentiation of Cancer Cells: Proto-Onco genes functions in development and cell differentiation, Biological effects of Oncogenesis in the process of transformation.

**BiY662 Basis of Molecular Evolution 3+0 7.5**

What is Molecular Evolution; Structure of Gene; Mutations and their Types; Dynamics of Genes in Populations: Mechanism of Evolution: Natural selection, Random genetic drift, Genetic polymorphism; the Neutral Mutations and Evolution; Evolutionary Changing in Nucleotide Sequences: Indirect estimation of the number of nucleotide substitutions, Rates and patterns of nucleotide substitution, Causes of variation in substitution rates; A Case of Positive Selection; Molecular Clocks; Molecular Phylogeny; Evolution by Gene Duplication; Evolution by Transposition; Genome Organization and Evolution.

**BiY663 Araneology 3+0 7.5**

Taxonomy and specification of Aranea: Morphology; Anatomoy: Endoskeleton, Exoskeleton; Biology of spiders, Ecological specifications; Metabolism; Digestion systems; Circulation systems; Respiration systems; Neural systems; Spider Webs: Structure and evolution; Locomotion and prey capture; Reproduction: Female and Male reproductive organs; Development; Venomous spiders: Venoms and effects.

**BiY664 Ecological Restoration 3+0 7.5**

Introduction to Ecological Restoration Concept: Philosophy of Ecological restoration; Concepts and themes in ecological restoration; Effective and Sustainable Use of Natural Sources: Waste management; Usage of water; Recycling of wastes; Productivity; Rehabilitation of Ecosystems by Using Natural Sources: Environmentally friendly green technologies and their applications; Phytoremediation; Basic concepts; Advantages and disadvantages; Wetlands: Importance and characteristics of wetlands; Constructed wetlands; Usage areas of constructed wetlands.

**BiY665 Advanced Biochemistry and Biochemical Techniques I 3+0 7.5**

Carbohydrates; Nucleic acids and water-soluble vitamin metabolisms; The structure of water-insoluble vitamins; Lipid biosynthesis; Carbohydrate biosynthesis; Clinical enzymology; Glycolysis; Glikolisiz; Hexoses degradation; Gluconeogenesis; Citric acid cycle; Regulation of the citric acid cycle; Roxidative phosphorylation; Regulation of oxidative phosphorylation; Lipid oxidation; Urea cycle; homogenization, centrifugation, separation techniques; Electrophoresis technique; Enzyme immunoassay measurement methods; Basic principles of flow cytometry; Foundations of spectrophotometry; Absorption laws; High-performance liquid chromatography; Imaging techniques.

**BiY666 Advanced Biochemistry and Biochemical Techniques II 3+0 7.5**

Interaction between proteins and ligands: Immune response and specialized regulatory properties of proteins; Molecular motors; Enzyme kinetics; Allosteric effect; Kinetic tests; Bioenergetics and anaplerotik reactions; Glioksilat cycle; Porphyrin synthesis and degradation of hemoglobin production; Glikoconjugates; Carbohydrate analysis; DNA methylation; Fosfotidilinozoits; Eikosoits; Synthesis of saturated fatty acids and unsaturated fatty acids; Cholesterol and other lipids are transported and degradation of purine and pyrimidine synthesis; Cholesterol; steroids and izoprenitlerin synthesis; Enzyme activities and purifying methods of measurement

**BiY667 Actinomycetes in Biotechnology 3+0 7.5**

Physiological Biochemical and morphological Properties of Actinomycetes; Genetic properties of Actinomycetes; Ecology of actinomycetes; Actinomycete Diversity; Isolation of Actinomycetes from Environmental Sources; Classification of Actinomycetes; Identification of Actinomycetes; Pathogenic Actinomycetes; Actinomycete Biotechnology; Actinomycetes and Lignin Degradation; Actinomycetes and their Antibiotics; Actinomycetes and enzymes.

**BiY668 Advanced Protein Biochemistry 3+0 7.5**

Amino Acids,Peptides and Proteins:Definition and classification,Polypeptides and proteins,Protein size, Composition and properties,Determination of primary structure;Protein Structure:Structure of peptide bonds, Secondary structure,Tertiary structure,Quaternary structure; Biological Functions of Proteins:Myoglobin, Hemoglobin,Cooperative binding,Sickle-cell anemia;Protein Purification:Homogenate preparation,Centrifugation, Dialysis,Chromatography applications,Electrophoresis; Enzymes:Naming of enzymes,Kinetic properties of enzymes, Characteristics of enzyme reactions,Enzyme inhibition, Coenzymes, Allosteric enzymes,Cellular regulation of enzymes, Abzymes, Ribozymes.

**BiY669 Biology of Lichenicolous Fungi 3+0 7.5**

What are lichenicolous fungi? Interactions of lichenicolous fungi with lichens; Saprotrophic interactions; Biotrophic and necrotrophic interactions; Gall forming lichenicolous fungi; Host specificity; The reasons for host specificity; The diversity of lichenicolous fungi; Important taxonomical characters for the identification of lichenicolous fungi; Classification of lichenicolous of fungi; Identification of lichenicolous fungi.

**BiY671 Statistical Analyses in Biology 3+0 7.5**

Introduction: Aim and scope, Importance and use of statistical analyses in biology, Basic concepts; Statistical Software: SPSS programme, SPSS menu, Methods of data entry into SPSS programme; Decision Making: Choosing appropriate analysis; Statistical Analyses; Descriptive Statistics; Some non-parametric tests: Chi-square test; Some Parametric tests: z and t tests, One and two way variance analyses (ANOVA), Covariance analysis (ANCOVA), Simple and multivariate linear regression and correlation analyses, Multivariate variance analysis (MANOVA), Cluster analysis, Discriminant Analysis; Interpretation of the results.

**BiY672 Advanced Biochemistry and Bioenergetics 3+0 7.5**

Biochemistry: Definition, Macromolecules; Enzymes: Classifications, Kinetic properties of enzyme reactions, Membranes, Membrane Transport: Chemistry of Different Reactions: Oxidation- reduction reactions, Group-transfer reactions, Hydrolysis reactions, Nonhydrolytic cleavage reactions, Isomeriation and rearrangement reactions, Bond formation

reactions using energy from ATP; Concepts of Bioenergetics: Standard free energy change, Measurement of  $\Delta G$ , ATP and phosphoanhydride bonds, Other reactive biomolecules for energy transfer.

**BiY673 Molecular Industrial Biotechnology 3+0 7.5**

Fermentation Technology; Commercial Production of Microorganism; Molecular Analysis and Amplification Techniques; Production of Gene Probes; The Expression of Foreign DNA in Bacteria; Yeast Cloning and Biotechnology; Cloning Genes in Eukaryotic Cell Lines; Biosensors; Protein Engineering; Vaccination and Gene Manipulation; Metagenomics in Biotechnology; Industrial Enzymes for Biopolymer Degradation.

**BiY674 Molecular Microbial Ecology Techniques 3+0 7.5**

Introduction to Molecular Microbial Ecology; Molecular Techniques in Microbial Ecology; Isolation of Nucleic Acids; DNA and RNA Extraction from Soil; Amplification; Polymerase Chain Reaction (PCR); Quantitative PCR of Environmental Samples; Detection of Microbial Nucleic Acids by Polymerase Chain Reaction in Aquatic Samples; Fluorescence In Situ Hybridization (FISH); Denaturing Gradient Gel Electrophoresis (DGGE); General overview.

**BiY675 Microbial Biofilms 3+0 7.5**

What is Biofilm?: Quorum sensing and microbial biofilms, Effect of quorum sensing on biofilm, Biofilms in disease, Tissue-related biofilm diseases, Chronic otitis media, Osteomyelitis, Biomedical implant-related infections, Oral biofilms, Ecological significance of plant-associated biofilms, Nutrient sources for biofilm formation, Biofilms in wastewater treatment systems, Biofilms in freshwater, Catalytic biofilms, Determination of biofilm formation in biofilm-forming microorganisms.

**BiY676 Comparative Animal Physiology 3+0 7.5**

Comparative Eco-physiology: Cellular approaches, The importance of water; Comparative Neurophysiology and Endocrinology: Nervous systems, Biological clock, Physiology of sense, Endocrine physiology; Comparative Muscle Physiology: Comparative Metabolic Physiology: Feeding and digestive physiology, Energy metabolism, Thermoregulation mechanisms; Comparative Cardio-Vascular Physiology: Vascular physiology in vertebrata and invertebrata; Comparative Urinary Systems: Water and salt physiology, Urinary physiology in invertebrata, Urinary physiology in vertebrata; Reproductive Physiology in Vertebrata and Invertebrata.

**BiY677 Fungal Systematic 3+0 7.5**

Introduction; History of Fungal Systematics; Categories; Nomenclature of Fungi: Naming of taxa, Some Rules of Nomenclature; Evolutionary Relationship of Fungi; Classification Systems in Fungi; Zoosporic Fungi; Chytridiomycota; Zygomycota; Ascomycota; Basidiomycota; Deuteromycota: Blastomycetes, Coelomycetes, Hyphomycetes; Fungi-related Studies in Turkey.

**BiY678 Significance of Plant Secondary Metabolites in Biotechnology 3+0 7.5**

Ecological Stress Factors: Biotic factors, Abiotic factors; Molecular Response Mechanisms in Stress Conditions: Homeostasis of Macromolecules and Ions; Synthesis of Protector Molecules; Generation Mechanisms of Reactive Oxygen Species; Plant Secondary Metabolites, Duties of Secondary Metabolites; Defense against Stress Conditions: Defense against herbivores, Defense against microorganisms; Metabolic and Advanced Ecological Functions; Usage of Secondary Metabolites: Secondary metabolites used as drug substances, as nutrition ingredients, as agricultural pesticide and as cosmetic products.

**BiY679 Food Mycology 3+0 7.5**

Culture Media and Isolation Methods Used in Food Mycology; Fungi in Food; Heat Resistant Fungi; Identification of Foodborne Fungi; Important Mycotoxins and Fungi Producing These Mycotoxins; Control of Foodborne Fungi: Cultural methods, Molecular methods; Control of Mycotoxins in Food: Analytical methods, ELISA applications, Fast methods; Limitations Related to Foodborne Fungi; Limitations Related to Mycotoxin Contamination in Food.

**BiY681 Enzyme Analyses and Activity Detection Methods 3+0 7.5**

Biochemical structure of enzymes: Enzyme nomenclature, Classification; Major principles of enzymatic analyses, Defining the initial velocity, Description of enzymatic activity and its measurement in a test tube; Activity measuring conditions, Internal and external factors that influence the enzymatic activity, Calculation of enzymatic activity, Units for measurement of enzymatic activity; Methods for detection and calculation of the specific activity; Fundamentals of enzyme kinetics: Factors influencing the enzyme kinetics, Types of enzyme kinetics, Detection methods for enzyme activity and inhibition; Enzyme activity measurement and calculating kinetic analyses: Detailed evaluation of kinetic analysis samples.

**BiY683 Advanced Cell Investigation Methods 3+0 7.5**

Techniques of investigation of a whole cell: Investigation with Fixation and Vital investigation, Cell cultures, Techniques used in analyses of cell components, Fractionating the cell on its Components, Homogenization Techniques; Cell

Visualization Methods; Recombinant DNA Technology and Fields of Application; Classical cell applications; Hybridization methods and investigation the cell on PCR.

**BiY684 (Eng) Fundamentals of Epigenetics 3+0 7.5**

Mechanisms of DNA methylation in mammals; Mechanisms of histone modifications; The epigenetics of non-coding RNA; Analysis of gene-specific DNA methylation; Methods for assessing genome-wide DNA methylation; Assessing epigenetic information; Epigenetics of eukaryotic organisms: Drosophila epigenetics, Mouse models of epigenetic inheritance, Metabolic regulation of DNA methylation in mammals; Stem cells and cellular differentiation; Epigenetics of X chromosome inactivation; Aging epigenetics; The effects of diet on epigenetic processes; Cancer epigenetics.

**BiY685 (Eng) Environmental Physiology of Animals 3+0 7.5**

Definition of ecophysiology; Fundamental mechanisms of ecophysiology: Water, ions, and osmotic physiology, Animal water balance, Osmoregulation and excretion, Metabolism and energy supply, Respiration and circulation metabolisms, Temperature and its effects, Nervous and muscle systems, Hormones and chemical control systems; Physiological adaptations in aquatic animals; Physiological adaptations in terrestrial animals; Physiological adaptations in parasitic animals; Effects of environmental stress on animal physiology: Physiological adaptations at the molecular and genome level.

**BiY692 Seminar 3+0 7.5**

**BiY703 Insect Physiology 3+0 7.5**

Introduction: Definition of insect physiology, History of insect physiology; Integument Morphology in Insects; Nutrition Physiology in Insects; Organ Systems in Insects: Neurophysiology, Muscle physiology, Morphology of digestive system and physiology, Intermediary Metabolism, Morphology of circulation system and its physiology, Chemical Composition of Hemocyte and Hemolymph; Respiratory physiology: Structure and Function of the Tracheae: Adipose tissue in insects, Hormonal system in insects.

**BiY703 (Eng) Insect Physiology 3+0 7.5**

Introduction: Definition of insect physiology, History of insect physiology; Integument Morphology in Insects; Nutrition Physiology in Insects; Organ Systems in Insects: Neurophysiology, Muscle physiology, Morphology of digestive system and physiology, Intermediary Metabolism, Morphology of circulation system and its physiology, Chemical Composition of Hemocyte and Hemolymph; Respiratory physiology: Structure and Function of the Tracheae: Adipose tissue in insects, Hormonal system in insects.

**BiY704 Fundamentals of Ecotoxicology 3+0 7.5**

Introduction to Ecotoxicology: Historic Need, Current Need, Goals; Major Classes of Contaminants: Inorganic Contaminants, Organic Contaminants, Radiation; Factors Influencing Bioaccumulation: Chemical Features Influencing Bioavailability, Biological Features Influencing Bioaccumulation; Molecular Effects and Biomarkers: Organic Compound Detoxification, Metallothioneins, Stress Proteins, Oxidative Stress and Antioxidant Response, DNA Modification, Enzyme Dysfunction and Substrate Pool Shifts; Cells, Tissues and Organs: General Cytotoxicity and Histopathology, Gene and Chromosome Damage, Cancer, Examples.

**BiY705 Insect Behavior 3+0 7.5**

Insect Anatomy and Morphology; Development of Insects; Species Diversity of Insects; His-tory of Insect Behaviour; Behaviour Diversity and Its Origin; Control of Behaviour; Pro-grammed and Integrated Behaviour; Spatial Alignment; Finding Food and Nutrition; Defense; Physical Communication; Chemical Communication; Mechanical Communication; Reproduc-tive Behaviour; Parental Behaviours and Social Life.

**BiY706 Advanced Bioimaging Techniques 3+0 7.5**

Light and Basic Principles of Microscopy: Electromagnetic and visible spectrum, Resolution, Magnification and visuaalization; Optical microscopy: Limiting factors, Bright field, Phase-contrast, Dark field and fluorescent microscopes, Recent developments in optical microscopy; Modern Fluorescent and Confocal Microscopy; Electron Microscopy (TEM, SEM); Atomic Force Microscope (AFM) and Super Resolution Microscopy (STED) Differences and Advantages; Microscopic Preparation Techniques; Microscopic Staining and Contrast Enhancement Techniques; Histochemistry and Immunohistochemistry.

**BiY707 Advanced Mycology 3+0 7.5**

Introduction; History of Mycology; Somatic Structure of Fungi: Hyphal structure of fungi, Special somatic structures; Lifestyles of Fungi: Fungi in bioluminescence; Number and Distribution of Fungi; Reproduction Types in Fungi: Sexual reproduction spores, Asexual reproduction spores; Sexual Availability of Fungi: Homothallic fungi, Heterothallic fungi; Relations of Fungi with Human: Some products derived from fungi, Mycotoxins, Toxic macrofungi; Fungiculture.

<b>BiY708</b>	<b>Advantages and Disadvantages of Cell Culture</b>	<b>3+0 7.5</b>
Cell Culture: Description of the cell culture, History of cell culture technology, Tissue culture; Main Types of Cell Cultures: Primary culture, Secondary cell culture; Cell Culture Laboratory Equipments: Basic equipment, Expanded equipment; Cell Culture Contamination: Some consequences of contamination, Major cell culture contaminants, Chemical contamination, Biological contamination, Cross contamination; Cell Culture Basics; Cell Lines; Media: Types of cell culture media; Advantages of Cell Cultures; Disadvantages of Cell Cultures.		
<b>BiY709</b>	<b>Soil Microfungi</b>	<b>3+0 7.5</b>
Isolation Methods of Soil Microfungi; Isolation of Heat Resistant Microfungi; Diagnosis of Microfungi with Traditional Methods: Culture media, Preparation, Identification and use of resources; Diagnosis of Microfungi with Molecular Methods: DNA isolation, Important gene regions and Amplification of gene regions, DNA sequence analysis, Evaluation of the sequence; Aspergillus; Penicillium; Fusarium; Rhizopus; Alternaria; Cladosporium.		
<b>BiY710</b>	<b>Advance Molecular Genetic Methods</b>	<b>4+0 7.5</b>
Methods of Nucleic Acid Labeling; DNA Isolation and Analysis Methods; RNA Isolation and Analysis Methods: Mirna Analysis Methods; Chromosome Staining and Analysis Methods; DNA Cloning Methods; Polymerase Chain Reaction (PCR) Methods; Methods of Obtaining Transgenic Organism; Genomic and Transcriptomics Study Methods: Microarray, Sequencing Methods; In Vitro Mutagenesis Method; Mutagenicity and Antimutagenicity Methods.		
<b>BiY711</b>	<b>Fauna of Turkey</b>	<b>3+0 7.5</b>
General Presentation of Turkey's Fauna, which is Considered One of the Richest Faunas in the World; Geological and Climatic Factors That Reveal the Abundance of Turkey's Fauna; Comparing Fauna of Turkey in Different Geological Eras and at Present: Endemic animals in Turkey and distribution of the endemic animals, The species which are endangered and extinct; International and National Projects and Agreements About the Fauna of Turkey; Conservation Activities for Biodiversity in Turkey.		
<b>BiY712</b>	<b>Research Methods In Zoology</b>	<b>3+0 7.5</b>
Description Methods to Wild Animals; Catching Methods of Vertebrata; Collection of Mammals: Types of traps, Swimming techniques and fixation, Skeleton extraction; Collection of Birds: Type of traps, Swimming techniques and fixation, Skeleton extraction; Collection of Fish, Amphibians and Reptilians; Type of Traps, Conservation Methods: Marking and monitoring methods of wild animals; Research Methods of Benthic Invertebrates: General characteristics of benthic invertebrates and sampling methods, Bentic invertebrates which are sensitive and tolerant to pollution, and identification methods.		
<b>BiY714</b>	<b>Animal Ecology</b>	<b>3+0 7.5</b>
Basic Principles of Animal Ecology: Ecological terms, Ecological research criteria; Ecological Factors: Abiotic factors, Biotic factors, Intraspecific factors, Sex and reproduction, Interspecific factors (Relationships between species); Principles on the Effects of Ecological Factors: Development temperature and thermal constant in animals; Classification of Ecosystems: Energy in ecosystems, Energy flow, Necessary substances for animals, Substance cycle; Population and Behavioral Ecology: Factors that effect population size; Ecophysiology: General homeostatic mechanisms in animals, Thermoregulation, Osmoregulation; Conservation Biology.		
<b>BiY716</b>	<b>Microfungus Identification Techniques</b>	<b>3+0 7.5</b>
<b>BiY790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>BiY890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>BiY890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>CAM513</b>	<b>Metallic Glasses</b>	<b>3+0 7.5</b>
Introduction; The Types of Metallic Glass Alloys, Structure of Metallic Glasses, Formation Theories of Metallic Glasses, Investigations on Behaviour and Properties of Non Crystalline Phases, Theoretical Mechanism of Deformation and Fracture, Effects of Crystallisation on the Mechanical Properties, General Application Fields of High Temperature Metallic Glasses.		

<b>CAM514</b>	<b>Chemical Durability of Glasses</b>	<b>3+0 7.5</b>
Definition and Importance of Chemical Durability; Chemical Endurance in Certain Corrosive Environments; Behaviour of Several Glass Systems in Different Environments; Factors Affecting Chemical Durability; Measuring Methods of Chemical Durability and Standard Tests; Improvement Method of Chemical Endurance; Highly Durable Commercial Glass Systems and Their Applications.		
<b>CAM515</b>	<b>Engineering Glasses</b>	<b>3+0 7.5</b>
Commercial Glass Systems; Soda-Lime-Silica Glasses; Borosilicate Glasses; Phosphate Based Glasses; Germanate Glasses; Chalcogenide Glasses; Metallic Glasses; Organic Glasses; Industrial Raw Materials Used in Glass Production and Their Properties; Glass Production; Certain Physical, Chemical, Mechanical and Optical Properties of Glasses; Glass Characterization Techniques; Technologically Important Glasses; Crystallization in Glass, Glass Ceramics and Their Applications		
<b>CAM601</b>	<b>Ionic Diffusion in Oxide Based Glasses</b>	<b>3+0 7.5</b>
Structure of Oxide Glasses; Investigation Methods for Glass Structure; Results of Experimental Studies; Diffusion Mechanisms in Glass; Chemical Diffusion; Impurity Diffusion; Activation Energy and Frequency Factor; Correlations Between Causes and Results.		
<b>CAM602</b>	<b>Glass Science and Technological Improvements</b>	<b>3+0 7.5</b>
Introduction; Lacks of Present Glass Systems and the Efforts on Their Eliminations; Latest Developments in the World of Technical Glasses; Interdisciplinary Relationships of Glasses with Other Materials and the Effects of Such an Interaction on Final Products; New Glass Production Processes; Precautions to be Taken for Cost Reduction; Relations Between Technology and Design; New Properties of Final Products and Their Characterisation; Environmental Consciousness and its Effect on the Production.		
<b>ÇEV501</b>	<b>Special Topics in Environmental Engineering I</b>	<b>3+0 7.5</b>
Current Subjects and Nationwide and Local Problems Will Be Covered in this Course.		
<b>ÇEV507</b>	<b>Biomoleculer Techniques in Water Treatment</b>	<b>3+0 7.5</b>
<b>ÇEV508</b>	<b>Microplastic Pollutants</b>	<b>3+0 7.5</b>
The Emergence of Plastics; The Contemporary History of Plastics; Plastic Production, Waste and Legislation; Physicochemical Properties and Degradation; Microplastics, Standardization and Spatial Distribution; The Interactions of Microplastics and Chemical Pollutants; The Biological Effects of Contaminated Microplastics; Microplastic Collection Techniques; Microplastic Separation Techniques; Microplastic Identification Techniques; Recent Studies on Microplastics; National R&D Capacity on Microplastics.		
<b>ÇEV510</b>	<b>Sustainable Waste Management and Circular Economy</b>	<b>3+0 7.5</b>
<b>ÇEV513</b>	<b>Antimicrobial Activity Protocols and Environmental Applications</b>	<b>3+0 7.5</b>
An Overview of the Antimicrobial Susceptibility Tests; Methods for Determining Bactericidal Activity and Antimicrobial Interactions: Synergy Testing, Time-Kill Curves, and Population Analysis; Molecular Methods for Bacterial Strain Typing; Antimicrobial Classification; Disk Diffusion Test and Gradient Methodologies; Macro and Microdilution Methods; Agar Dilution Test; Antifungal Susceptibility Testing of Yeasts; Antifungal Susceptibility Testing of Filamentous Fungi; Serum Bactericidal Test; Bioassay Methods for Antimicrobial and Antifungal Agents; Anaerobe Antimicrobial Susceptibility Testing.; Automated Systems.		
<b>ÇEV515</b>	<b>Sustainable Infrastructure Engineering</b>	<b>3+0 7.5</b>
Sustainability of Infrastructure: Evaluation of climate change and disaster resilience in a changing and transforming world; Global Standards For The Sustainability of Infrastructures, National and Local Practices; Planning, Designing, Building, Operating, Maintaining, and End-of-Life Recycling of Environmentally Responsible, Economically Feasible, and Socially Inclusive Infrastructures; Cost-Effective Engineering Solutions, and Evaluation Methods That Provide The Least Environmental Impact and The Most Social Benefit In Sustainable Infrastructures; Funding and Financial Resources For Sustainable Infrastructures		
<b>ÇEV517</b>	<b>Modeling of Air Pollution</b>	<b>3+0 7.5</b>

Atmospheric Physics and Atmospheric Chemistry; Air Pollution and Meteorological Events; Air Pollution Models; Mathematical Modeling; Meteorological Modeling; Eulerian Dispersion Models; Gaussian Models; Lagrangian Dispersion Models; Statistical Models; Utilization of Computer Software Related to Modeling and Case Problem Solutions.

**ÇEV523 Instrumental Analysis and Evaluation Methods in Environmental Engineering 3+0 7.5**

Terminology of Instrumental Analysis in Environmental Engineering; Unit Conversions and Computations; Basic Principles; Theory of the Working Principles of Basic and Frequently Used Instruments; Preparations Before Use: Sample preparation, Calibration, Working Data etc.; Post-assessment; Choosing the Best Analysis Method; Use of the Present Instruments and Practical Considerations.

**ÇEV524 Ecotoxicological Risks of Pollutants 3+0 7.5**

General Information About Ecotoxicology; Sources of the Pollutants Qualified as Toxic; Influence Mechanisms and the Ways of Take Into and Discharge From the Body; Determination of the Toxicity and Dose-Response Relations; Suggesting Threshold Values; Examples of Investigation on Ecotoxicology; Bioaccumulation and Bi magnification.

**ÇEV525 Biomonitoring and Techniques in Monitoring Environmental Quality 3+0 7.5**

General Descriptions of Factors that Affect Environmental Quality; Importance of Biomonitoring; Suitable Organisms and Their Features; Methods of Biomonitoring; Comparison of the Reliabilities of Biomonitoring Studies with Other Analysis; Case Studies on Biomonitoring.

**ÇEV526 Integrated Waste Management Economics 3+0 7.5**

The Selection and Application of Suitable Techniques; Technologies and Management Programs to Achieve Specific Waste Management Objectives; Cost-Benefit Analysis on the Selection of Some Disposal Alternatives; Life Cycle Inventory; Basic Environmental Effects on Sanitary Landfilling and Incineration and Their Economic Evaluation.

**ÇEV527 Advanced Solid Waste Management I 3+0 7.5**

Integrated Solid Waste Management: Solid Waste Generation, Separation at the Source and Storage, Solid Waste Collection Systems, Analysis of Collection Systems, Unit Operations Used for the Separation and Processing of Solid Wastes; Transfer and Transport of Solid Wastes: Types of Transfer Stations; Recycling Processes; Recycling / Recovery Systems; Biological and Chemical Conversion Technologies: Aerobic and Anaerobic Composting Processes and Technologies, Energy Recovery of Biological Conversion Processes.

**ÇEV528 Industrial Air Pollution and Control 3+0 7.5**

Planning Industrial Air Pollution Survey; Sources, Inventories, Emission Factors Field Sampling for Various Industrial Pollutants; Air Quality Monitoring Studies for Industrial Areas; Various Strategies Related to Industrial Pollution Control; Air Pollution Control at Combustion and Non-Combustion Emission Sources; Control of Fugitive Emissions; Control Technologies for Pollutants at Gaseous and Vapor Phase and Control Equipment Design; Control Technologies for Particulate Pollutants and Dust Collector Design; Control Costs; Economic Analysis.

**ÇEV530 Anaerobic Biotechnology for the Treatment of Wastes 3+0 7.5**

Basic Principles of Anaerobic Biotechnology; Advantages and Disadvantages of Anaerobic Biotechnology over Aerobic Biotechnology; Basic Process Microbiology; Kinetics and Stoichiometry of Anaerobic Reactions; Protocol of Anaerobic Treatability; Management Concepts; Basics of Process Design; Alkalinity; Nutrition and Trace Element Requirement; Toxicity and Microbiological Adaptation; Energy Production in Anaerobic Systems; Examples of Anaerobic Treatment of Industrial; Agricultural; Solid and Hazardous Wastes.

**ÇEV531 Statistical Analysis of Engineering Data 3+0 7.5**

Basic Statistical Concepts; Regression and Correlation Analysis; Analysis of Variance; Identification of the Method for Experimental Studies; Reduction of Experimental Errors During Experimental Data Collection; Determination of the Relations Between Parameters that Affect Experimental Results; Analysis in Experimental Design; t, f and  $\chi^2$  Tests; Establishing Mathematical Models; Testing of Hypothesis Related to Mathematical Modeling and Related Rules of Decision; Factorial Design and Applications Related to Engineering Topics; Computer Aided Data Analysis Systems and Data Evaluation; Utilization of Software in Data Analysis.

**ÇEV533 Nonpoint Source Pollution 3+0 7.5**

Point and Nonpoint Sources in Water Pollution: Definition of the nonpoint source pollution; Its characterization; Sources and Causes; Transport Routes of Pollutants from Diffuse Sources; Hydrological Aspects of Nonpoint Source Pollution; Erosion and Soil Loss; Nonpoint Source Pollution Management; Watershed Management; Pollution Control; Best Management Practices; Modeling of Nonpoint Source Pollution; Model Classification; Characteristics of the Models Used in Nonpoint Source Pollution Modeling and Their Comparison.

**ÇEV535 Groundwater Pollution and Treatment 3+0 7.5**

Formation of Groundwater; Introduction to Groundwater Geochemistry: Solution Equilibrium; Carbonate Chemistry; Weathering; Redox Processes; Origins and Scenarios of Groundwater Contamination; Pollutant Transport: Retardation of the Chemicals; Dispersion and Diffusion; Flushing and Aquifer Clean-Up; Physical/Chemical Interactions of Pollutants With Soil Matrix and Water; In-Situ and Ex-Situ Treatment Technologies.

**ÇEV536 Natural Treatment Systems 3+0 7.5**

Definition, Aim and Characteristics of Natural Treatment Systems; Types of Natural Treatment Systems; Wetlands: Natural Wetlands; Wetlands in Turkey and their Environmental Potentials; Constructed Wetlands; Surface Flow Systems; Subsurface Flow Systems; Aquatic Plants and Plant Selection; Fundamental Considerations in the Application of Natural Treatment Systems; Wastewater Characteristics; Treatment Mechanisms Applied; Public Health; Slow-Rate and Rapid Infiltration Systems; Design Principles of Natural Treatment Systems; Case Studies.

**ÇEV539 Life Cycle Assessment 3+0 7.5**

Life Cycle Assessment (LCA): Concept and history; LCA Methodology: Goal and scope, Definition, Inventory analysis, Impact assessment; LCA and ISO 14000 Relation; Life Cycle Analysis Softwares and Applications.

**ÇEV540 Modelling of Environmental Systems 3+0 7.5**

Modeling and General Principles; Characteristics of Natural Systems with Respect to Modeling; Modeling of Well-Mixed One-dimensional Systems; Advection and Dispersion; Modeling of One-dimensional Streams; Modeling of Two-dimensional Systems like Lakes and Oceans; Numerical Solutions; Presentation of the QUAL2E Model and Applications.

**ÇEV541 Water Treatment Technologies and Applications 3+0 7.5**

Selection of Process for Water Treatment; Factors influencing the choice, Evaluating process options, Examples of treatment process; Filter Media; Filter Bed and Materials; Flow Through Porous Media; Rapid/Slow Sand Filters; Specifications and Operations; Ion-exchange and Adsorption; Theory, Materials and Reactions, Adsorption Kinetics, Columns, Regeneration; Adsorption of Organic Compounds; GAC/PAC Adsorption Systems; Membrane Filters and Design; Chemical Oxidation; Use of Oxidants for Water Treatment and Applications.

**ÇEV542 Nitrogen and Phosphorus Removal from Municipal Wastewater 3+0 7.5**

Nitrogen Removal: Source of nitrogen in wastewater, Principles of nitrification and denitrification and options, Combined nitrification/denitrification systems; Physical/chemical nitrogen removal processes: Breakpoint chlorination, Air stripping of ammonia, Selective ion exchange; Phosphorus removal: Sources of phosphorus in wastewater, Principles of chemical phosphorus removal and options, Principles of biological phosphorus removal mechanisms; Affecting Factors and Systems.

**ÇEV543 Accreditation Process of Test Laboratories 3+0 7.5**

General Definitions in Accreditation Process; Fundamentals of TS EN ISO/IEC 17025: Short history of accreditation, Developments of accreditation, Comparison with ISO 9001-2000; Advantages of Accreditation; Scope of TS EN ISO/IEC 17025: Main scope, Reference standards and documents, Terms and definitions, Management conditions, Technical conditions; Accreditation Practices: Preparation of documents, Preparation of standard operation procedure (SOP), Uncertainties.

**ÇEV544 Metal Pollution and Environment 3+0 7.5**

Introduction to Metal Pollution: General evaluation of metal pollution, Definitions and topics; Metal Pollution in Water: Aquatic ecosystems, Toxic materials, Metal concentration in river, lake and ocean waters, Heavy metals in aquatic organisms; Metal Pollution in Soil and Sediment: Sources, Reasons, Accumulation, Pollution results; Metal Existence in Air: Causes and solutions, Cycle of elements; Relationship between metals and microorganisms: Metal extraction.

**ÇEV545 Advanced Microbial Ecology 3+0 7.5**

Introduction to Microbial Ecology: Microbial variety and definitions, Microorganism nutrition; Factors affecting microorganisms: Physical, Chemical, Biological Factors; Types of Microorganism Surroundings: Terrestrial and aquatic environments; Microbial Interaction: Competition, Succession, Antimicrobial materials; Microorganism Relations: Symbiotic relation, Interrelations between microorganisms, Other cooperations; Biogeochemical Cycles: Chemical element, Soil and petroleum formation; Pathogenic Organisms: Bacterial, viral, fungal diseases; Pollution Microbiology: Toxins, Aerosols, Metals, Radiation.

**ÇEV546 Advanced Treatment Techniques 3+0 7.5**

Electrochemical Engineering and Applications; Electrochemical Technologies and Water Pollution; Electrochemical Technologies and Air Pollution; Electrochemical Reactors and Electrodes Used in Pollution Control; Transfer Processes in Electrochemical Reactors; Performance Criteria for Electrochemical Reactors; Cost of Electrochemical Processes; Removal



of Organic Compounds by Electrochemical Methods; Removal and Recovery of Metals; Removal of Inorganic Compounds; Sterilization of Water and Wastes; Electrochemical Applications for Nuclear Wastes; Removal of Gaseous Pollutants and Electrochemical Methods for their Conversion to Useful Products.

**ÇEV547 Special Waste Management 3+0 7.5**

Terminology and Definitions; Principles of Waste Management; Electrical and Electronic Waste Management; Healthcare Waste Management; Waste Oil Management; Waste Vegetable Oil Management; Waste Batteries and Accumulators Management; Waste Tire Management; Excavation Soil, Construction and Demolition Waste Management; Nuclear Waste Management; Planning of Special Waste Programs: Using different decision making techniques; Case Studies.

**ÇEV549 Advanced Techniques in Hazardous Waste Management 3+0 7.5**

Principles of Hazardous Waste Management: General definitions, National and international legislations, Characterization and Monitoring of Contaminated Sites with Hazardous Wastes; Risk Management; Advanced Treatment and Disposal Methods: Soil vapor extraction, Distillation, Solvent extraction, Supercritical fluid extraction, Biological methods, Phytoremediation, Stabilization and solidification, Thermal methods; Case Study related to Hazardous Waste Treatment.

**ÇEV551 Industrial Processes and Pollution Prevention 3+0 7.5**

Pollution Control and Prevention Techniques in Industrial Processes: Pollution prevention and waste minimization concepts, Terminology, National and international legislation; Waste Minimization and Resource Conservation Based on Cleaner Production: Pollution prevention strategies, Physical, chemical, biological and thermal techniques; Life Cycle Assessment; Industrial Symbiosis: Industrial symbiosis concept and best available technologies, Eco-efficiency in industrial processes, Eco-industrial parks strategies; Case Studies on Pollution Prevention Techniques.

**ÇEV552 Contaminated Site Remediation 3+0 7.5**

**ÇEV553 Green Building Certification Programs and Applications 3+0 7.5**

Green Buildings: Basic concepts, History of green buildings; Green Building Certification Programs: Energy Star, BREEAM, LEED; LEED Certification Program: Structure of the program; Certification Rating Systems; Investigation of LEED Certified Buildings; Cost of Green Buildings; LEED for New Construction; LEED for Existing Buildings; Green Building Application for New or Existing Buildings.

**ÇEV555 Different Decision Making Techniques in Environmental Management 3+0 7.5**

Decision Making Problems: Decision components, Basic concepts and definitions; Multi-Criteria Decision Making: MCDM components, MCDM problem types, MCDM methodology; Evaluation Methods for MCDM Problems; Analytical Hierarchy Process; Analytical Network Process; ELECTRE Method; PROMETHEE Method; Linear and Nonlinear Programming; Application of Different Decision Making Methods; Software on Waste Management and Energy Management.

**ÇEV557 Scientific Research Processes 3+0 7.5**

Scientific Concepts; Student-Advisor Communication; Building Research Questions/Hypothesis and Development; Information Needs and Sources; Approaches for Precision Searching; Academic Database ve Fair Use; Thinking Critically About Information Sources; Ethical Use of Sources and Plagiarism - Applications on Turnitin or Ithenticate Programs; Time Management in Research Processes; Scientific Activities and Products: Congress, Symposium, Workshop, Project, Article, Poster, Presentation; Different Applications in Data Processing-Sigmaplot; Different Applications in Presenting Results-Prezi; Different Applications in the Processing of Bibliography-Endnote.

**ÇEV559 Environmental Biogeochemistry 3+0 7.5**

Basic Concepts of Biogeochemistry: Beginning of life, Formation of soil, Chemical structure of water resources; Environmental Biogeochemistry: Biogeochemical Processes in Terrestrial and Aquatic Ecosystems, Interaction between seasonal and regional variations of biogeochemical cycles, Interactions with anthropogenic environmental perturbations and biological biogeochemical cycles, Effects of natural processes and perturbations on the behavior and bioavailability of pollutants; The role of biogeochemistry in environmental management concepts and tools: Ecosystem services, Environmental matrices, Biogeochemistry in EU Directives and Turkish environmental legislation.

**ÇEV561 Small Scale Drinking and Potable Water Treatment 3+0 7.5**

**ÇEV592 Seminar 3+0 7.5**

- ÇEV601 Special Topics in Environmental Engineering II 3+0 7.5**  
Current Subjects and Nationwide and Local Problems Will Be Covered in This Course.
- ÇEV604 Environmental Organic Chemistry 3+0 7.5**  
Basic Concepts of Organic Chemistry; Classification of Chemicals; Solid / Liquid / Gas Phase Equilibrium Partitioning; Molecular interaction and thermodynamics, Vapor pressure, Activity and solubility, Partitioning between air / water and organic solvent, Organic liquid-water partitioning, Organic acids and bases, Sorption processes; Transformation Processes: Abiotic Processes, Hydrolysis, Redox, Photochemical; Biotic Transformation Processes; Transport Processes: Advection, Diffusion; Receptor Modeling; Recent Studies on Synthetic Organic Pollutants.
- ÇEV609 Engineering for Sustainable Environment 3+0 7.5**
- ÇEV610 Industrial Environmental Quality Management 3+0 7.5**  
Management of Air and Water Quality; Solid Wastes; Hazardous and Toxic Wastes at Industrial Facilities; Industrial Hygiene and Risk Management; Quality of Work Environment at Industrial Facilities and its Effect on the Health of Workers; Worker Health-Worker Safety Procedures; Environmental Impact Assessment (EIA) Studies; Environmental Quality Management Systems (EQMS) - ISO 14000 Applications; Legislation and Standards Related to Conservation of Environmental Quality; Quality Monitoring and Evaluation Studies; Procedures Applied in Impact Assessment and Regulation; Studies Toward Conservation and Improvement of Environmental Quality.
- ÇEV611 Risk Assessment for Environmental Health 3+0 7.5**  
Introduction to Risk Assessment: Risk, Defining environmental risks; Elements of Risk Assessment: Hazard assessment, Dose-response assessment, Exposure assessment, Exposure routes, Ways of exposure, Risk characterization; Contaminant-specific Conditions: Risk assessment for carcinogens, Risk assessment for noncarcinogens; Limitations of Risk Assessments: Sources of uncertainties, Dealing with uncertainties; Risk Communication; Case Studies in Environmental Health Risk Assessment.
- ÇEV612 Transfer Mechanisms of Incineration Processes 3+0 7.5**  
Design and Engineering Principles of Incineration Processes; Destruction and Removal Efficiency; Excess Air, Temperature and Turbulence Effects on Flow Regime; Steady-State Mass and Heat Transfer; Combustion and Chemical Kinetics.
- ÇEV614 Advanced Solid Waste Management II 3+0 7.5**  
Thermal Conversion Technologies: Fundamentals of Thermal Processing, Combustion Systems, Pyrolysis Systems, Gasification Systems; Environmental Control Systems; Air Pollution Control, Water Pollution Control, Ash Disposal; Energy Recovery Systems; Sanitary Landfills: Landfill Siting Considerations, Landfill Design, Control of Leachate, Energy Recovery Processes of Landfill Gas; Restoration and Rehabilitation of Landfills.
- ÇEV616 Advanced Disinfection Techniques 3+0 7.5**  
Investigation of Disinfection and Sterilization in the Laboratory; Various Methods: Filtration; Interilization; Sterilization; Tyndalization; Sterilization With Chemical Addition; General Disinfection And Affecting Factors; Type of Disinfectant; Type of Microorganism; Disinfection Duration; Ultraviolet Radiation; Fluorine; Chlorine; Hypochlorite; Alcohols; Techniques Based on Photoactivation; Electrochemical Disinfection; Disinfection With Electrooxidation; Bacteria Removal by Electroadsorption; Disinfection With Electrocoagulation; Disinfection With Ultrasound.
- ÇEV617 Thermal Conversion Technologies 3+0 7.5**  
Fundamentals of Thermal Processing: Stoichiometric Combustion, Excess Air Combustion, Heat released from combustion; Materials and Heat Balance for the Combustion of Solid Waste; Combustion Systems: Types of combustion systems; Heat Recovery Systems; Pyrolysis Systems; Gasification Systems: Description of the gasification process, Gasifier Types; Environmental Control Systems; Energy Recovery Systems: Flow diagrams.
- ÇEV619 Environment Quality Development Plans 3+0 7.5**  
Pollution Prevention Concept; Properties and Fates of Environmental Contaminants: Organic chemicals, Metals, Contaminant transport and transformation processes; Industrial Activities and Environment: Air pollution, Solid wastes, Hazardous wastes, Water pollution, Energy usage; Resource depletion; Improved Manufacturing Operations: Process development and design; Pollution Prevention Economics: Organizing the program, Preliminary assessments, Plan development; Reclamation Technologies: Environmental Management Systems; Environmental Audit Mechanisms.
- ÇEV620 Transport and Fate of Pollutants in Water Systems 3+0 7.5**

Fundamentals of Pollutant Transport in Water Systems (Streams, Lakes, Marine Environment); One-dimensional and Two-dimensional Transport; Continuity and Momentum Equations; Diffusion and Dispersion of Pollutants; Analytical and Numerical Solutions; Behavior of Pollutants in Water Systems; Conservative and Nonconservative Behavior; Degradation Reactions (Hydrolysis, Photolysis, Biodegradation); Other Mechanisms (Volatilization, Settling).

**ÇEV621                      Advanced Techniques for Atmospheric Analyses                      3+0   7.5**

Atmospheric pollutants, organic and inorganic pollutants present in liquid, solid and gaseous phases in the atmosphere. Pre-treatment procedures for the atmospheric samples and advanced techniques applied for the extraction of samples. Analytical techniques such as GC, GC-MS, LC, LC-MS for the determination of organic pollutants and their working principles, calibrations; Analytical techniques such as UV-VIS, AAS, GFAAS, ICP, ICP-MS for the determination of inorganic pollutants and their working principles, calibrations; Qualitative and quantitative instrumental analysis; standard reference materials, accuracy and precision calculations in quality control analysis.

**ÇEV623                      Global Warming Parameters and Control Techniques                      3+0   7.5**

Cause-Effect Relations for Global Warming/Cooling and Different Views; Historical Earth-Temperature Profile; Greenhouse Effect and the Greenhouse Agents; Global Climate Systems; Natural Radiative Energy Interactions; Earth Energy Balance; Equivalent Carbon Dioxide Concentration and Earth Carbon Balance; Deforestation Issues; Relationships between Population and Economic Growth, Global Energy, Temperature and Carbon Cycle, and the Related Models; New Technology Designs and Principals for Controlling Global Temperature Changes; International Economic Allocation Models such as Carbon Tax, etc. for the Contributors of Global Warming Agents; Forecasting Capabilities of the Models and Evaluation of Scenario-Based Data for the Future; International Protocols.

**ÇEV624                      Atmospheric Chemistry                      3+0   7.5**

Introduction: Description of atmosphere, Composition of air, Solar radiation, Importance of atmospheric reactions; Atmospheric trace compounds: sulfur-containing compounds, nitrogen-containing compounds, halogen-containing compounds; Atmospheric ozone; particulate matter: Stratospheric aerosols, tropospheric aerosols, carbonaceous particulates, mineral dust; Overview of stratospheric chemistry: Chapman reactions, nitrogen oxide cycle, ozone; Overview of tropospheric chemistry: Photochemical cycles of NO<sub>2</sub>, NO and Ozone, Chemistry of methane, Tropospheric ozone budget, Chemistry of nonmethane organic compounds, chemistry of biogenic hydrocarbons; Acid rain: Formation and fate of inorganic and organic acids in the troposphere.

**ÇEV625                      Integrated Natural Resource Management                      3+0   7.5**

Description of Natural Resource; Fading and Inexhaustible Natural Resources; Importance of Natural Resource; Concept of Management; Biotic and Abiotic Resources Management; Sustainable Living; Sustainable Ecosystems; Threat Factors for Natural Resource; Integrated Natural Resource Management Principles and Tools; Variable-Sized Analysis and Methods; Resource Management Practices in Different Areas.

**ÇEV626                      Nanotechnology Applications in Water and Wastewater Treatment                      3+0   7.5**

Relation Between Nano Materials and Water and Wastewater treatment; Present and Prospective Applications of Nanotechnology in Water and Wastewater Treatment; Adsorption Applications in Drinking and Wastewater in Nanotechnology; Nanotechnological Membrane Preparation and Their Application Processes in Water and Wastewater Treatment; Nanotechnology Applications in Water and Wastewater Treatment for Disinfection; Nanosensors in Water and Wastewater Treatment.

**ÇEV627                      Environmental Biotechnology                      3+0   7.5**

Introduction to Environmental Biotechnology: General definitions and notions; Chemical Microbiology: Chemical components and function of cell, General biochemical reaction mechanisms; Biokinetics: Reaction kinetics and biokinetic levels; Treatment Microbiology: Biological treatment processes; Bioreactors; Nutrient Removal: Nitrogen removal, Phosphorus removal; Production of Biofuel: Bioethanol production, Biogas production; Bioremediation; Current literature surveys about environmental biotechnology

**ÇEV629                      Biodiversity and Protected                      3+0   7.5**

Description of Biodiversity: Genetic diversity, Species diversity, Ecosystem diversity, Processing diversity; Importance of Biodiversity; Loss of Biodiversity; Protection of Biodiversity: Protection efforts and methods, National and international responsibilities, Protected areas, Conventions; Threat to Biodiversity; Turkey's Biodiversity; Methods for Sustainable Use for Biological Resources.

**ÇEV631                      Electrochemical Water and Wastewater Treatment                      3+0   7.5**

Basic Concepts in Electrochemistry; Electrocoagulation: reactions, electrode materials, electro-Fenton methods, applications in water and wastewater treatment, an experiment in the lab.; Electrochemical oxidation(EO): indirect EO, direct EO, electrode materials, electrochemical oxidation of organic compounds, electrochemical oxidation of inorganic compounds, electrochemical disinfection, applications in water and wastewater treatments, an experiment in the lab.;

Electrochemical Reduction: electrochemical reduction of metals, electrochemical reduction of inorganic and organic nitrogen compounds; Electroflotation: principles; Electrodialysis: principles, main calculat.

**ÇEV633 Biological Treatment Of Industrial Wastes 3+0 7.5**  
 Industrial Wastes Definition and Types of Industrial Wastes; Existing Pollutants in Industrial Wastes: Heavy metals, Pesticides, Polycyclic aromatic hydrocarbons, Chlorinated hydrocarbons, Petroleum hydrocarbons, Detergents, Antibiotics, Dyes, Oils, Xenobiotic compounds, Polymers, Explosives; Biological Treatment Definition and Types of Biological Treatment; Biological Treatment Strategies: In-situ biological treatment, Ex-situ biological treatment; Biological Treatment Application Methods: Bacterial biological treatment, Mycoremediation, Phytoremediation, Nanobiotechnology, Biosensors.

**ÇEV692 Seminar 3+0 7.5**

**ÇEV790 Thesis 0+1 30.0**

**ÇEV890 Thesis 0+1 30.0**

**ÇEV890-0 Thesis (Thesis Proposal) 0+1 30.0**

**ÇYÖ501 Domestic Wastewater Management 3+0 7.5**  
 Domestic Wastewater Management: Centralized / Decentralized Wastewater Management; Wastewater Quantity and Characteristics: Wastewater flow characteristics, Calculation of flowrates, Wastewater characteristics, Grey water; Decentralized Wastewater Management Systems: Cesspool, Septic tank, Imhoff tank, Sand filters; Decentralized Wastewater Management Systems: Screens, Grit chamber, Settling tanks, Activated sludge, Disinfection.

**ÇYÖ502 Hazardous Waste Engineering and Management by Decision Making 3+0 7.5**  
 Definition of Hazardous Waste Engineering and Management; Legal Status Related to Hazardous Wastes; Classification and Characterization of Hazardous Wastes; Hazardous Waste Transport Mechanism; Risk Analysis of Contaminated Sites with Hazardous Wastes; Pollution Prevention and Waste Minimization Approach in Hazardous Wastes; Transportation of Hazardous Wastes; Physical, Chemical and Biological Treatment Methods; Thermal Methods; Construction, Operation and Closure of Hazardous Waste Landfills; Healthcare Medical Waste Management and Case Study; Multi Criteria Decision Making; Benefit/Opportunity/Cost/Risk Analysis; Planning of Hazardous Waste Management by Decision Making Techniques.

**ÇYÖ503 Legislation on Environmental Issues I 3+0 7.5**  
 Environmental Legislation and its Purpose; Water Pollution Control Directive; Announcement of Notification for Administrative Procedures, Announcement of Notification for Sampling and Analysis Methods, Municipal Wastewater Treatment Directive, Announcement of Notification for Sensitive and Less Sensitive Water Areas, Announcement of Notification for of Wastewater Treatment Plans Technical Procedures for Wastewater Treatment Plants, Quality Directive of Swimming Pool Water, Announcements Notifications and Circulars Related to Aall Ssubjected Ddirectives, Notices and dData Fflow Rrelated to lRegulationsegal devising.

**ÇYÖ504 Legislation on Environmental Issues II 3+0 7.5**  
 Legislation on Wastes; Regulation on the Waste Management Directive; Regulation Directive on the Control of Packaging Wastes; Regulation Directive on the Waste Incineration; Regulation Directive on Landfills; Directive on the Control of Waste Electric and Electronic Devices; Regulation Directive on the Control of Batteries and Accumulators Control; Regulation Directive on the Control of Waste Oil and Waste Vegetable Oil; Regulation Directive on the End-of-Life Tires; Regulation Directive on the Control of PCB and PCT Wastes; Regulation Directive on the Control of Healthcare Medical Wastes; All Notifications and Circulars are related by Related to These Regulations Directives; Licensing Procedures for Waste Management; Data Processing on the Legislation.

**ÇYÖ505 Bioenergy Production 3+0 7.5**  
 Overview of Bioenergy Generation Production: Definition, Principles and limitations; Process Microbiology: Environmental factors; Kinetics and Modeling: Basic elements, Modeling of energy generation production; Anaerobic Reactor Configurations for Bioenergy Production: Classification of anaerobic bioreactors; Molecular Techniques: Fundamentals of molecular techniques; Bioenergy Recovery from Sulfate-Rich Waste Streams: Sulfate-reducing bacteria; Bioenergy

Generation Production from Residues of Biofuel Industries; Biohydrogen Production: Biological hydrogen production, Dark fermentation; Microbial Fuel Cell: Evaluation of MFC performance and design; Biogas Processing: Biogas production.

**ÇYÖ506                      Quality Management System Approach in Testing Laboratories                      3+0    7.5**

Concept of Quality Concepts: Total quality management, Standard and standardization; TS EN ISO/IEC 17025 Standard: History, Benefits; Concept of Accreditation Concept: Accreditation steps, International scale; Accreditation System Setup for aA Laboratory: Scope, Reference to standards, Terms and descriptions; Management Requirements: Points to consider in management requirements; Technical Requirements: Points to consider in technical requirements; Internal and External Quality Control: Audits, Quality control cards, Conformity tests.

**ÇYÖ507                      Industrial Wastewater Control                      3+0    7.5**

Selection of Treatment Process: Analysis of production process, Waste characterization, Determination of candidate technologies, Economic analysis; Industrial Wastewater Properties: Priority pollutants, Metals, Colours, Phosphorus-containing compounds, Nitrogen-containing compounds, Other pollutants, Pollution Prevention: General approach, Benefits of preventing pollution, Reducing pollution, Pollution prevention benefits, Recycling, Re-use, Industrial wastewater treatment methods: Equalization, Chemical methods, Biological Methods.

**ÇYÖ508                      Drinking Water Quality and Control                      3+0    7.5**

Quality of Drinking Water:, Drinking water standards:, Problems Rrelated with to Wwater Ssources and Ssuggested solutions:, Water sources, Selection of water sources and classification, Diseases can that can be transmitted infected with wwater:, Unit Basic Operations aAnd Processes Applied iin Water Treatment:, Aeration, Rapid mixing-slow mixing, Sedimentation, Softening, and Ffiltration systems, Disinfection:, Problems Rrelated with Wwater Ddistribution Networkssystem and Plpumping Ssystem.

**ÇYÖ509                      Sustainable Practices in Agriculture and Environment                      3+0    7.5**

The concept of environment; The reasons for the emergence of environmental problems; climate, food and water resources; agricultural methods; sustainable, organic, traditional agriculture; Agricultural environmental policies in Turkey. Agriculture and Chemical fertilizers: Nitrogen and phosphorus fertilizers; Pollutant sources: Soil and water pollution; Agriculture and gas emissions, Agricultural mechanization and its environmental effects; Environmental effects of industrial livestock methods; Agriculture and erosion; Pesticide pollution: Behavior of pesticides in the environment; Heavy metal accumulation; Incorrect watering; green farming; European Green Consensus, Impact of climate change on agriculture; Other agricultural applications.

**ÇYÖ510                      Determining the Environmental Performance of Products and Processes                      3+0    7.5**

Environmental Performance Determination Methods: Eco-labels, Environmental Product Declarations (EPD), Life Cycle Assessment (LCA), Life Cyle Cost Analysis (LCC); LCA Concept and Methodology: Definitions of gGoal and scope definition, Inventory analysis, Impact assessment, Interpretation; LCA Software Tools: Sample LCA studiesy; Criteria Used for Determining the Environmental Performance of Products; Global Warming, Ozone depletion, Photochemical ozone formation, Acidification, Eutrathpication, Ecotoxicity, Human toxicity.

**ÇYÖ512                      Indoor Air Quality Measurement                      3+0    7.5**

Importance Factors of Indoor Air Quality; Indoor Air Pollutants and tTheir Sources; Comfort Parameters Affecting Indoor Air Quality and Their Relations with tThe Pollutants; Indoor Air Quality Measurement and Sampling Methods: Equipments and techniques for measurement and sampling studies, Extraction and analysis methods after sampling; Effects of Poor Air Quality and Sick Building Syndrome.

**ÇYÖ514                      Urban Air Quality Management                      3+0    7.5**

Factors Effecting Air Quality in Urban Settlements; Components of an Air Quality Management System; Clean Air Action Plans (CAAP): Turkish legislation on preparation of CAAPS, Developing an action plan, Determination of air quality in cities, Monitoring the air pollution, Source characterization, Emission inventories and modeling, Exposure assessment and effects on health effects, Geographical Iinformation Ssystem applications; Air Pollution Abatement Measures: Strategies to reduce air pollution from due to residential heating, Strategies for traffic related air pollution, Strategies for industrial air pollution; Case Studies of Urban Air Quality Management From in Mega-Cities.

**ÇYÖ515                      Global Climate Change and Natural/Meteorological Disasters                      3+0    7.5**

**ÇYÖ516                      Ecosystem Ecology                      3+0    7.5**

Concept of Ecosystem: Biological structure, Basic concepts of ecology; Biosphere and Ecosystem: Food chains, Trophic levels, Energy flow, Biogeochemical cycles, Ecological competition; Ecological Factors: Biotic factors, Abiotic factors,



estimation; Kalman filters; Wiener filters. Random variables: Introduction to concepts; Probability distribution functions; Probability density functions; Joint probability functions; Functions with random variables; Solutions of function sets; Averages: Expected values of random variables; Conditional expected values; Moments; Chebyshev and Schwarz inequalities; Moment generating functions; Chernoff bounds; Characteristic functions; Vector random variables, joint distributions and densities, means of random vectors, covariance matrices, diagonalization of covariance matrices; Decision and estimation theory: Parameter estimation; means and covariance matrices of random vectors; Random sequences: Linear systems and random sequences; Large number theory; Stochastic processes: Important stochastic processes; Random input linear systems; Classification of random processes; Mean square calculus: Continuity and derivatives; Stochastic integrals; Stochastic differential equations; Ergodicity; Karhunen-Loeve expansion; Stationary processes and sequences: White noise; Stationary processes and linear systems; Wide sense stationarity; Vector processes; State equations; Estimation theory: Orthogonality and linear estimation; Kalman filters; Wiener filters.

**EEM507 (Eng) Integrated Optical Waveguides 3+0 7.5**

Wave Equation; Boundary Conditions for Dielectric Interfaces; Reflection and Phase Shift; Electromagnetic Analysis of the Planar Waveguide: Eigenvalues for the slab waveguide, Guided modes in a waveguide; Dispersion in Waveguides; Wave Equation for Optical Fibers; Power Confinement in a Step-index Fiber; Attenuation and Nonlinear Effects in Waveguides; Wave Equation Analysis of a Rectangular Waveguide; Perturbation Approach and Effective Index Method; Beam Propagation Method for Analyzing Optical Waveguides; Coupled Mode Theory; Device Simulations Using Beam Propagation Method.

**EEM508 (Eng) Reliability Analysis in Power System 3+0 7.5**

Introduction, reliability definitions, historical development and reliability-cost analysis, Basic probability theory, Component reliability functions, Failure rate models and function and parameter estimation from available past data, System reliability evaluation, Time dependent reliability evaluations for mission-oriented systems, Continuous Markov Chains, Limiting state probability evaluations, frequency and duration, Approximate reliability calculations, Electric power generation and transmission system reliability assessment, Electric power distribution system reliability assessment, Monte-Carlo Simulations.

**EEM509 (Eng) Radio Frequency and Microwave Circuits 3+0 7.5**

Transmission Lines and Smith Chart; Resonators; Impedance Matching Networks; Scattering Parameters; Passive Microwave Devices: Filters, Splitters, Couplers, Isolators, Hybrids; Transistor Amplifiers and Oscillators; Phase Locked Loops (PLLs), Mixers and Detectors; Noise, Distortion and non-linearity calculations for communications systems; Computer Aided Design (CAD) Tools.

**EEM510 (Eng) Machine Learning for Dynamical Systems and Control 3+0 7.5**

Fundamental Concepts: Regression and Model Selection, Clustering and Classification, Neural Networks and Deep Learning; Data-Driven Dynamical Systems: Overview, Dynamic Mode Decomposition, Sparse Identification of Nonlinear Dynamics, Koopman Operator Theory, Data Driven Koopman Analysis; Data Driven Control: Model Predictive Control, Nonlinear System Identification for control, Machine Learning Control; Physics Informed Machine Learning: SINDY Autoencoder-Coordinates and Dynamics, Koopman Forecasting, Physics Informed Machine Learning.

**EEM511 (Eng) Introduction to Machine Learning 3+0 7.5**

Linear and Polynomial Regression, Logistic Regression, Regularization, Maximum Likelihood, Loss Function, Perceptron, Gradient Descent, Back Propagation Algorithm, Bias Variance Tradeoff, Unsupervised Learning, K-Means Clustering, Self-Organizing Map (Kohonen Maps), Learning Vector Quantization, Support Vector Machines, Dimension Reduction Techniques, Principal Component Analysis (PCA), Applications of Classification and Clustering Problems.

**EEM513 (Eng) Network Security and BlockChain 3+0 7.5**

**EEM515 (Eng) Dynamics of Electrical Machinery 3+0 7.5**

**EEM527 (Eng) Advanced Power Electronics Circuits 3+0 7.5**

Industrial Applications of Power Electronics; Brief Review on Converters; Various Industrial Applications of Converters. Motor Speed Drives; High Voltage DC Transmission and Utility Applications; Harmonic Standards; Converter Harmonic Mitigation Techniques; Gate and Base Drive Circuits; Snubber Circuits; Component Temperature Control and Heat Sinks; Design of Magnetic Materials.

**EEM528 (Eng) GPU Computing 3+0 7.5**

Introduction to GPU Programming: PC and GPU Architecture, What is GPGPU, Introduction to CUDA: CUDA API and SDK, CUDA threads; Programming Model: Kernels, Thread hierarchy, Heterogeneous programming, Computing

capability; Memory: Memory hierarchy, Device memory, Global memory, Shared memory, Asynchronous access; Asynchronous Concurrent Execution: Concurrent execution between Host and Device, Overlap of data transfer and kernel execution, Concurrent data transfers, Synchronous Calls; Introduction to OpenCL: Basics, Comparison of CUDA and OpenCL.

**EEM530 (Eng) Hardware Security and Trusted Circuit Design 3+0 7.5**

Security and Protection Aspects in Hardware Design: Vulnerability in digital logic design; Cryptographic Algorithms; Cryptographic Processors: Processor design for block ciphers and public-key algorithms; Side-Channel Attacks and Countermeasures: Power and timing attacks, Fault-injection attack; Fault-Tolerant Computing: Error-correcting codes; Hardware Trojan Horse: Formal methods for secure hardware, Detection strategies; Security of Reconfigurable Devices: Code obfuscation, Random number generators; Hardware metering: Physical unclonable functions; Trusted Computing Platform; Anti-Counterfeiting Methods; Intellectual Property Protection.

**EEM534 (Eng) Data-Communication Networks 3+0 7.5**

Overview on ISO Model; TCP/IP Stack Base Applications; Wireless Networks and Recent Protocols on Wireless Communications; Security on Networks; Network Security and Vulnerability; Data Security; New Trends and Technologies on Fast Communications; ATM Network Principles; Gigabit Ethernet, 10-Gigabit Ethernet; Voice Over IP Protocols; Fast Multimedia Information Transfer Preliminaries.

**EEM541 (Eng) Linear Systems Theory I 3+0 7.5**

Linear Spaces and Linear Transformations; Mathematical Description of Continuous- and Discrete-time Systems (Modeling); Input-Output Modeling; Impulse and Pulse Response; Transfer Matrices; State Variables and State-Space Modeling; System Response; Solution to the State Equations of Continuous- and Discrete-Time Linear Time-Varying and Time-Invariant Systems; Similarity Transforms; Controllability and Observability; Stability; Input-Output Stability; Internal Stability.

**EEM545 (Eng) System Modeling 3+0 7.5**

Systems and Models; Examples of Models; Models for Systems and Signals; Principles of Physical Modeling; Some Basic Relationships in Physics; Bond Graphs; Computer-Aided Modeling; Introduction to Identification; System Identification as a Tool for Model Building; Program Packages for Identification; Simulation and Model Use.

**EEM546 (Eng) Fundamentals of Robotics 3+0 7.5**

Introduction to the Fundamental Concepts of Robotics; Description of Local Positions; Orientation and Frames; Transformation Arithmetic; Manipulator Kinematics; Link Description; Actuator Space; Joint Space and Cartesian Space; Inverse Manipulator Kinematics; Algebraic Solution and Geometric Solution; Jacobians; Velocities and Static Forces; Manipulator Dynamics; Trajectory Generation; Control Of Manipulators.

**EEM547 (Eng) Fundamentals of Detection and Estimation 3+0 7.5**

Random Vectors: Joint distribution and densities, Multiple transformation of random variables, Multidimensional Gaussian distribution, Conditional distributions, Conditional expected values; Parameter Estimation: Linear estimation of vector parameters, Smoothing, prediction and filtering, Maximum likelihood estimators, Significance testing, Hypothesis testing, Bayesian analysis, Confidence intervals; Stochastic Processes: Stationary processes, Ergodicity, systems with stochastic inputs; Spectral Analysis: Correlations and spectra, Linear systems, Factorization and innovations, Matched filter, Spectral representation and Fourier transforms; Karhunen-Loeve Expansion; Queuing Theory and Markoff Processes.

**EEM548 (Eng) Power System Protection 3+0 7.5**

Principles of Protection of Power Systems: System grounding, Circuit breakers, Fuses, Relay input sources, Optical voltage and current transducers; Fundamental Protection Concepts: Differential, Directional impedance, etc.; Generator Protection: Differential, Negative sequence, Loss of excitation, etc.; Motor Protection: Grounding fault, Locked rotor, Undervoltage, Phase rotation, etc.; Bus Protection; Reactor Protection; Capacitor Bank Protection; Transformer Protection: Differential, Sudden pressure, Over temperature, Low oil, etc.; Line Protection: Directional comparison, Blocking, etc.; Types of Faults in Power Systems.

**EEM549 (Eng) Advanced Electrical Machinery 3+0 7.5**

Synchronous and Induction Motors; Doubly Fed Induction Motor; High Frequency Motors; Linear Machines; Braking Motors; Motors with External Rotors; Oscillating Motors; Poly-phase Commutator Motors; Schrage Motors; Single-Phase Commutator Motors; Brushless Motors; Hysteresis Motors; Reluctance Motors; Step Motors; Repulsion Motors; Universal Motors; Permanent Magnet Synchronous Machines.

**EEM551 (Eng) Control Design Methods 3+0 7.5**



Performance Criteria; Design and Compensation Techniques Using Frequency Response Methods; Minor-Loop Design; Improving System Performance By Feed-Forward Control; Controllability; Observability; and Canonical Forms; Relations Between Modern and Classical Techniques; Luenberger Observer; State Feedback; Pole-Zero Assignment Methods.

**EEM552 (Eng) Micro-Nanodevices and Thin Film Applications 3+0 7.5**

Semiconductor Materials: Material properties, Charge carriers and transport, Generation and recombination, Doping; Solid State Devices Basic Physics: Schrödinger equation, Semiconductor quantum wires-wells-dots; Microelectronic Device Structures: MOS field effect transistor, Bipolar junction transistor, Device operation through energy band diagrams; Thin Films: Fabrication techniques, Vacuum technology, Growth mechanisms, Film characterization techniques, Surface treatments, Thin film solar cells; Nanotechnology: Nanomaterials and nanodevices, State-of-the-arts devices, Future trends; Sustainable Energy Production Technologies.

**EEM553 (Eng) Digital Control Theory 3+0 7.5**

Discrete-Time Systems; Z Transform; Sampling; Reconstruction; Digital to Analog and Analog to Digital Transformations; Open-Loop and Closed-Loop Discrete-Time Systems; Sampled Data Systems; Response of Discrete-Time Systems; Stability; Digital Controller Design; Pole Assignment; State Estimation; Quantization Errors.

**EEM554 (Eng) Nonlinear Control Systems 3+0 7.5**

Lyapunov Stability; Advanced Stability Analysis; Stability of Perturbed Systems; Input-Output Stability; Periodic Orbits; Perturbation Theory and Averaging; Singular Perturbations; Analysis of Feedback Systems; Feedback Control; Exact Feedback Linearization; Lyapunov Based Design.

**EEM561 (Eng) Machine Vision 3+0 7.5**

Introduction: Human and computer vision systems; Cameras and Optics; Light and Color; Stereo and Range Images; Segmentation; Feature Detection and Mapping: Edge detection, Line fitting, Template matching; Multi-Resolution Representations and Applications; Machine Learning Overview: Clustering, Classification; Subspace Methods: PCA, ICA; Recognition: Feature extraction, Object detection and recognition; Motion and Tracking: Feature Tracking.

**EEM562 (Eng) Signal Coding 3+0 7.5**

Principles of Signal Representation and Codes; Scalar and Vector Quantization; Quantizer Optimization; Lossless Coding and Entropy; Huffman-Shannon Type Coders; Dictionary Techniques; Predictive Coding; Optimum Prediction Filter Design; DPCM, Signal Space Representations; Transforms; KLT; Orthogonal and Biorthogonal Systems; Basis Signals and Projections; Sub band Decomposition; Wavelet - Sub band Filter Relation; Wavelet Design; Transform and Wavelet Coding; International Standards Relating to the Covered Subjects.

**EEM564 (Eng) Artificial Neural Networks 3+0 7.5**

Learning and Generalizing; Perceptron and Linear Decomposition; Multi-Layered Perceptron and Nonlinear Decomposition By Back Propagation Algorithm; Hopfield Model and BAM; Self-Organizing Mapping and Unsupervised Learning Models; Simulated Annealing and Boltzman Machine.

**EEM565 (Eng) Image Processing 3+0 7.5**

Introduction to Image Processing; Two-Dimensional Discrete-Time Signals; Fourier Representation; Two-Dimensional Sampling and Restoration; Two-Dimensional Anti-Aliasing Techniques; Image Representations; Image Transforms; Basis Vector - Basis Image Relations; Optimum Transforms and Representations; Transforms Such As KLT, DCT, Etc, Dithering, Imaging and Color Spaces; Morphology; Edge Detection and Other Binary Image Operations; Image Enhancement; Projection Based Restoration; Image Reconstruction; Image Segmentation and Object Extraction.

**EEM566 (Eng) Pattern Recognition 3+0 7.5**

Introduction to 1-D, 2-D and Multi-Dimensional Pattern Recognition; Bayes Decision Theory; Decision Boundaries; Classifiers and Discriminating Functions; Parameter Estimation; Clustering; Specification Selection; Image Grammar and Language; Artificial Intelligence in Pattern Recognition; Applications of Artificial Neural Networks.

**EEM567 (Eng) Advanced Computer Architecture 3+0 7.5**

Introduction: Technological trends, Cost and performance; Quantitative Principles of Computer Design; Instruction Set Architecture Design: Classifying ISAs, Role of compilers, MIPS Architecture; Pipelining: Data and control hazards; Pipelining Implementations and Multicycle Operations, MIPS R4000 Pipeline; Instruction Level Parallelism: Dynamic scheduling and branch prediction, Overview of superscalar, Loop unrolling; Static Branch Prediction; Memory hierarchy Design and Caches: Cache performance, Cache design issues, Main memory design issues; Overview of Interconnection Networks: Connecting two computers, Connecting more than two computers, Examples of interconnection Networks.

**EEM568 (Eng) Fundamentals of Energy Storage Technology 3+0 7.5**

History of Energy Storage Systems; Battery Technologies; Fundamentals of Capacitors; Lithium-Ion Batteries; Semiconductor Capacitors; Capacitor Design and Characterization Techniques; Design, Production, and Operation of Functional Capacitors; Supercapacitors; Applications of Supercapacitors in Electric and Hybrid Electric Vehicles; Supercapacitors in Renewable Energy Production; Current Trends, Innovations; Challenges Associated with Current Supercapacitor Technology.

**EEM592 (Eng) Seminar 3+0 7.5**

**EEM599 (Eng) Semester Project 3+0 0.0**

**EEM603 (Eng) Function Space Methods in Engineering 3+0 7.5**

Sequences; Series; Limit; Continuity; Differentiation; Riemann Integral; Proof Methods; Lebesgue Spaces; Fourier Series; Fourier Transformations; Hardy Spaces and Engineering Applications of Hardy Spaces; Optimization Methods; Optimization Applications in Engineering.

**EEM604 (Eng) Optimization in Power Systems 3+0 7.5**

Optimisation Theory; Classification of Mathematical Programming Methods; Hydro-electric and Thermal Plant Modelling; Economic Dispatch of Thermal Units; Transmission Losses; Unit Commitment Problem in Interconnected Network; Methods of Load Forecasting; Optimal Power Flow; Cost Models for Planning.

**EEM605 (Eng) Power Systems Stability 3+0 7.5**

Stability Definitions; Simulation Methods; One-Machine System Stability; Swing Equations; Equal Area Criteria; Multi-Machine System Stability; Mathematical Models of Synchronous Machine; Phase Models; (d-q-0) Model; State-Space Models; Excitation and Prime Mover System Models; Stability Analysis.

**EEM606 (Eng) Parallel Computer Architecture 3+0 7.5**

Introduction: Why parallel architecture, Convergence of parallel architectures; Fundamental Design Issues; Shared Memory Multiprocessors: Cache coherence, Memory consistency, Synchronization; Snoop-Based Multiprocessor Design: Single-Level Caches with an Atomic Bus, Multilevel Cache Hierarchies, Split-Transaction Bus, Case Studies; Scalable Multiprocessors; Directory-Based Cache Coherence: Directory Protocols, Memory-Based Directory Protocols, Cache-Based Directory Protocols, Synchronization; Hardware/Software Trade-Offs; Interconnection Network Design: Interconnection Topologies, Routing, Switch Design, Flow Control, Case Studies.

**EEM607 (Eng) Parallel Computing 3+0 7.5**

Introduction: What is parallel computing?, The scope of parallel computing; Models of Parallel Computers: Parallel architectures, Interconnection networks, Routing and communication cost; Basic Communication Operations: One-to-All and All-to-All Broadcast, One-to-All and All-to-All Personalized Communication, Circular shift; Performance and Scalability of Parallel Systems: Performance metrics, The Scalability of Parallel Systems, The Isoefficiency Metric; Parallel Programming: Parallel Programming Paradigms, Message-Passing Programming Paradigm, Shared-Address-Space Programming Paradigm, Data-Parallel Languages; Dense Matrix Algorithms; Solving Sparse Systems of Linear Equations; Sorting; Parallel I/O.

**EEM608 (Eng) Advanced Linear Control Design 3+0 7.5**

Elements of convex analysis; Special algorithms for convex optimization: cutting-plane algorithms, ellipsoid algorithms, Ritz approximations; Controller design specifications and approaches: multi-criterion optimization; Robustness specifications.

**EEM609 (Eng) Multivariable Control Systems I 3+0 7.5**

Review of linear algebra: Invariant subspaces, matrix dilation problems; Linear dynamical systems: Lyapunov equations, balanced realizations; Performance specifications: Hilbert and Hardy spaces, Induced system gains; Stability and performance of feedback systems; Performance limitations; Model reduction by balanced truncation and Hankel norm approximation; Model uncertainty and robustness.

**EEM610 (Eng) Multivariable Control Systems II 3+0 7.5**

Linear Fractional Transformation; Structured Singular Values; Parameterization Of Stabilizing Controllers; Algebraic Riccati Equations; H-2 Optimal Control; Linear Quadratic Optimization; H-Infinity Control; Controller Order Reduction.

**EEM611 (Eng) Power System Harmonics 3+0 7.5**

Power quality and harmonics; Harmonic analysis : Fourier Transformations; Fundamentals of harmonics; Harmonics in power systems; Effects of harmonic distortion on power systems; Mitigation of power system harmonics; Standards for the limitation and control of power system harmonics; Modeling of power system components for harmonic analysis; Power system harmonic studies : Harmonik power flow; Advance topics of power system harmonics in smart grids.

**EEM617 (Eng) Special Topics in Systems Theory 3+0 7.5**

Some Current Special Topics in Systems Theory: Finite-dimensional and infinite-dimensional systems, Controllability and observability of infinite-dimensional systems, Systems described by partial differential equations, Systems described by delay-differential equations, Pointwise and distributed time-delay systems, Retarded and neutral systems, Controllability and observability of time-delay systems, Pointwise and distributed parameter systems, Discrete-event and hybrid systems, System identification.

**EEM618 (Eng) Power Quality Analysis 3+0 7.5**

Definition of Power System Transients; Transient Events During Normal Operation; Transient Events During Faults; Monitoring Methods of Transients and Detection of Quality Features; Analysis Methods Using DFT and Wavelet Transforms; Analysis of Power Quality Using Symmetrical Sequence Components; Simulation Methods and Applications; Analysis of Example Systems Through Simulations.

**EEM619 (Eng) Wireless Communication 3+0 7.5**

Wireless Channel Modeling: Path loss and shadowing; Statistical Fading Models; Time Diversity: Coding and Interleaving; Antenna (Spatial) Diversity; Frequency Diversity; Direct-Sequence Spread Spectrum; Multi-Carrier Systems: OFDM; Narrowband Cellular Systems; CDMA: Generation of Pseudonoise Sequences, Power Control, Handoff, Averaging; Capacity of Wireless Channels.

**EEM620 (Eng) Special Topics in Control Engineering 3+0 7.5**

Some Current Special Topics in Control Engineering: Decentralized and hierarchical control, Control of infinite-dimensional systems, Stabilization of infinite-dimensional systems, Infinite-dimensional controllers, Stabilizing controller design, Robust control, Robust servomechanism problem, Control of time-delay systems, Time-delay controller design, Distributed control, Optimization in control, Control of discrete-event and hybrid systems, Supervisory control.

**EEM621 (Eng) Nano and Micro-Fabrication Techniques 3+0 7.5**

Cleanroom Environment, Safety and Processing; Micrometrology and Materials Characterization; Material Properties, Crystal Structure and Growth of Silicon; Thin-Film Materials and Processes: PVD, CVD, PECVD, ALD, Metallic thin films, Oxide and nitride thin films, Polymer films; Advanced Thin Films; Pattern generation and optical lithography; Wet, Dry and Ion Beam Etching; Thermal Oxidation; Nano and Micro-Fabrication Equipment.

**EEM623 (Eng) Advanced Digital Signal Processing 3+0 7.5**

Signal Models; Adaptive Filtering; Signal Spaces: Orthogonality; Hilbert and Banach Spaces; Projection Theorem Representation and Approximation: Least squares fitting; Minimum Mean Square Estimation; Wiener Filtering; Lp Optimization Linear Operators and Matrix Inversion; Matrix Factorizations: LU Factorization; Cholesky Decomposition; Unitary Matrices; Householder Transformation; Givens Rotations Eigenvalues and Eigenvectors: Matrix Diagonalization; PCA; Eigenfilters; Signal Subspace Techniques Singular Value Decomposition and Its Applications; Special Matrices and Their Applications: Toeplitz and Circulant Matrices; Durbin Algorithm; Lattice Filters.

**EEM624 (Eng) Advanced Topics in Deep Learning 3+0 7.5**

Machine Learning Basics; Deep Feedforward Networks: Gradient based learning; Optimization for Deep Models; Convolutional Neural Networks; Model-free Deep Reinforcement Learning; Model-based Deep Reinforcement Learning; Inverse Reinforcement Learning; Recurrent Neural Networks; Markov Decision Processes; Monte Carlo Methods; Linear Factor Models; Deep Generative Models: Variational autoencoders, Representation learning, Generative adversarial networks.

**EEM625 (Eng) Advanced Topics in Digital Systems I 3+0 7.5**

Combinational Logic Circuits; Sequential Logic Circuits; Finite State Machines; Logic Synthesis; Logic Simulation; Timing Analysis; Hardware Description Languages; VHDL; Hardware Software Codesign Methodology; Power; Performance; Security; Side-channel Resistant Design; Advanced Architectural Design; Partitioning; Hardware to Software Interfacing Techniques; Memory; Scratchpad; Cache; High-Level Synthesis; Data Types for HLS; Loops for HLS; Verification; Test; Design Space Exploration; Efficient Hardware Accelerator Design; Advanced FPGA Applications.

**EEM641 (Eng) Sensor Array Signal Processing 3+0 7.5**

Introduction: Sensor array geometry and mathematical model, Narrowband model and assumptions; Direction of Arrival Estimation: Classical methods, Spectral-MUSIC, Root-MUSIC, ESPRIT, Min-Norm, Stochastic and deterministic maximum likelihood methods, Spatial smoothing, Virtual array, Array interpolation, Cramer Rao lower bound; Array Signal

Processing for Communications: Beam-space processing, Delay-and-sum beamforming, Filter and-sum beamforming, Capon, MVDR beamforming, Robust beamforming; Source Localization: Triangulation, Least squares methods, Error ellipse, Stansfield, Maximum likelihood methods, Time-difference of arrival techniques for source localization.

**EEM642 (Eng) Linear Systems Theory II 3+0 7.5**

Polynomial Matrices; Multi-Input Multi-Output (MIMO) Poles and Zeros; Minimal Realization of MIMO Systems; Equivalent Systems; Identification By Markov Parameters; State Feedback; State Observers; Static and Dynamic Output Feedback; Pole Assignment; Servomechanism Problem; Diagonalization; Composite Systems; Mathematical Description; Controllability; Observability; Stability; Controller Design.

**EEM643 (Eng) Estimation Theory 3+0 7.5**

Deterministic Least-Squares Parameter Estimation and the RLS Adaptive Filter Algorithm; Stochastic Least-Squares Parameter Estimation: Least-squares estimation and linear least-squares estimation, MAP estimation; ML estimation and Cramer-Rao lower bound, Innovations process; Wiener Theory For Scalar Processes: Continuous-time and discrete-time Wiener smoothing, Continuous-time and discrete-time Wiener-Hopf equations and causal Wiener filters., Application to prediction and additive white-noise problems; The Discrete-time Kalman Filter: Predicted estimator, Time and measurement-update, Filtered estimator forms, Linearized and extended Kalman filters, Kalman Filter For Smoothed Estimators: Bryson-Frazier formulas; Array Algorithms.

**EEM645 (Eng) System Identification 3+0 7.5**

Systems and Models; Signal Spectra; Singular Realization Behavior and Ergodicity Results; Simulation and Prediction; Modal Sets; Modal Structures and Identifiability; Nonparametric Time and Frequency Domain Methods; Transient Response Analysis and Correlation Analysis; Frequency Response Analysis; Parameter Estimation Methods; Using Frequency Domain Data to Fit Linear Models; Convergence and Consistency; Consistency and Identifiability; Asymptotic Distribution of Parameter Estimates; Subspace Methods for Estimating State Space Models.

**EEM646 (Eng) Fuzzy Systems 3+0 7.5**

Fuzzy Control from an Industrial Perspective; Capabilities and Restrictions of Fuzzy Control; Knowledge Based Controllers; Classical Set Theory; Mathematics of Fuzzy Control; Fuzzy Sets; Fuzzy Relations; Approximate Logic; Representation of a Rule Set. Fuzzy Knowledge Based Controller (FKBC) Design Parameters; Structure of FKBC; Rule Base; Knowledge Base; Decision Mechanism; Fuzzification and Defuzzification Methods; Nonlinear Fuzzy Control; FKBC Types; Adaptive Fuzzy Control; Stability of Fuzzy Systems.

**EEM651 (Eng) Signal Transforms 3+0 7.5**

Concept of Signal Space; Signal Representations; Orthogonal Spaces and Transforms: Least-squares representation, decorrelation, 2D expansions; Short-time Fourier Transforms and Frames; Subband decomposition, Filterbank structure and implementation constraints; Time-frequency Representations and Wavelets; Relations of Discrete Wavelets and Subband Decomposition, Wavelet Design - Filterbank Design; Compression and Efficient representation applications.

**EEM652 (Eng) Optimal Control 3+0 7.5**

Pontryagin's Minimum Principle; Hamilton-Bellman-Jacobi Equations; Calculus of Variations; Fundamental Concepts; Functionals of a Single Function; Functionals Involving Several Independent Functions; Piecewise-Smooth Extremals; Constrained Extrema; Optimal Control Problems; Necessary Conditions; Minimum-Time and Minimum-Energy Problems; Singular Intervals; Linear Quadratic Optimal Control; Finite Horizon and Infinite Horizon Problems.

**EEM656 (Eng) Large-scale Systems 3+0 7.5**

An Overview of Large-Scale Systems; Interconnected Systems; Decentralized Systems; Hierarchical Systems; Multi Time-Scale Systems; Stability of Large-Scale Systems; Decentralized Fixed Modes; Decentralized Control; Hierarchical Control; Multi Time-Scale Control; Disjoint and Overlapping Decompositions; Constrained Optimization and Decentralized Optimal Control; Robust Controller Design Methods for Large-Scale Systems.

**EEM657 (Eng) Control of Robotic Systems 3+0 7.5**

Robot Dynamics; Fundamental Control Methods Applied to Robotic Systems; Control Problems for Robot Manipulators; Position and Velocity Control; Multi-Input Multi-Output Control Systems and Robotics Applications; Cartesian Based Control Systems; Computed Torque Method; Robust Control for Robot Manipulators; Adaptive Control; Force Control; Hybrid Position and Force; Industrial Robot Control Systems.

**EEM658 (Eng) Adaptive Control 3+0 7.5**

Real-time Parameter Estimation; Least-squares and Regression Models; Estimating Parameters in Dynamical Systems; Self-Tuning Regulators; Model-Reference Adaptive Systems; Properties of Adaptive Systems; Stability; Convergence; Robustness; Averaging; Auto-Tuning; Gain Scheduling; Design of Gain-Scheduling Controllers; Nonlinear Transformations; Practical Issues and Implementation.

**EEM660 (Eng) Discrete Event Systems** **3+0 7.5**  
Introduction to Discrete Event Systems; Modelling Methods: Petri nets, Automata, Formal languages; Mathematical Formalisms; Types, and Properties of Modelling Methods; Supervisory Control Design: Forbidden state control approach for all modelling methods, Structural and behavioural control approaches for Petri nets.

**EEM661 (Eng) Advantage in Cryptology** **3+0 7.5**  
Public-key cryptography: RSA systems, discrete logarithm systems, elliptic curve systems; Finite field arithmetic; Elliptic curve arithmetic: elliptic curves, point representation and the group law, point multiplication, Koblitz curves; Elliptic curve cryptography; Implementation issues, applications of elliptic curves: factoring, primality test. Public-key cryptography: RSA systems, discrete logarithm systems, elliptic curve systems; Finite field arithmetic; Elliptic curve arithmetic: elliptic curves, point representation and the group law, point multiplication, Koblitz curves; Elliptic curve cryptography; Implementation issues, applications of elliptic curves: factoring, primality test.

**EEM667 (Eng) Statistical Signal Processing** **3+0 7.5**  
Signal Modeling; Least Squares Method; Pade Approximation; Stochastic Models; ARMA; AR; MA Models; Levinson Recursion; Lattice Filters; FIR and IIR Filters; Wiener Filter; FIR and IIR Types; Spectrum Estimation; Parametric and Nonparametric Methods; Minimum Variance Spectrum Estimation; Maximum Entropy Methods; Frequency Estimation; Adaptive Filters; FIR; IIR and Recursive Types.

**EEM692 Seminar** **3+0 7.5**

**EEM790 (Eng) Thesis** **0+1 30.0**

**EEM890 (Eng) Thesis** **0+1 30.0**

**EEM890-0 Thesis (Thesis Proposal)** **0+1 30.0**

**EKiM510 Organic Chemistry of Biomaterials** **3+0 7.5**  
**(Eng)**  
Carbohydrates: Monosaccharides, Polysaccharides, Synthesis and reactions; Lipids: Basic properties, Fatty acids, Triglycerides, Terpenes, Steroids, Reactions and synthesis; Amino Acids, Peptides, and Proteins: Reactions and synthesis, Primary, secondary and tertiary structures of proteins, Structures and functions of enzymes; Nucleic acids: Nucleosides, Nucleotides, DNA, RNA.

**EKiM511 Advanced Organic Chemistry I** **3+0 7.5**  
Basic Concepts: Electronegativity, Hybridization, Molecular orbital theory, Bond formation, Formal charge and oxidation steps, Acid-base theory; Stereochemistry and Conformational Analysis; Reaction Thermodynamics and Kinetics; Nucleophilic Substitution Reaction Mechanisms (SN1, SN2); Elimination (E1, E2, E1Cb) and Addition Reaction Mechanisms; Carbonyl Compounds: Addition reactions,  $\alpha$ -Position reactivity, Condensation reactions; Reactions of Carboxylic Acids and Their Derivatives; Conjugated Unsaturated Systems; Aromaticity and Reactions of Aromatic Compounds.

**EKiM512 Advanced Organic Chemistry II** **3+0 7.5**  
Carbocations and Their Rearrangement Reactions; Rearrangements in Electron-Deficient Systems; Carbens and Their Reactions; Nitrenes and Their Reactions; Radical Reactions and Mechanisms; Pericyclic Reactions: Frontier molecular orbitals, Woodward-Hoffmann rules, Electrocyclic Cycloadditions, Sigmatropic, and Chelotropic Reactions; C-C Bond Formation and Other Reactions using Transition Metal Organometallic Compounds: Cross-Coupling reactions, Olefin metathesis, and Homogeneous catalytic hydrogenation of olefins.

**EKiM513 Gas Chromatography and Applications** **2+1 7.5**  
Fundamental Principles of Gas Chromatography; Components of Gas Chromatography; Injection Systems; Columns: Types of columns, Column Materials; Detectors; Mass spectrometer; Ionization: Electron impact, Chemical ionization; Mass Analyzer: Magnetic sector, Quadrupole, Time of flight, Ion trap; Analysis: Selecting and preparation of samples, Method

development for temperature programming, Qualitative analysis, Quantitative analysis, Structural analysis with mass spectrometer.

**EKiM514 Heterocyclic Chemistry 3+0 7.5**

Heterocyclic Compounds: Classification and nomenclature of heterocyclic compounds; Three Membered Heterocyclic Compounds: Properties, synthesis and reactions of three-membered heterocyclic compounds containing one and two heteroatoms; Four Membered Heterocyclic Compounds: Properties, synthesis and reactions of four-membered heterocyclic compounds containing one and two heteroatoms; Five Membered Heterocyclic Compounds: Properties, synthesis and reactions of heteroaromatic compounds containing one, two, three and four heteroatoms; Other Heterocyclic Compounds.

**EKiM610 X-Ray Photoelectron Spectroscopy and its Applications 3+0 7.5**

Overview of Surface and Interface Analysis; Electron Spectroscopy: Some Basic Concepts; Components of Electron Spectrometer; Depth Profile; Heterogeneous Catalysis Applications of Electron Spectroscopy; Metallurgical Applications of Electron Spectroscopy; Applications of Electron Spectroscopy to Polymer Technologies; Applications of Electron Spectroscopy to Corrosion Science; Biotechnological Applications of Electron Spectroscopy; Comparison of XPS and AES techniques with other analytical techniques; Sample Analysis Application; Processing of Data; Interpretation of Spectra: Qualitative and Quantitative Interpretation.

**ENM501 Design and Analysis of Experiments 3+0 7.5**

Introduction to Design of Experiments; One Factor Variance Analysis-ANOVA; Model Adequacy Checking; Blocking and Confounding; Introduction to Factorial Design; 2k Design; Fractional Factorial Design; 3k Factorial Design; Mixture Design and Analysis; Response Surface Method.

**ENM502 Production Management Systems 3+0 7.5**

Concept of Computer Aided Production Management; Production Lines and Their Modeling; Using Analytical and Heuristic Approaches in Assembly Line Balancing; Pull and Push Production Systems; Just in Time Production (JIT) Approach; Kanban Systems and Design of Kanban Systems; Alternative Systems to Kanban; Optimum Production Technology Approach; Group Technology and Cellular Manufacturing; Design and Application of Flexible Manufacturing Systems; Production Systems Scheduling and New Trends in Control.

**ENM503 Advanced Techniques in Linear Programming 3+0 7.5**

Theoretical Foundation of Linear Programming and Simplex Algorithm: Big M, Two-Phase, Single-Artificial Variable, Dual Simplex, Revised Simplex Algorithms; Duality Theorem and Its Applications; Sensitivity Analysis and Parametric Programming; Goal Programming and Its Applications; Data Envelopment Analysis and Its Applications; Cutting Planes; Bounded Variable Technique; Interior Point Algorithms.

**ENM504 Decision Making Methods 3+0 7.5**

Decision Analysis; Decision Analysis Basic Concepts; Decision Making Under Certainty; Uncertainty and Risk; Bayes Decision Theory; Decision Tree; Utility Theory; Multi Criteria Decision Making; Analytical Hierarchy Process; ELECTRE; Decision Model Applications.

**ENM505 Sequencing and Scheduling 3+0 7.5**

Role of Sequencing and Scheduling; Classes of Scheduling Problems; Single Machine Scheduling; Parallel Processing and Batch Sequencing Assembly Line Balancing Problem; Network Based Scheduling; Manpower Scheduling; Common Scheduling Problems and Heuristics: Backward-forward Heuristic; Early and Late Penalties; Common Due Date; Scheduling with Meta-Heuristics: Simulated Annealing and Taboo Search.

**ENM508 Reliability of Systems 3+0 7.5**

The Concept of Reliability; Obtaining Reliability Function; Weibull Distribution; Utility Time of Elements; System Reliability as a Function of Component Breakdown; Reliability Block Diagrams and Failure Trees; Abrasion and Reliability; Reliability of Serial and Parallel Systems; Network Reliability; Measurements and Tests of Reliability; Applications of Reliability in Manufacturing and Service Systems.

**ENM509 Supply Chain Management 3+0 7.5**

Basic Concepts of Supply Chain and Logistics Systems; Using Mathematical Models and Numerical Techniques in the Analysis of Supply Chain and Logistics Systems; Analyzing Basic Components of Supply Chain: Procurement, Inventory, Production and Transportation; Structural Analysis of Production and Inventory Systems; Modeling Stochastic Supply-Timed Inventory Systems and Solution Approaches; Modeling Multi-Stage Inventory Systems and Solution Approaches; Coordination of Material, Information and Financial Flows in Supply Chain; SCOR Model.

**ENM512 Research Techniques in Human Engineering 3+0 7.5**

Introduction to Human Factors Engineering: Definition, Scope, and Aims; The Importance of Human Factors Engineering with Respect to Industrial Engineering and Management; Evolution of Working; Evolution of the Supply of Performance; Anatomical and Mechanical Structure of the Human Body; Analysis of Working Environments with Respect to Anthropometry; Working Conditions; Designing Workplaces According to Ergonomics Principles; Machine System Protections; Work Accidents; Shift Working.

**ENM514 Mathematical Programming 3+0 7.5**

Importance of Modeling, Difficulties in Solving Process; Linear Modeling Examples; Integer Linear Modeling Examples; Network Models; Fundamental Solution Techniques for Linear Models; Fundamental Solution Techniques for Integer Linear Models; Non-Linear Modeling Examples; Fundamental Solution Techniques for Non-Linear Models; Introduction to GAMS and Lingo Software; Rules to Express a Model Using GAMS; Solving a Model With GAMS and Interpreting Solution Report; Tricks About Modeling and GAMS.

**ENM515 Energy Systems 3+0 7.5**

Basic Concepts in Thermodynamics: Internal Energy; Enthalpy; Open and Closed Systems; Entropy and Exergy; Power Cycles; Power Cycles; Solar Energy: Passive Solar Systems; Active Solar Systems; Geothermal Energy: Heating; Ground Source Heat Pumps; Power Generation; Wind Energy: Wind Measurements and Power Estimation; Wind Energy: Wind turbines; Economic Analysis of Energy Systems.

**ENM516 Multi Criteria Decision Making 3+0 7.5**

Multi Criteria Decision Making (MCDM) Terminology; MCDM Concepts; Relation between Multi Criteria and Multi Objective Decision Making; Methods for Discrete MCDM Problems; Multi Attribute Utility Theory; Analytic Hierarchy Process and Analytic Network Process; Outranking Procedures; ELECTRE I Method, ELECTRE III Method, Promethee Method; Theories of Interactive Methods; Interactive Approaches to Linear and Quasiconcave Utility Functions.

**ENM517 Special Topics in Facilities Planning 3+0 7.5**

Facilities Planning Process; Quantitative Models for Facilities Planning; Facility Location Models; Constructing Iso-Cost Contour Lines; Special Facility Layout Planning Models and Design Algorithms; Machine Layout Models; Conventional Storage Models; Automated Storage and Retrieval Systems; Order Picking Systems; Fixed-Path Material Handling Models; Waiting Line Models; Simulation Models.

**ENM518 Metaheuristics 3+0 7.5**

Optimization: Models and methods; Basic Concepts in Metaheuristics: Performance analysis for metaheuristics; Single Solution Based Metaheuristics: Local search, Simulated annealing, Taboo search, Iterated local search, Variable neighborhood search, Guided local search; Population Based Metaheuristics: Evolutionary algorithms, Scatter search, Ant colony optimization, Particle swarm optimization, Bees colony, Artificial immune system.

**ENM519 Strategic Choice and Planning in International and National Context 3+0 7.5**

Basic Concepts of Strategic Management: Vision, Mission, Strategy, Policy; Strategic Management in Business: Definition, Purpose and characteristics of strategic management, Strategic management process and phases; Competitive Analysis Providing Strategic Choice and Decision-Making in Competitive Environment and Portfolio Analysis; Structure of the Strategy Implementation Process and Style of Planning; Review, Evaluation and Control of Strategies; Analysis of the Problems Faced by National and International Firms to Select Market; Market Entry Modes; Joint Venture; Direct Foreign Investment; International Strategic Alliances.

**ENM520 Advanced Management Technics 3+0 7.5**

Basic Concepts of Advanced Management; Classical approaches, Scientific management, First managerial theories, Bureaucracy approaches, Human relations and Behavioral science approaches; First Contributions to the Theory of Organization and Decision-Making; Systematist Thought and the Emergence of Open Systems Approach; Modern Approaches to Management: Reengineering, Balanced Scorecard, Production methods, Total quality management; Chaos Theory and Methods of Decision-making in Chaos; Performance Measurement, Absenteeism; Case Study Discussions.

**ENM521 Advanced Production Systems 3+0 7.5**

Introduction; Comparison of Traditional and Advanced Production Systems: Trends, Manufacturing (Structure); Introduction to Manufacturing Systems Engineering; Manufacturing Systems Engineering; CAD and Product Design: CAM, CIM; Group Technology and Cellular Manufacturing System; Transition to Cellular Manufacturing System; Trends of Cellular Production System; Cellular Manufacturing System and Mass Individualization; Flexible Manufacturing System and Agile Manufacturing System; Value Streams Maps; Restriction of Theory; Future of Factory (Green Factory); Green Manufacturing, Recycles; Conclusions.

**ENM522 Multivariate Statistics, Application Tools and Techniques 3+0 7.5**

Multivariate Random Distributions; Matrices: Linear Transformation; Eigenvectors and Eigenvalues; Principal Component Analysis: Total Variation Explained by Principal Components; Factor Analysis: Barlett tests, Orthogonal factor models, Factor rotation and factor scores; Cluster Analysis Methods; Discriminant Analysis; Structural Equation Modeling; Path Analysis; Model Fit Indices; Model Testing and Model Modifications; Models with Non-Normal or Small Data Bootstrapping; Application Tools and Techniques of Multivariate Data Analysis.

**ENM523 Introduction to Mathematical Optimization 3+0 7.5**

Some Important Extremal Problems; One Variable Optimization; Methods in One Variable Optimization; Multivariable Optimization; Gradient Method; Affine Sets; Convex Sets; Separation Theorem; Polyhedral Sets; Corner Points; Cones; Convex Functions; Directional Derivatives; Subdifferential; Nonlinear Programming; Convex Programming Problem; Duality Theory in Convex Programming; Simplex Method; Penalty Function Method.

**ENM524 Predicting with Machine Learning 3+0 7.5**

Fundamental Concepts of Learning; Data Representation; Supervised Learning; Classification; Regression; Unsupervised Learning; Association Analysis; Clustering; Dimensionality Reduction; Feature Extraction; Model Validation; Parameter Optimization.248

**ENM525 Modeling and Analysis of Time Series Using R 1+2 7.5**

**ENM526 Advanced Data Analytics 3+0 7.5**

Basic concepts about data and data analytics; Classification and history of data analytics; Exploratory data analysis and applications in univariate, bivariate and multivariate data; Data collection methods; Data quality and preprocessing; Missing data problem and solution methods; Detection and handling of outlier data; Data manipulation, transformations and rescaling; Data visualization; Dimensionality reduction; Attribute selection; Frequent pattern mining; Oversampling/undersampling in unbalanced datasets; Python apps for data science.

**ENM527 Logistics Modeling and Optimization 3+0 7.5**

Distribution, Transportation, Communication Networks: Applications for optimal location of service facilities and routing of vehicles, Modeling, Theory, Algorithms; Networks: Fixed charge facility location problems, P-median, P-center, Covering problems, Hub location problems; Tools for the Analysis of Location Problems; Linear Programming and Lagrangean Relaxation; Vehicle Routing Problems (VRP): Construction and improvement algorithms, Location-routing problems; Multi Objective Logistics Problems; Hill Climbing Algorithms; Simulated Annealing Algorithms.

**ENM528 Integer Programming 3+0 7.5**

Basic concepts in integer programming; Use of 0-1 integer variables in linear integer programming; Integer mathematical model examples and obtaining solutions with software packages; Network and routing problems and solution approaches; Counting, rounding and dynamic programming techniques; Branch boundary and branch cutting algorithms; Additive algorithm for 0-1 integer models; Cutting plane algorithm; Column generation method.

**ENM529 Optimization for Machine Learning 3+0 7.5**

Convex Optimization in Machine Learning; Formulation of Machine Learning Problems: Support Vector Machines, Logistic Regression; First-Order Methods: Gradient Decent Method (GD), Stochastic Gradient Decent (SGD), Noise Reduction Methods, Adaptive Methods, Convergence Analysis of First Order Methods; Second-Order Methods: Stochastic BFGS Method, Stochastic L-BFGS Method, Convergence Analysis of Second Order Methods.

**ENM530 Social Network Analysis 3+0 7.5**

Social Network Analysis Definition and History; Social Network Analysis Basic Concepts; Social Network Structures and Models; Calculating Social Network Measurements; Visualizing Social Networks; Information Diffusion in Social Networks; Influence and Homophily in Social Networks; Cluster and Community Analysis in Social Networks; Software Used for Social Network Analysis; Sample Social Network Analysis Applications with Python

**ENM592 Seminar 3+0 7.5**

**ENM599 Term Project 3+0 0.0**

**ENM601 Introduction to Convex Analysis 3+0 7.5**



Convex Sets; Topological Properties of Convex Sets; Hyperplanes; Polyhedral Sets; Separation Theorems for Convex Sets; Convex and Concave Functions; Continuity and Differentiability of Convex Functions; Directional Derivative; Subdifferential; Subdifferentiability of Convex Functions; Second Order Differentiability; Positive Definiteness; Positive and Negative Definite Matrices; Positive Definiteness and Convexity Conditions; Optimality Conditions for Convex Unconstrained Optimization Problems; Weierstrass Theorem.

**ENM602 Stochastic Analysis 3+0 7.5**

Stochastic Functions and Characteristics of Stochastic Functions; Conditional Expectation; Conditional Independence; Types of Convergence of Sequence of Random Variables; Continuity, Differentiation and Integration of Stochastic Functions; Special Types of Stochastic Processes: Markov processes, Poisson processes, Gauss processes, Poisson processes, Gauss processes, Wiener processes; Stochastic Integral and Stochastic Differential Equation; Ito's Formula; Some Applications of Stochastic Integration and Stochastic Differential Equations.

**ENM603 Unconstrained Optimization 3+0 7.5**

Examples of extremal problems; Mathematical modeling; Convex sets and convex functions; Directional derivative; Subdifferential; One-variable unconstrained optimization; Line search without using derivatives; Bisection search method; Newton's method; Multidimensional search using derivatives; Method of steepest descent; Multivariable method of Newton; Subgradient Optimization.

**ENM604 Constrained Optimization 3+0 7.5**

General Definition of Constrained Optimization Problems; Convexity Properties; Optimality Conditions for Constrained Optimization Problems; Fritz John Optimality Conditions, Karush-Kuhn-Tucker Optimality Conditions; Definition of the Dual Problem and Formulation; Duality Theorems; Lagrangian Duality; Saddle Point Optimality; Solution Methods in Constrained Optimization; Subgradient Methods; Cutting Plane Method; Penalty Function Methods; Augmented Lagrangian Penalty Functions; Augmented Lagrangian Method of Multipliers; Modified Subgradient Method.

**ENM605 Operations Research in Healthcare 3+0 7.5**

Fundamentals of Operations Research; Modeling; Assignment Problems: Nurse-to-patient assignment problems; Healthcare Planning: Demand forecasting, Location selection, Capacity planning; Queue Management and Design; Healthcare Systems Scheduling Problems: Patient scheduling, Nurse scheduling; Workforce and Workload Models; Workload Balancing; Application of Decision Making Methods.

**ENM606 Multi-Objective Optimization 3+0 7.5**

Fundamentals of Decision Making in Multi-objective Environment; Ordering Relations in Vector Spaces; Cones; Ordering Relations and Cones; Various Concepts of Efficient Solutions in Multi-objective Optimization; Pareto Optimal Points and Pareto Optimal Solutions; Characterization of Efficient Solutions; Scalarization Methods: Epsilon constraints method, Benson method, Conic scalarization method; Comparison of Different Scalarization Methods; Goal Programming.

**ENM608 Fuzzy Sets and Systems 3+0 7.5**

The Concept of Fuzziness and Linguistic Variables; Mathematical Expression of Fuzziness; Definition of Membership Function; Construction of Membership Functions; Fuzzy Numbers and Variables; Fuzzy Set Operations: Algebraic operations,  $\alpha$ -cuts; Convex Fuzzy Sets; Transpose Techniques; Analysis of Decision Models in Fuzzy Environments; Fuzzy Decision Models; Fundamental Application Areas of the Fuzzy Set Theory in Industrial Engineering.

**ENM610 Finance Engineering 3+0 7.5**

Introduction to Brownian Motion: Properties and financial applications; Stochastic Processes with Jump; Poisson Process; Options; Options as an Instrument of Volatility; Tools for Volatility Engineering: Volatility swaps and volatility trading pricing; Tools in Financial Engineering: Classical Black-Scholes option pricing model, Merton's three asset option pricing model; Jump - Diffusion Option Pricing; Cox-Rubenstein Model; Optimal Portfolio and Consumption Models; Scheduled and Unscheduled Stochastic Events.

**ENM612 Data Mining with Mathematical Programming 3+0 7.5**

Overview of Data Mining; Data Mining Problems: Clustering, Classification, Association analysis; Clustering Problems and Solution Methods: Mathematical programming to solve clustering problem; Classification Problems and Solution Approaches: Approaches based on mathematical programming, Robust linear programming, H-polyhedral separation, Max-min separation, Support vector machines; Classification Approaches Based on Polyhedral Conic Functions (PCF): Polyhedral conic functions algorithm, Integer programming model, Kmeans clustering for large-scale problems; Association Analysis Problems and Solution Approaches.

**ENM614 Material Handling and Warehousing Systems 3+0 7.5**

Fundamental Concepts of Material Handling: Importance and scope of material handling in manufacturing, Principles, Unit load; Material Handling Systems: Vehicles, Conveyors, Carousels, Automated guided vehicles (AGV); Warehousing:

Importance of warehousing, Components, Operations; Warehouse Site Selection; Warehouse Design: Stock keeping unit (SKU), Storage methods, Racking systems, Warehouse layout; Automated Storage and Retrieval Systems (AS/RS); Efficiency in Material Handling and Warehousing; Measurement of Warehouse Performance; Modeling and Simulation of Material Handling and Warehousing Systems.

**ENM616 Ergonomics and Occupational Biomechanics 3+0 7.5**  
 Ergonomics; Human Body: Motion system, Neural system, Energy expenditure, Muscular and skeletal systems; Applied Anthropometry; Topics Related to Work Physiology and Biomechanics; Principles of Ergonomics at Work; Engineering Anthropometry and Its Applications; Energy Expenditure at Work; Work Design: Principles of work design; Occupational Disorders; Low-Back Disorders.

**ENM618 Advanced Techniques in Simulation 3+0 7.5**  
 General Principles of Simulation; Modeling of Complex Systems; Establishment of Reliable and Valid Simulation Models; Comparison and Evaluation of Alternative System Structures; Variance Reduction Methods; Experimental Design and Optimization; Simulation of Manufacturing and Material-Handling Systems with ARENA Program; Simulation of Computer Systems; Simulation of Computer Networks.

**ENM620 Heuristics and Matheuristics in Operations Research 3+0 7.5**  
 Mathematical Modeling: Location problems, Vehicle routing problems, Location-routing problems, Scheduling problems; Heuristics: Construction heuristics, Improvement heuristics; Metaheuristics: Simulated annealing, Ant colony algorithm, Genetic algorithm, Variable neighborhood search, Adaptive large neighborhood search; Decomposition Matheuristics: Cluster first route second approaches, Two phase approaches, Partial optimization approaches, Rolling horizon approaches; Improvement Matheuristics: One-shot approaches, MILP models for local optimization; Multi objective matheuristics.

**ENM627 Dynamic Programming 3+0 7.5**  
 Theory and Practice of Dynamic Programming; Sequential Decision Making Over Time; Optimal Value Function and Bellman's Functional Equation for Finite and Infinite Horizon Problems; Introduction of Solution Techniques: Policy iteration, Value iteration, and Linear programming; General Stochastic Formulations; Markov Decision Processes; Dynamic Programming Applications: Network flow, Resource allocation, Inventory control, Equipment replacement, Scheduling and queueing control.

**ENM629 Mathematical Statistics 3+0 7.5**  
 Parameters and Characteristics; Statistical Estimator: Requirements, Methods of construction, Distributions of statistical estimators; Design of an Experiment and Analysis of Variance; Regression and Correlation Models; Conditional Distribution; Residual Analysis in Linear and Nonlinear Regression; Basic Concepts of Nonparametric Statistics; Location Function and Location Model; Tolerance Limits; Tests Based on Binomial Distribution; Contingency Tables; Nonparametric Methods Based on Ranks; Nonparametric Regression Methods; Statistics of Kolmogorov-Smirnov Type; Tests on Independent Samples.

**ENM692 Seminar 3+0 7.5**

**ENM790 Thesis 0+1 30.0**

**ENM890 Thesis 0+1 30.0**

**ENM890-0 Thesis (Thesis Proposal) 0+1 30.0**

**ENT501 Industrial Design I 3+0 7.5**  
 Scale; Function; Aesthetic; General Design Methods; Project Planning; General Design Strategy of Organization and Relationship Between Policies; Principles and Methods Valid in Plan that Produced for a New Product; Project Applications; Analysis of Design Language in Product Design Processes; Design Challenging Conditions; Interaction Analysis; Cultural Analysis.

**ENT502 Industrial Design II 3+0 7.5**

Rapid Prototyping Methods and Applications; Formal and Functional Analysis of Potential Trends; Development of Alternative Solutions and Evaluation of Methods Used in Testing Steps; Using High Technology for Product Development and Sample Analysis; Examining Design and Cost Relation.

**ENT503 Design Management 3+0 7.5**

Establishment of Design Units in Industrial Production; Examining the Designer's Role in this Establishment From Sketch Phase to Prototyping; Management of Design Group; Determining the Design Policy in Company; Comparison of Design Management Processes With Different Production Systems and Different Cultures.

**ENT504 Portfolio Presentation Techniques 3+0 7.5**

Personalization Methods in Preparation and Presentation of Portfolio; Evaluation of Works By Exchanging Ideas in Group Criticizing Meetings and Proposing New Solution Methods; Interactive CD Or URL Portfolio Works; Modern Portfolio Presentation Techniques.

**ENT506 Media and Design 3+0 7.5**

Concept of Communication; Theories and Principles of Communication; Communication Methods; Visual and Audio Visual Tools and their Usage; Effects of Visual and Audio Visual Tools; Future of Communication and its Possible Effects on Design; Multimedia and Internet; Communication By Means of Widespread Usage of Intranet and Such Networks and Communicating Feature of Design.

**ENT507 Quality in Industrial Design 3+0 7.5**

What is Quality?; How Can Quality Can Be Achieved in Design?; Aims and Needs of Off-Line Quality Control Methods; Developing Quality in Design; Quality Function Deployment and Taguchi Method; Reflection of Customer Needs and Requirements to the Design and Customer.

**ENT508 Product Identity 3+0 7.5**

Defining the Development Process of Product Identity in Industrial Production; Role of the Corporate Identity in the Product Identity; Effects of Cultural Structure and Technological Development on Product Identity; Brand Concept and Creation Process of a Brand.

**ENT509 Cultural Problems 3+0 7.5**

Definition of Culture; Human and Culture; Affects of Notion of Culture on Design; Definition of Design and Industrial Design as a Cultural Notion; Cultural Problems in Design and Solutions; Intercultural Relationships and Deviations on Design Dimension.

**ENT510 New Approaches in Design 3+0 7.5**

German Expressionism; New Expressionism; Late Modernism; Pop Culture and Anti-Design, Postmodernism; New Design; Deconstructionist; Kitch; Minimal Design, Design and Emotion; Phenomenological Approach; Conceptual Design.

**ENT511 Advanced Computer Aided Manufacturing 3+0 7.5**

Applications of Computer Aided Manufacturing; Production Applications of STL Modules; Modeling and Analysis; CNC Machines And Analysis of Production Formats, Computer Aided Applications on Worknc; Molds and Molding Technologies; Real Production of Application Models.

**ENT512 Role of Sector in Product Development 2+2 7.5**

Product Development Process; Product Planning; Defining Customer Needs; Product Features; Concept Development; Concept Evolution; Concept Testing; Product Architecture; Industrial Design; Design for Manufacturing; Prototyping; Product Development Economics; Procet Management.

**ENT513 Creation of Brand and Market Strategies 3+0 7.5**

Product Identity Concept in Design; Corporate Identity Concept in Design; Brand Concept: Creating a brand, Presentation of a brand, Brand and target market adaptation, Brand definition; Brand and Product Relation; Marketing Concept; Evaluation of Marketing Methods; Marketing the Brand: Collecting market data, Evaluating market data; Determining Marketing Strategies; Adaptation of Brand and Marketing Strategies; Testing Marketing Strategies: Collecting data, Evaluating data; Modifications on Marketing Strategies According to Gained Information.

**ENT514 Theory and Origins of Sustainable Design 3+0 7.5**

Historical Evolution of Sustainable Design: Human-environment relations before industrial revolution, 1960-1980 period, 1980-2000 period, 2000 to today; Sustainable Design Approaches: Green design, Ecodesign, Sustainable design, Life cycle assessment, Product service systems; Environmental Criteria; Paradigm Shift for Industrial Design; Social and Ethical Criteria; Perception of Sustainable Design and Risks; Education for Sustainable Design; Research for Sustainable Design.

<b>ENT515</b>	<b>Technical Analysis in Design</b>	<b>3+0 7.5</b>
<b>ENT516</b>	<b>Form and Meaning in Product Design</b>	<b>3+0 7.5</b>
<b>ENT518</b>	<b>Remote Design Research</b>	<b>3+0 7.5</b>
<b>ENT519</b>	<b>Advanced Presentation Techniques I</b>	<b>2+2 7.5</b>
	First Step of Visualizing the Design; Sketch and Sketch Applications; Sketching Techniques; Black Lead Pencil; Marker; Pastel; Gouache; Colored Pencil; Presentation Posters; Aim; Definition; Dimensions and Poster Samples; 3D Presentation Techniques; Modeling and Prototyping Methods; Modeling Applications; Prototyping and Evaluations.	
<b>ENT520</b>	<b>Advanced Presentation Techniques II</b>	<b>2+2 7.5</b>
	Personalization Methods in Preparation and Presentation of Portfolio; Evaluation of Works by Exchanging Ideas in Group Criticizing Meetings and Proposing New Solution Methods; Interactive CD Or URL Portfolio Works; Modern Portfolio Presentation Techniques.	
<b>ENT521</b>	<b>Computer Aided Design I</b>	<b>2+2 7.5</b>
	Pixel and Vector Based Software; Menus and Virtual Tools Used in Two Dimensional Software; Image File Formats: Jpg; Jpeg; Bmp; Psd; Tiff; Tga; Resolution; Creation of Image Files; Determining the Size and Resolution; Processing; Recording; Transferring Images to Virtual Medium; Scanning; Preparing Images for Print; Plot Settings and Plotting.	
<b>ENT522</b>	<b>Computer Aided Design II</b>	<b>2+2 7.5</b>
	Introduction of the Concept of Designing in a Virtual Medium; Assistant Virtual Tools Used in Fashion Design; Introduction and Using of these Tools; Using the Virtual Tools for Production; Joining Design and Production Processes in Virtual Medium; Introduction and Use of Production Oriented Software; Applications and Evaluations.	
<b>ENT523</b>	<b>Visualisation</b>	<b>3+0 7.5</b>
	Concept of Visualization: What is visualization, Source, Message, Channel, Target, Feedback, Human factor in visualization; Perception; Signs; Elements of Visualization; Visualization; Tools of Visualization and Usage of Them; Importance of Visualization in Design; Product and User Relations; True Presentation of Product Itself to User; Importance of Visualization in Product and User Interaction; Ergonomics and Visualization.	
<b>ENT525</b>	<b>Advanced Computer Aided Industrial Design I</b>	<b>2+2 7.5</b>
	CAD/CAM Concepts (Computer Aided Design and Manufacturing Concept), CAID Design Steps and Software, Catia V5 Interface- Catia V5 Basic Structure, Integration Catia, V4-V5, Sketcher Modules, Basics of Geometrical-Dimensional Analysis, Basic of Solid Modeling, Assembly Design, Generative Drafting, Interactive Drafting, Photo-Realistic Render.	
<b>ENT526</b>	<b>Advanced Computer Aided Industrial Design II</b>	<b>2+2 7.5</b>
	Definition of parametric surfaces in NURBS-MESH concept; Types of 3D images; Ligts and Materials; Selection of Appropriate visualization Methods; Works of Render Images; 3D vector based software Applications; Interactive Visualization in 3D; Generation of interactive 3D images.	
<b>ENT527</b>	<b>Automotive Industry and Design</b>	<b>3+0 7.5</b>
	Development of Industrial Design in World Automotive Industry: Band system (mass production), Periods of war, Economic crisis; Innovation Trends: New lines, Advances in body and engine technology, End of the unlimited stylism period in the US; Towards the Oil Crisis and Economic Models; Increase in Type of Models and Emergence of New Manufacturers; Development of Automotive Industry in Turkey: First automotive products in Turkey, Import substitution and first domestic manufacturing, Export-oriented industrialization policies, Search for new design, New investors and manufacturers.	
<b>ENT528</b>	<b>Sustainable Design Practice</b>	<b>3+0 7.5</b>
	Non-Sustainable Design; Life Cycle of Products: Raw material, Production, Transportation, End of Life; Sustainable Design in Local and Global Context; Local and Global Social Problems and Designer Responsibilities; Design for Social Innovation; Research for Sustainable Design Practice; Ecodesign Practice; Sustainable Design Practice; Guidance Software for Sustainable Design Practice.	

**ENT529 Ocular Culture and Design Thinking 3+0 7.5**

Linear History of Visuality: Image, Techné and causality principles, Methods of record and appearance of image forms; Non-linear History of Visuality: Technique, Technology, Consumption society, Production paradigm, and economics and politics of image; Design Tools and Image: Thinking practice, Mind and representation problem, Abstraction, Meaning, Language, Schema, Form, Geometry, Mechanics, Electronics, Binary representation, Plasticity; Static Meaning and Being: Linear thinking and rhizomatic thinking.

**ENT531 Design Research Methods 3+0 7.5**

**ENT533 Service Design 2+1 7.5**

Service Design: Service design and basic concepts; Research for Service Design: Research basics, Generating insights; Managing Stakeholders: Defining project stakeholders, Understanding stakeholder needs, Classifying and mapping stakeholders and their needs, Creating personas; Business Modelling: Defining the business model, Ideation Tools and Techniques: Mindmaps, Moodboards, Inspiration boards, Brainstorming, Prototyping and Testing: Low-fidelity and high-fidelity prototypes; Delivering and Operating the Service: Service design case study.

**ENT592 Seminar 3+0 7.5**

**ENT790 Thesis 0+1 30.0**

**FBE510 Ethics of Science and Research Techniques 2+0 7.5**

General Principles of Ethics and Application Fields: Theoretical introduction to ethics, Theory of ethics, Philosophy of ethics of science; Ethics of Scientific Research: Basic principles of scientific ethics, Ethical evaluation in scientific research; Publication Ethics in Production of Information: Description of scientific authorship, Ethics and law, Legal property rights, Reasons, Kinds and prevention of scientific misleading; Research Methods and Techniques: Investigation of research process, Investigation of research methods, Finding required literature about the subject, Obtaining data and evaluation, Methods of report writing.

**FBE510 (Eng) Ethics of Science and Research Techniques 2+0 7.5**

General Principles of Ethics and Application Fields: Theoretical introduction to ethics, Theory of ethics, Philosophy of ethics of science; Ethics of Scientific Research: Basic principles of scientific ethics, Ethical evaluation in scientific research; Publication Ethics in Production of Information: Description of scientific authorship, Ethics and law, Legal property rights, Reasons, Kinds and prevention of scientific misleading; Research Methods and Techniques: Investigation of research process, Investigation of research methods, Finding required literature about the subject, Obtaining data and evaluation, Methods of report writing.

**FBE510-O Ethics of Science and Research Techniques (Online) 2+0 7.5**

General Principles of Ethics and Application Fields: Theoretical introduction to ethics, Theory of ethics, Philosophy of ethics of science; Ethics of Scientific Research: Basic principles of scientific ethics, Ethical evaluation in scientific research; Publication Ethics in Production of Information: Description of scientific authorship, Ethics and law, Intellectual property rights, Reasons, Kinds and prevention of scientific misleading; Research Methods and Techniques: Investigation of research process, Investigation of research methods, Finding required literature about the subject, Obtaining data and evaluation, Techniques of report writing.

**FİN528 Sport Finance 3+0 6.0**

Financial issues in sport; basic financial concepts; financial systems and how they operate; business structure; financial statements; approaches to financial planning; obtaining funding; capital stocks-bonds; capital budgeting; short-term financial management; inventory and production management; taxation and legal issues; spending earnings.

**FİZ501 Mathematical Physics 3+0 7.5**

Formal Definitions of Vectors; Scalars and Invariants; Orthogonal Transformations; Cartesian Tensors; Vector and Tensor Fields; Generalized Coordinates; General Coordinate Transformations; Gradient; Divergence; Curl and Laplacian in Generalized Coordinates; Formal Properties of Matrices; Eigenvalue Problem; Cayley-Hamilton's Theorem; Functions of Matrices.

**FİZ503 Ion Exchange 3+0 7.5**

Crystal Systems; Analysis of Crystal Structures; Classification of Crystals According to Their Bound-structures; Metallic Crystals; Ionic Crystals; Covalent Crystals; Molecular Crystals; Packing in a Crystal; Faraday's Laws of Electrolysis; Molar Conductivity; Arrhenius' Theory; Debye-Hückel's Theory; Ionic Mobility; Transportation Coefficients; Ionic Conductivities; Ions in any Solution; Activity Coefficients in Ionic Media.

**FI505 Physical Adsorption 3+0 7.5**

Introduction to Physical Adsorption; Historical; Adsorption Isotherms; Adsorption Forces; Thermodynamics of Adsorption; Adsorbents; Porous and Nonporous Solids of High Surface Area; Classification of Pore Sizes; Micropores, Mesopores and Macropores; External and Internal Surface; Particle Size Distribution; Relationship Between Specific Surface and Particle Size Physical Adsorption of Gases by Nonporous Solids; Type II Isotherm; BET Model; Mathematical Nature of the BET Equation; Application of the BET Equation to Experimental Data; Point B Method; Determining the Molecular area; Step Like Isotherms.

**FI507 Quantum Mechanics and Molecular Spectroscopy 3+0 7.5**

General Formalism of Quantum Mechanics; The Harmonic Oscillator; Angular Momentum in Quantum Mechanics; Spin; Identical Particles Systems; Perturbation Theory; Quantum Mechanics Explanation of Molecular Structure; The Absorption and Emission of Electromagnetic Wave by Molecules; Rotational and Vibrational Spectrum of Two-Atom Molecules; Microwave Spectroscopy; Vibrational Spectroscopy.

**FI508 Quantum Mechanics 3+0 7.5**

Schrödinger Wave Equation; Eigenfunction and Eigenvalues; One Dimensional Potentials; General Formalism of Wave Mechanics; Operators in Quantum Mechanics; N-Particle Systems; The Schrödinger Equation in Three Dimensions; Angular Momentum and Spin; Spherical Symmetric Potential; Approximate Methods and Perturbation Theory; Symmetry and Transformations; Identical Particles; Scattering Theory.

**FI509 Instrumental Analysis Methods 3+0 7.5**

Physical Properties of Matter and Electromagnetic Waves; Absorption Rules; Uv-Vis Spectroscopy; Vibrational Spectroscopy; Infrared Spectroscopy; Raman Spectroscopy; Nuclear Magnetic Resonance Spectroscopy; Mass Spectroscopy; Molecular Spectroscopic Applications.

**FI510 Evolution of Stars 3+0 7.5**

Birth of Stars; Interstellar Environment; Gravitation; Stellar Formation; The Virial Theorem; The Hertzsprung-Russell Diagram; Evolution of Stars on the Main Sequence; Advanced Levels On Stellar Evolution; Evolution of the Sun as the Main Sequence Stars; Evolution of Small, Medium and Massive Stars; Nuclear Reactions on Stars; Hydrogen Flash and red Giant Level; Helium Flash; Carbon Flash; Neon Flash; Oxygen Flash; Silicon; Sulphur and Magnesium Flash; Death of Stars; White Dwarfs; Physical Formation of White Dwarfs; Degenerate Electron Gases; Falling Luminosity and Internal Structure; Collapse of Nuclei and Supernovae Explosion, Classification of Supernovae; Physical Structure of Nebula; Properties of Type II Supernovae Explosions; Properties of Type Supernovae Explosions; Neutron Stars; Binary Pulsar Systems; Observed Rotational Rate Increase; Physical Structure of Neutron Stars; Rotation and Magnetic Fields of Neutron Stars; Pulsars; Neutron Stars Comparison With Pulsars; Producing

**FI512 High Energy Astrophysics 3+0 7.5**

Analysis of Light; Atoms and Sub Atomic Particles; Stimulation and Ionisation; Electromagnetic Spectrum; Radio Astronomy; X-ray and  $\gamma$ -ray astronomy; Ultraviolet and Infrared Astronomy; Neutral Hydrogen and Molecular Line Astronomy, Optical Astronomy; Theoretical Astronomy. Cosmic Ray Physics; Ionisation Losses and Non-relativistic Treatment; Relativistic Case and Ionisation Losses; Ionisation Losses of Electrons; The radiation of accelerated Charged Particles; Bremsstrahlung; Non-relativistic and Thermal Bremsstrahlung; Relativistic Bremsstrahlung. Interactions of High Energy Photons; Photoelectric Absorption; Compton Scattering; Electron Positron Pair Production; Cherenkov Radiation; Electron-Positron Annihilation and Positron Production Mechanism. Nuclear Interactions; High Energy Protons; Cosmic Ray Nuclei; Nuclear Emission Lines; Cosmic Rays in Atmosphere. Detectors For High Energy Particles; X-ray and  $\gamma$ -rays; Study of High Energy Particles; Gas-Filled Detectors-Proportional Counter

**FI514 Electromagnetic Wave Theory 3+0 7.5**

Complex Vectors; Complex Algebra; Complex Representation of Time-Harmonic Scalars; Real Vectors; Complex Vectors; Time Averages; Maxwell Equations; Maxwell Equations for Time-Harmonic Fields; Lorentz Force Law; Poynting's Theorem; Uniform Plane Waves; Uniform Plane Waves in Free Space; Polarization; Plane Waves in Dissipative Media; Reflection and Transmission of Waves; Boundary Conditions; Reflection and Transmission at a Dielectric Interface; Reflection by Perfectly Conducting Planes.

**FI515 Analysis of the X-ray Spectrum 3+0 7.5**

X-Rays; The Properties of the X-Rays; Production of the X-Rays; Continuous Spectrum; Characteristic Spectrum; Crystalline Structures; Directions and Planes in the Lattice; Diffraction Theory; Bragg's Law; Directions of the Diffraction;

Diffraction Methods; Diffraction by the Atoms; Diffraction by the Electrons; Diffraction by the Unit Cells; Calculations of the Intensities; Experimental Methods in X-Ray Diffraction; Laue Method; Rotating Crystal Method; Powder Method; The Use of Diffraction Pattern.

**FİZ522 Geometric Algebra and Applications 3+0 7.5**

Vectors, Complex Numbers and Matrices: Pauli Spin Matrices and Spinors; Geometric Algebra and Applications: Subspaces, Bivectors, Three-vectors, Quaternions, Multi-vectors, Inner, Outer and Geometric Product, Matrices Representation of  $Cl_2$  and  $Cl_3$ ; Algebraic Operations in Geometric Algebra: The Rank and Inverse of Multi-vector, Pseudoscalar, The Dual of Multi-vector, The Projection and Perpendicular Component of Multi-vector; Reflection Operations in Geometric Algebra: Reflection Operations in Euclidian Plane, Reflection Operations in Euclidian Space; The Rotation Operations in Geometric Algebra: Rotation Operations in Euclidian Plane, Rotation Operations in Euclidian Space; Geometric Algebra Application in Physics: Mechanic, Electromagnetism, Quantum, Molecular Physics.

**FİZ523 Optoelectronic Physics I 3+0 7.5**

Quantum Mechanics and Statistical physics of Electrons; Classical description of physics, Quantum description of physics, The Schrödinger equation for electrons, The free electron problem, Filling of electronic states: statistics, Scattering of electrons, Electrons In Crystals: Semiconductor Bandstructure; The challenge of solid state electronics, Periodicity of a crystal, Basic lattice types, Electrons in a periodic potential, Metals, Semiconductors, and Insulators, Holes in semiconductors, Bandstructures of some semiconductors, Modification of bandstructure, Doping Of Semiconductors; Intrinsic carrier concentration, Doping: donors and acceptors, Carriers in doped semiconductors, Modulation doping, Transport And Optical Properties In Semiconductors; Scattering in semiconductors, Velocity-Electric field relations, Very high field transport: breakdown, Carrier transport by diffusion, Transport by drift and diffusion, Optical properties of semiconductors, Charge injection and quasi-f

**FİZ524 Optoelectronic Physics II 3+0 7.5**

Junctions In Semiconductors: P-N Diodes; Device demands, The unbiased p-n junction, P-N junction under bias, The real diode: consequences of defect, High voltage effects in diodes, Modulation and switching: ac response, Application of diodes, Semiconductor Junction With Metals And Insulators; Metals as a conductors: interconnects, The Schottky barrier diode, Ohmic contacts, Insulator-semiconductor junctions, Application and technology issues, Optoelectronic Devices.

**FİZ525 Some Biophysical Techniques Connected With Waves 3+0 7.5**

Microscope and Some Special Microscope Techniques, Light Microscope, Compound Microscope, Immersion Microscope, Acoustic Microscope, UV Microscope, Polarization Microscope; Electron Microscope, Electron Waves, Electrostatics Lens, Magnetic Lens; X-Rays and Applications, X-Rays Spectrum, Absorption of X-Rays, X-Rays Diffraction; Ultrasound and Applications, Absorption of Sound, Acoustic Impedance; Holography; NMR and Applications, Resonance Principles, Fundamental Concepts, Spin Magnetic Moment of Electron; Doppler and Applications.

**FİZ526 Classical Mechanics 3+0 7.5**

Kinematics of a Particle; D'Alembert Principle and Lagrange's Equations; Simple Applications of Lagrange Formulations; Calculus of Variations; Hamilton's Principle; Symmetry Properties of Conservation Theorems; Two-Body Central Force Problem; Virial Theorem; Kepler's Problem; Rigid Body Kinematics; Euler's Angles; Euler's Equations.

**FİZ527 Advanced Statistical Physics 3+0 7.5**

Main Principles of Statistical Physics: Statistical distribution, Statistical independence, Liouville theorem, Statistical matrix, Distribution in quantum statistics, Energy, Entropy, Permanent increment principle of entropy; Thermodynamic Magnitudes: Temperature, Pressure, Work and heat amount, Heat function, Free energy and thermodynamic potential, Adiabatic process and the process of Jule-Thompson; Gibbs Distribution: Gibbs and Maxwell distributions, Free energy and Gibbs distribution, Thermodynamic perturbation theory, Gibbs distribution of system with variable number of particles, Finding out thermodynamic rules from Gibbs distribution; Theory Of Ideal Gas: Boltzman distribution, Unbalanced ideal gas, Monoatomic gas, Twoatomic gas, and polyatomic gas; Fermi And Bose Distribution: Fermi distribution, Bose distribution, Degenerated electronic gas, Degenerated Bose gas, Radiation of black substance; Non-Ideal Gas: Serial development according to the density, Formula of Van Der Waals, Totally ionized gas; Balance Circumstances of Phase: Critical points, Properties of substances close to the critical points; Fluctuation: Gauss distribution, Fluctuations of thermodynamic magnitudes, Fluctuations in ideal gas, Formula of Poisson.

**FİZ528 Adsorption Technology 3+0 7.5**

Adsorption as a process; Basic Concepts, Regeneration, Practical Guidelines, Moving Bed, Experimental Design and Testing, Adsorption Forces, Porosity, Surface Function Groups, Isostere, Isobar, Classification of Adsorption Isotherms: Equilibrium Models, Single Component Adsorption, Multi Component Adsorption, Adsorption Kinetics: External Diffusion, Internal Diffusion, Diffusion Model; Surface Diffusion Model, Combined Diffusion Model Concept of Differential Reactor; Theoretical Considerations, Materials, Equilibrium Studies, Kinetic Studies, Conclusions.

**FİZ529 Thin Film Characterization 3+0 7.5**  
Importance of Materials Characterization; Techniques of Structural Characterization: X-ray analysis, Texture coefficient, Grain size, Morphological analysis, Determination of thickness; Optical Characterization of Materials: Optical properties, Optic band gap, Determination of direct and indirect band gap; Optical Constants: Some dispersion relations, Refractive index, Extinction coefficient, Absorption coefficient, Transmission, Reflection, Optical conductivity, Complex dielectric function; Electrical Characterization of Materials: Resistivity measurement techniques, Conductivity type measurement techniques, Hall and magnetoresistivity mobility measurement techniques.

**FİZ530 Thin Film Technology 3+0 7.5**  
The Preparation Methods of Thin Films; Vacuum Technology: Kinetic theory of gases, Gas transport and pumping, Vacuum pumps, Vacuum systems, The role of the vacuum in the thin film technology; Evaporation Processes: The physics and chemistry of evaporation, Evaporation processes and applications; Chemical Vapor Deposition (CVD): Thermodynamics of CVD, Thermal CVD processes; Sputter Deposition Processes: Sputter sources, Sputter coating systems; Sol-Gel Coatings: The sol-gel process; Spray Pyrolysis Method.

**FİZ531 Amorphous Material Physics 3+0 7.5**  
Theory of Electronic States in Amorphous Materials: Theoretical methods, The density of states, Anderson localization; Amorphous Materials: Definition of amorphous materials, Amorphous metals, Liquid metals and semi-metals, Amorphous semiconductors, Amorphous germanium and silicon, Alloys, Glassy materials, Ceramics; Amorphous Material Physics: Structural properties, Optical properties, Optical band gap, Electrical properties.

**FİZ532 Particle Physics 3+0 7.5**  
Discoveries of Particles; Classification of Particles and Their Interactions; Introduction to Quantum Electrodynamics; The Feynman rules for QED; Parton model; Quantum Chromodynamics; Weak Interactions of Leptons and Quarks; Electroweak Unification; Introduction to Gauge Theories.

**FİZ533 Special Function in Physics I 3+0 7.5**  
Differential Equations in Physics; Solutions of the Equations Using Separation of Variables and Green's Function; Sturm-Liouville Theory; Legendre Polynomials; Associated Legendre Polynomials; Laguerre Polynomials; Hermite Polynomials; Bessel Functions; Hypergeometric Functions; Physical Applications.

**FİZ537 Fundamentals of Impedance Spectroscopy 3+0 7.5**  
Basic Definitions, and History; The Importance of Interfaces, Impedance-Related Functions, History, Elementary Analysis of Impedance Spectra; Physical Models for Equivalent Circuit Elements, Simple RC Circuits, Selected Applications of IS; The Electrical Analogs of Physical and Chemical Processes; The Electrical Properties of Bulk Homogeneous Phases, Mass and Charge Transport, Interfaces and Boundary Conditions, Grain Boundary Effects, Current Distribution, Porous and Rough Electrodes, Physical and Electrochemical Models; The Modeling of Electrochemical Systems, Equivalent Circuits, Modeling Results.

**FİZ538 Special Functions in Physics II 3+0 7.5**  
Partial Differential Equations in Physics; First Order and Second Order Partial Diferantial Equations; Heat Equations; Wave Equations; Green's Functions; Time Independent And Time Dependent Green's Functions; Solutions of the Differential Equations by Separation of Variables and Green's Function Technique; Integral Equations; Fredholm and Volterra Type Integral Equations; Calculus of Variations.

**FİZ539 Dynamics and Relativity 3+0 7.5**  
Galilean Relativity, Conservation Laws In Physics; Central Forces? Problems; Mechanical Vibrations and Waves; Systems of n Particles; Solid Body Motion; Rotation and translation, Collisions; Problems in physics, Scattering of Particles and Applications; Special Relativity; Space-Time Geometry; 4-vectoral operations, Relativistic Dynamics; General Relativity, Principle of equivalence, Curved space.

**FİZ540 Characterization of Solids 3+0 7.5**  
Electromagnetic spectrum, Interaction with material, Structural analysis with x-ray diffraction spectroscopy, Electrical characterization, Surface analysis with scanning electron microscope, Structural analysis with transition electron microscope, Photoluminescence, Electroluminescence, Magnetoresistance, IR, Raman.

**FİZ541 Semiconductors 3+0 7.5**  
Crystal Structure of Solids and Energy Bands; Semiconductor Materials and Their Properties; Doping of Semiconductors; Carrier Transport in Semiconductors; Generation and Recombination of Carriers; Direct and Indirect Band Transitions; Photoconductivity; The p-n Junctions; Solar Cells.



- FİZ542 Electromagnetic Theory 3+0 7.5**  
Boundary Value Problems in Electrostatics; Multipole Expansions; Electrostatics Problems in Dielectric Media; Boundary Value Problems in Magnetostatics; Maxwell Equations; Poynting Theorem; Conservation of Energy and Momentum.
- FİZ543 Condensed Matter Physics I 3+0 7.5**  
Phonons and Lattice Dynamics, Electrons in solids, Electron-Phonon Interactions, Electron-Electron and Electron-Lattice Impurity Interactions, Transport Theory, Plasmons, Polaritons and polarons.
- FİZ544 Condensed Matter Physics II 3+0 7.5**  
Classification of materials, Introduction to magnetic materials, Magnetic susceptibility, Langevin diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and ferrimagnetism, Measurement techniques for magnetic properties.
- FİZ545 Characterization Methods of Porous Solids and Powder Minerals 3+0 7.5**  
Gas Adsorption: Physisorption of gases by clays and zeolites, Energetics of physisorption, Interpretation and classification of physisorption-isotherms, Vacuum Volumetric Measurement (Manometry): Calibration of sample cells, Outgassing the adsorbent sample, Adsorption equilibrium, Temperature, Pressure, Volumetric sorption analyzer instruments (Autosorb-1C and Nova concepts), Determination of surface area from Langmuir and BET theories, Thermal Properties of Clays and Zeolites: Volumetric and structural changes on dehydration, TGA/DTA/DSC applications, Chemical (XRF) and Structural (XRD) Properties of Clays and Zeolites.
- FİZ546 Infrared Detection Systems: Physics and Technology 3+0 7.5**  
Electromagnetic spectrum and infrared radiation: Atmospheric transmission and windows; Radiometry: Planck's Law; Black body radiation; Solid angle, radiance, emissivity; Optical detection processes; Thermal detectors: Bolometers; Pyroelectric detectors; Thermoelectric detectors; Photon detectors: MCT photodiodes; Schottky barrier photodetectors; Hetero-junction internal photoemission detectors; Blocked impurity band detectors; Homo-junction internal photoemission detectors; Quantum well and quantum dot photodetectors; Type-IIsuperlattice photodetectors; Detector parameters: Responsivity, noise, signal-to-noise ratio, noise equivalent power;
- FİZ547 Lab VIEW: Graphical Programming Language 3+0 7.5**  
Introduction to graphical programming language LabVIEW; Front panel; Block diagrams; Working with virtual instruments and error correction; Virtual instruments and sub-virtual instruments: Loops; Structures; Sequences; Graphs; Data collection; Analysis and presentation.
- FİZ549 Hypercomplex Numbers in Physics 3+0 7.5**  
Hypercomplex Numbers and Their Basic Properties: Complex numbers, Split-complex numbers, Dual numbers, Basic operations, Matrix representations of hypercomplex numbers, Hyperbolic numbers in physical applications; Quaternions and Their Physical Applications: Real, Complex, Dual, Hyperbolic and split quaternions, Basic operations, Matrix representations of quaternions, Quaternionic representation of physical quantities; Octonions and Their Physical Applications: Real, Split and hyperbolic octonions, Basic operations, Matrix representations, Octonionic representation of physical quantities; Sedenions: Definition, Basic operations, Sedenions in physical applications.
- FİZ550 Geometry and Topology in Physics 3+0 7.5**  
Vector Spaces; Topological Spaces; Differentiable Manifolds; Vectors and Tensors on a Manifold; Lie Derivatives; Exterior Forms; Exterior Derivatives; Inner Product Operators; Riemannian and non-Riemannian Geometries; Metric Tensor; Metric Compatibility; Connections; Riemann Tensor; Ricci Tensor; Torsion; Levi-Civita Connection; Connection with Torsion; Covariant Derivatives; Cartan Structure Equations; Bianchi Identities; Hodge Operator; Applications in Physics.
- FİZ551 Plasma Physics 3+0 7.5**  
Introduction: Occurrence of plasmas in nature, Definition of plasma, Concept of temperature, Debye shielding, Plasma parameters, Criteria for plasmas, Applications of plasma physics; Single-Particle Motions; Plasmas As Fluids: Introduction, Relation of plasma physics to ordinary electromagnetics; Waves in Plasma: Representations of waves, Plasma oscillations; Kinetic Theory: Equations of kinetic theory; Sheaths.
- FİZ552 (Eng) Quantum Physics 3+0 7.5**  
Origins of Quantum Physics, Blackbody radiation and photoelectric effect, X Rays, Compton scattering, Atomic spectra, Bohr atom - quantization of energy; Particle-Wave Mechanics; Schrödinger Equation, Particle in a box and standing waves, Finite square well, Expectation values of classical observables, Quantum theory of atoms, Hydrogen atom, Spin and magnetic moments - Stern-Gerlach, Angular momenta and spin addition rules - Spin-Orbit, Molecules; Solids, Crystal structure, Free electron vs. fermi gas theory of electrical properties, Band theory of solids and semiconductors.

- FiZ553 Molecular Modelling 3+0 7.5**  
Basic concepts in molecular modelling; Molecular mechanical models; Hartree Fock method; Basis sets; Semi-empirical methods; Structural geometric optimizations; Density functional theory and its applications; Vibrational frequencies; Determination of scaling factors; Applications of GaussView program; Applications of Gaussian program; Comparison of theoretical and experimental data for sample molecules.
- FiZ554 Surfactants in Aqueous Solutions 3+0 7.5**  
Introduction to Surface Active Agents (Surfactants); Properties of Surfactants; Classification of Surfactants: Cationic, Anionic and nonionic surfactants; Ecological Effects of Surfactants; Micelle Formation: Critical micelle concentration, Hydrophobic and hydrophilic groups, Effects of parameters such as pH and Temperature in micelle formation; Phase Behaviors of Surfactant Systems; Colloidal Forces; Adsorption of Surfactants on Interfaces; Cationic Surfactant Adsorption on Clays: Organoclays.
- FiZ556 Experimental Techniques in Particle Physics 3+0 7.5**  
Passage of Radiation Through Matter: Ionization, Multiple scattering, Cherenkov radiation; Ionization Detectors: Multiwire proportional chambers, Drift chambers, Time projection chambers; Scintillators; Photomultiplier Tubes; Semiconductor Detectors; Photographic Emulsions; Detector Design and Sub-detectors: Trackers, Calorimeters, Spectrometers; Triggers; Statistics and the Treatment of Experimental Data: Probability Distributions, Measurement errors, Parameter estimation, Hypothesis testing; Detector Simulations; Particle Accelerator Concepts.
- FiZ557 Radiation Physics 3+0 7.5**  
X-ray generation, continuous and characteristic X-ray spectra; Interaction of heavy charged particles with matter; Interaction of electrons with matter; Interaction of photons with matter; Methods of radiation detection: Ionization in gases, ionization current, ionization pulses; Methods of radiation detection gas-filled detectors: ionization chamber, proportional counter, Geiger-Müller counter; Band theory of solids, semiconductors, p-n junctions; Semiconductor detectors; Scintillation, scintillation in organic scintillators, scintillation detectors; Thermoluminescence dosimeters, chemical dosimeters, calorimetry, neutron detectors.
- FiZ559 Essential MATLAB Applications for Physicists 1+2 7.5**  
The MATLAB Desktop: File operations, Using menus, Definition of variables, Functions and basic commands, Mathematical operations in Matlab, Working with complex numbers; Matrices and Vectors: Definition of matrices, Basic matrix operations, Vectors, Vector operations with Matlab; Decision and Loop Commands: Decision commands, Loop commands, Physical applications, Graph Plotting: Plotting the graph of a function, Customizing graph, Plotting graphs of functions together, Physical applications; Limits, Derivatives and Integrals with Matlab: Limit of a function, First derivative, Second derivative, Definite Integrals, Indefinite integrals, Physical applications.
- FiZ592 Seminar 3+0 7.5**
- FiZ601 Clay and Clay Minerals I 3+0 7.5**  
Definitions; Factors Controlling the Properties of Clay Materials; Clay-Mineral Composition; Nonclay-Mineral Composition; Classification and Nomenclature of Clay Minerals; Structures of Clay Minerals; Kaolinite Minerals; Halloysite Minerals; Montmorillonite Minerals; Definition of Structures By X-Ray Diffraction; Electron Microscope.
- FiZ602 Clay and Clay Minerals II 3+0 7.5**  
Ion Exchange Through Clays; Cation-Exchange Capacity, Causes of Cation Exchange; Theory of Cation Exchange; The Nature of Water Adsorbed by Clays; Clay-Water System; Heat of Wetting; Time Factor; Definition of Specific Surface Area in Clays; Hydration and Dehydration Through Clays; Dehydration Curves; Differential Thermal Analysis.
- FiZ604 Selected Topics in Zeolite Molecular Sieves 3+0 7.5**  
Physical Properties of Zeolite Crystals; Optical Properties; Dielectric Properties; Electrical Properties; Thermochemistry; Zeolite Water; Ionchange Reactions in Zeolites; Ion Exchange Theory; Hydrogen Exchange in Zeolites; Cation Sieve Effects in Zeolites; Adsorption on Zeolites; Heat of Adsorption; Character of the Adsorbed Phase in Zeolites; Adsorption Separation of Gas Mixtures.
- FiZ605 Selected Topics on Clay and Clay Minerals I 3+0 7.5**  
The Properties and the Structures of Clay and Clay Minerals; Structure and Composition; Clay-water Systems; Miscellaneous Properties; Clays in Ceramic Industry; Plasticity; Drying Properties; Firing Properties; Clays in Petroleum Industry; Search for Petroleum; Producing Operations; Investigation of Usability on Various Branches of Industry.
- FiZ606 Selected Topics in Electromagnetic Wave Theory 3+0 7.5**

Waveguides and Resonators; Paralel-Plate Waveguides; Rectangular Waveguides and Resonators; Dielectric Slab Waveguides; Coaxial Lines; Transmission Lines; Transmission-Line Equations; Impedances; Generalized Reflection Coefficient and Smith Chart; Antennas; Vector and Scalar Potential Functions; Fields of Antennas; Linear Antennas; Rayleigh Scattering; Fourier Optics and Holography; Doppler Effect; Plane Waves in Anisotropic Media.

**FiZ607                      Optical Properties of Semiconductors I                      3+0    7.5**

Energy States in Semiconductors; Band Structure; Impurity States; Band Tailing; Excitons; Donor-Acceptor Pairs; Perturbation of Semiconductors by External Parameters; Pressure Effects; Temperature Effects; Electric Field Effects; Magnetic Field Effects; Absorption; Fundamental Absorption; Higher Energy Transitions; Exciton Absorption; Transitions Between a Band and an Impurity Level; Intraband Transitions; Free Carrier Absorption; Hot-Electron-Assisted Absorption.

**FiZ608                      Optical Properties of Semiconductors II                      3+0    7.5**

Relationship Between Optical Constants; Absorption Coefficient; Index of Refraction; Kramers-Kronig Relations; Reflection coefficients; Absorption Spectroscopy; Radiative Transitions; Van Roosbroeck-Shockley Relation; Radiative Efficiency; Fundamental Transitions; Transitions Between a Band and an Impurity Level; Donor-Acceptor Transitions; Intraband Transitions; Nonradiative Recombination; Auger Effect; Surface Recombination.

**FiZ610                      Selected Topics on Clay and Clay Minerals II                      3+0    7.5**

Dielectric Properties of Clays; Variation Of Permittivity Versus Humidity; Frequency of Electric Field; Cole-Cole Diagrams; Various Physicochemical Properties of Clays; Adsorption-Desorption Properties; Ion Exchange Properties; Effects of Various Factors on Adsorption Properties of Clays.

**FiZ611                      Selected Topics in Solid State Physics                      3+0    7.5**

Metal-Semiconductor Contacts; Energy-Band Relation; Surface States; Current Transport Mechanisms; Thermionic Emission Theory; Diffusion Theory; Tunneling Current; Characterization of Potential Barrier; Current-Voltage Measurement; Activation Energy Measurement; Capacitance-Voltage Measurement; Photoelectric Measurement; Barrier Height Adjustment; Ohmic Contact.

**FiZ612                      Dielectric Physics                      3+0    7.5**

Behavior of Dielectrics in Static Electric Fields; Electric Susceptibility and Permittivity; Dielectric Polarization; Polarization Vector and Molecular Quantities; Clausius-Mosotti's Equation and Lorenz's Local Field; Dipole Moments in Solutions; Mosotti's Catastroph; Onsager's Local Field; Electric Susceptibility of Dipolar Gases; Dielectric Theories of Kirkwood and Fröchlich; Behavior of Dielectrics in Alternative Electric Fields; Dielectric Polarization in Alternative Electric Fields; Debye's Absorption and Dipolar Dispersion; Cole-Cole's Diagram; Cole-Cole's Equation; Cole-Davidson's Equation; Kramer-Kronig's Equations.

**FiZ614                      Selected Topics in Classical Mechanics                      3+0    7.5**

Legendre Transformations and Hamilton Equations of Motion; Conservation Theorems and Physical Meaning of Hamilton's Equations; Some Applications of Hamilton's Equations; Canonical Transformations; Hamilton-Jacobi Theory; Vibrating Systems; Diatomic Molecule.

**FiZ616                      Group Theory and Applications to Physics                      3+0    7.5**

Symmetry Elements and Operations; Point Groups; Non-Degenerate Representations; Matrices; Degenerate Representations; Applications to Molecular Bonding; Applications to Molecular Vibration.

**FiZ617                      Lie Groups and Physical Applications                      3+0    7.5**

Basic Structure Blocks; Set; Group; Symmetry Operations; Symmetry Operations and Group; Extra Definitions; Subgroups; Classes; Matrices; Matrices and Symmetry Operations of Square; Matrix Representations of a Group; Field; Linear Vector Spaces; Algebra; Bases; For a Group; For Field; For a Vector Space; For An Algebra; Isomorphism; Homomorphism; Irreducible and Reducible Matrix Representations; Discrete Groups; Orthogonal Groups;  $O(3)$ ; Orthogonal Transformation and Orthogonal Group; Physical Applications; Lie Group  $U(n)$  and  $SU(n)$  Groups;  $U(n)$  and  $SU(n)$  Generators;  $SU(2)$  and  $SU(3)$  Generators; Rotation and Angular Momentum; Linear Representations of A Lie Group; Quantum Mechanics and Group Theory; Physical Applications.

**FiZ619                      Conduction Mechanisms in Solids                      3+0    7.5**

Basic Concepts Related to Electrical Conduction; Energy Band Model; Tunneling Model; Hopping Model; Electrical Properties; Formation of Traps; Charge Carrier Injection from Contacts; Electrical Contacts; Types of Electrical Contacts; Charge Carrier Injection through Potential Barriers from Contacts; Conduction Mechanisms in Solids; Ionic Conduction; Tunnel or Field Emission; Ohmic Conduction; Space Charge Limited Conduction; Poole-Frenkel Emission; Schottky Emission.

- FİZ621 Selected Topics in Adsorption Technology 3+0 7.5**  
 Gravimetric Differential Reactor for Adsorption Studies; Experimental Results and Discussion, Materials, Equilibrium Isotherm, Kinetic Studies, gravimetric Differential Reactor for Water Adsorption Studies; Experimental Results, Experimental Procedure, Equilibrium, Kinetic Analysis, Combined Diffusion Differential Reactor Models; Liquid-Solid Systems, Gas-Solid Systems, Ds-Dp Determination, Thermodynamics Analysis of Adsorption Systems: Methods and Models, Experimental Procedure, Method of Approach.
- FİZ622 Selected Topics of Advanced Statistical Physics 3+0 7.5**  
 Solids: Solids at low temperatures, Solid at high temperatures, Debye's interpolation formula, Thermal expansion of solids, Phonons, Quantum liquid, Bose spectrum, Superfluent, Fermi spectrum, The electron spectrum of metals, The electron spectrum of solid insulators, Phonon creation and annihilation operators, Negative temperatures; Non-ideal gases: Deviation of gases from the ideal state, Expansion in powers of the density, Van der Waals' formula, Completely ionized gases, Degenerated Bose gas, Degenerated Fermi gas, Thermodynamic quantities for a degenerate plasma; Phase Equilibrium: Conditions of phase equilibrium, The Clapeyron-Clausius formula, The critical point, The law of corresponding states; Solutions: Systems containing different particles, The phase rule, Weak solutions, Osmotic pressure, Mixtures of ideal gases, Mixtures of isotopes, Gases and liquids; Fluctuations: The Gaussian distribution, The Gaussian distribution for more than one variable, Fluctuations of the fun
- FİZ623 Selected Topics in Mathematical Physics 3+0 7.5**  
 Fourier Series; Average Value of a Function Complex Form of Fourier Series; Parseval Theorem; Power; Root; Logarithm and Trigonometric Functions of a Complex Number; Integral Transformations; Laplace and Fourier Integral Transformations; Gamma; Beta and Error Functions; Elliptic Integrals and Functions; Quaternions.
- FİZ624 Selected Topics in Semiconductors 3+0 7.5**  
 Quantum Theory of Electrons in Periodic Lattices; Bloch theorem; Kronig-Penney Model; Crystal Momentum and Effective Mass; Electrons and Holes; Free-Electron Approximation; Tight-Binding Approximation; Constant Energy Surfaces and Brillouin Zones; Insulators; Semiconductors and Metals; Uniform Semiconductors in Equilibrium; Intrinsic and Impurity in Semiconductors; Statistics of Electrons and Holes; Ionization Energy of Impurity Centers; Conductivity; Hall Effect and Magnetoresistance; Ellipsoidal Energy Surfaces; Excess Carriers in Semiconductors; Continuity Equation; Drift Mobility and Haynes-Shockley Experiment; Recombination Mechanisms.
- FİZ627 Selected Topics in Ion Exchange 3+0 7.5**  
 Ion Exchange Procedures: Batch Operation; Column Process; Continuous Process; Types of Ion Exchangers; Synthetic; Natural; Cellulose; Ion Exchangers; Active Coals; Ion Exchange Membranes and Liquid Ion Exchangers; Properties of Ion Exchangers; Humidity Content and Density; Particle Size; Cross-Linking; Porosity; Swelling; Ion Exchange Capacity; Selectivity; Application Fields of Ion Exchangers.
- FİZ629 Electromagnetic Wave Theory 3+0 7.5**  
 Spin: The spin operator, Spinors, The wave functions of particle with arbitrary spin; Identity of particles: The principle of indistinguishability of similar particles, Exchange interaction, Symmetry with respect to interchange, Second quantization (the case of Bose statistics), Second quantization (the case of Fermi statistics); Addition of angular momentum: 3j-symbols, Calculation of matrix elements of tensors, 6j-symbols; The theory of elastic collisions: The general theory of scattering, The unitary condition for scattering, Born's formula, The quasi-classical case, Scattering at high energies, The scattering of slow particles, Resonance scattering at low energies; Inelastic collisions: Elastic scattering in the presence of inelastic processes, Inelastic scattering of slow particles, Breit and Wigner's formulae, Inelastic collisions between fast electrons and atoms, Scattering from the molecules.
- FİZ630 Magnetic Properties of Solids 3+0 7.5**  
 Landau quantization and de Haas Alphen Effect, Integer quantum Hall Effect (IQHE), Fractional Quantum Hall Effect (FQHE), Geometric Magnetoresistance (GMR), Magnetic Anisotropy, Magnetostriction.
- FİZ631 Organic Semiconductor Physics 3+0 7.5**  
 Introduction to the physics of organic semiconductor, Organic materials, Organic semiconductors and electronic properties of interfaces between organic semiconductors and metals, Electrical conductivity mechanism in organic semiconductors, Optical properties of organic semiconductors, Organic thin film transistors, Organic light emitted diodes, Organic solar cells.
- FİZ632 Classical Electrodynamics 3+0 7.5**  
 Electromagnetic Waves in Conducting and Non-conducting Media; Wave Guides; Multipole Radiation; Electromagnetism and Special Theory of Relativity; Motion of Charged Particles in Electromagnetic Field; Radiation from Moving Charges.
- FİZ633 Band Theory in Semiconductors 3+0 7.5**

Group theory and character tables for band theory, Effective mass theory, Plane wave approximation at band theory, K.p method, Pseudo-potential method.

**FiZ634 Gravitation and Cosmology 3+0 7.5**

Concept of Absolute Space-time; Special Theory of Relativity; Minkowski Space-time; Lorentz Transformations; Geometric Structures in Gravitation; Connection Structure and Curvature; General Theory of Relativity; Einstein Field Equations; Derivation of Field Equations by Variation Principle; Generalized Theories of Gravitation; Theories of Gravitation with a Scalar Field; Schwarzschild Solutions.

**FiZ635 Ultra Cold Atomic Gases 3+0 7.5**

The non-interacting Bose Gas; The Weakly Interacting Bose Gas; Atomic Properties; Trapping and Cooling of Atom; The Magneto Optical Trap; Interactions Between Atoms; Basic Scattering Theory; Theory of the Condensed State; Ground State of a Trapped Condensates; Energy, Chemical Potential and Virial Theorem; TF Approximation; Density and Momentum Distribution; Attractive Potential; Dynamics of the Condensate; Release of Trap and Expansion of The Gas; Solitons; Microscopic Theory of the Bose Gas; Excitation in a Trapped Gas; Interference and the Josephson Effect; The Bose Einstein Condensation in Optical Lattice; The Bose Einstein Condensation in Low Dimension; Rotating Condensates; Quantized Vortices; Superfluidity; Quantum Hydrodynamics; ; Trapped Clouds at nonzero Temperatures; Mixtures and Spinor Condensates, Fermionic Condensates, The BCS Transition

**FiZ636 Molecular Beam Epitaxy: Instrument and Application 3+0 7.5**

Components of molecular beam epitaxy (MBE) instrument: Vacuum chamber; Vacuum pumps; Effusion cells; Reflection high energy electron diffraction (RHEED) technique: Operation and applications; Temperature readers; Residual gas analyzer (RGA); Epitaxial film deposition parameters: Material flux measurements; Growth parameters calibration; Application and usage areas of epitaxial films

**FiZ637 Fundamental Properties and Gas Adsorption Applications of Naturel Adsorbents 3+0 7.5**

Fundamental factors in designing adsorbents: Potential energy of adsorption; Heat of adsorption; Effects of adsorbate properties on adsorption (Polarizability (?); Dipol moment ( $\mu$ ) and quadrupole moment (Q)); Basic considerations for sorbent design: Polarizability (?); Electronic charge (q) and van der Waals radius (r); pore size and geometry; Investigation of adsorption behavior on natural zeolites: Structure and cations sites of natural zeolites; Natural zeolites and Molecular Sieving Properties; Unique adsorption properties of natural zeolites; Interactions of adsorbate with cation site; charge and ionic radius; Adsorption applications of various gases on natural zeolites

**FiZ638 Fundamentals of Semiconductor Device and Technology 3+0 7.5**

Semiconductors: Fundamentals, doped-undoped structures; Fermi level; Electron and hole densities; Devices and operation basics: P-n junction; metal-oxide semiconductors (MOS); Bipolar junction transistors (BJT); Metal-oxide semiconductor field effect transistors (MOSFET); Elements of quantum mechanics: Black body radiation and atom models; Wave-particle duality; Basic formalism and Schrödinger equation; Particle in a box and quantum mechanical confinement; Energy-band theory: Kronig-Penney model; Particle motion and effective mass; E-k diagrams; Semiconductor hetero- and multi-junctions; Structures with quantum wells: Quantum wells; Calculations of the conduction bandenergy levels; Intersubband transitions; Design details of quantum well; infrared Quantum wire and quantum dot structures;

**FiZ639 Physical Mechanisms of Variables Stars 3+0 7.5**

Types and Physical Properties of Variable Stars; Orbital Cycle: White dwarf and red dwarf, Keplerian motion; Ellipsoidal Variations; Mass Transfer; Bright Spot; Spectral Characteristics; Emission and Absorption Lines; Disc spectrums; Eclipse Mapping; Physical Properties of Interaction Mechanisms: Accretion disc models, Siphons, Winds, Streams, Flickering, Oscillations.

**FiZ640 Structural Properties of Accretion Disc in Binary Stars 3+0 7.5**

Accretion as a Source of Energy: The Eddington limit, The emitted spectrum, Accretion theory and observation; Accretion in Binary Systems: Interacting binary systems, Roche Lobe overflow, Roche geometry and binary evolution; Disc Formation; Accretion Discs: Radial disc structure, Steady thin discs, Dwarf novae; Accretion onto Compact Objects: Boundary layers, Accretion columns; Thick Discs: Limiting luminosity, Dynamical stability; Accretion flows: Astrophysical applications.

**FiZ641 Gas Adsorption Applications of Clay Type Naturel Adsorbents 3+0 7.5**

Gas Adsorption by Clays: Structural features of layer silicates, Silicates with two-layer sheets and silicates with three-layer (Kaolinite, smectites and sepiolite), Physisorption of gases by kaolinite, Physisorption of gases by smectites: Adsorption of non-polar molecules and adsorption of polar molecules, Adsorption applications of various gases on clays.

**FiZ642 Infrared and Raman Spectroscopy 3+0 7.5**

Electromagnetic Wave and Matter Interaction; Molecular Vibrations; Vibration of Diatomic Molecules: Vibrational spectra of diatomic molecules, Rotational spectra of diatomic molecules; Infrared Spectroscopy: Basic concepts in infrared spectroscopy, Modes of vibration, Infrared spectrometer, Methods of infrared spectrum, Analysis of molecular structure by infrared spectroscopy; Raman Spectroscopy: Classical and quantum theory, Raman spectrometer, Methods of Raman spectrum, Analysis of molecular structure by Raman spectroscopy.

**FİZ643 Matrix Isolation Techniques and Applications 3+0 7.5**

Introduction to the Matrix Isolation Technique: Setting up a matrix isolation laboratory; Basic procedures for matrix preparation; Matrix Isolation Infrared Spectroscopy: Molecular conformational studies with matrix isolation infrared spectroscopy; Hot Vibrational Conformational Processes of Matrix-Isolated Molecules Induced by NIR-Laser Light; UV-Induced Photochemistry and Photoisomerization of Matrix-Isolated Molecules: Practical Examples.

**FİZ644 Nuclear Magnetic Resonance Spectroscopy 3+0 7.5**

Introduction to NMR Spectroscopy and Resonance; Definition of Chemical Shift; Investigation of Spin-spin Interactions; Investigation of Proton-proton Interactions; Dynamic NMR Spectroscopy; <sup>13</sup>C NMR Spectroscopy; Pulsed NMR Spectroscopy; <sup>13</sup>C NMR and Chemical Shifts; Multi Pulsed NMR Experiments; Introduction to Two-dimensional NMR Spectroscopy; Interpretation of NMR Spectra.

**FİZ645 Semiconductor Device Technology 3+0 7.5**

**FİZ646 Principles of Plasma Discharges 3+0 7.5**

Introduction: Plasmas and sheaths, Discharges; Basic Plasma Equations and Equilibrium: Field equations, current and voltage, The conservation equations, Boltzmann's equation, Debye length; Atomic Collisions; Plasma Dynamics: Diffusion; Particle and Energy Balance in Discharges; Capacitive Discharges: Homogeneous model, Inhomogeneous model; Inductive Discharges: Inductive source configuration; Direct Current Discharges.

**FİZ647 Natural Zeolites 3+0 7.5**

**FİZ649 Atom, Molecule and Spectroscopy 3+0 7.5**

Basic Concepts of Atoms: Atom and its structure; Atom Models: Thomson, Rutherford and Bohr atom model; Central Field Problem and Hydrogen Atom: Wave mechanics of hydrogen atom, solution of Schrödinger equation in spherical coordinates; Atomic Spectroscopy: Term concept in atomic spectroscopy, Electron placement in atoms; Molecular Structure: Molecule, Molecule vibrations; Molecular Bonds: Ionic bond, Covalent bond, Van der Waals bond, Metallic bond; Spectroscopy: Electromagnetic waves, Absorption rules; Molecular Spectroscopy: Rotation Spectra of Diatomic Molecules, Vibration Spectra of Diatomic Molecules; Types of Electronic Radiation.

**FİZ652 Recommended Course Content 3+0 7.5**

**FİZ653 Device Physics 3+0 7.5**

Compound and Alloy Semiconductors; Heterostructures; Heterojunctions; Metal-Semiconductor FieldEffect Transistor; Logic-Gate Device Structures; Heterojunction Field-Effect Transistor; Quantum Effect Structures; Epitaxy; Light Emission and Absorption; Dielectric Waveguides; Photonic Crystals; Light Emitting Diodes; Lasers; Detectors; Modulators; Microwave Devices; One Dimension SchrodingerPoisson Solver; Device Design.

**FİZ654 Advanced Quantum Mechanics 3+0 7.5**

Symmetry in Quantum Mechanics: Symmetries, Conservation laws and degeneracies, Discrete symmetries, Parity or space inversion, Lattice translation as a discrete symmetry, The time-reversal discrete symmetry; Approximation Methods: Time-independent perturbation theory; Application of Approximation Methods to Atomic Physics : The Zeeman and the Stark effects, Fine and Hyperfine structure, Light-atom interactions, Atomic transitions; Scattering Theory: The scattering amplitude, The Born approximation, Partial waves.

**FİZ655 Theories of Gravitation 3+0 7.5**

Space and Time in Theory of Relativity; Manifolds; Tensors and Differential Forms; Orthonormal Frames; Spacetime Metric; Inner Product Operators; Exterior Derivatives; Lie Derivatives; Connection and Curvature; Covariant Derivatives; Cartan Structure Equations; Spacetime Torsion; Metric Compatibility and Non-Metricity; General Relativity; Vacuum Solutions of General Relativity; Gauge Theories and Gravitation; Einstein-Maxwell Gravity Theory; Scalar Tensor Theories

of Gravitation; Einstein-Maxwell-Dilaton Gravity Theory; Modified Theories Of Gravity; Quadratic Curvature Gravity Theories; Noether-Wald Charges.

**FİZ658 Characterization of Porous Materials 3+0 7.5**

Introduction: Gas adsorption; Physical Adsorption Forces; Adsorption Isotherms; Measurement of Adsorption Isotherms; Adsorption Mechanism; Adsorption Hysteresis; Surface Area from the Langmuir and BET Theories; Other Surface Area Methods; Micropore Analysis; Mesopore Analysis; Pore Size and Surface Characteristics of Porous Solids By Mercury Porosimetry; Chemical Adsorption.

**FİZ658 (Eng) Characterization of Porous Materials 3+0 7.5**

Introduction: Gas adsorption; Physical Adsorption Forces; Adsorption Isotherms; Measurement of Adsorption Isotherms; Adsorption Mechanism; Adsorption Hysteresis; Surface Area from the Langmuir and BET Theories; Other Surface Area Methods; Micropore Analysis; Mesopore Analysis; Pore Size and Surface Characteristics of Porous Solids By Mercury Porosimetry; Chemical Adsorption.

**FİZ692 Seminar 3+0 7.5**

**FİZ790 Thesis 0+1 30.0**

**FİZ890 Thesis 0+1 30.0**

**FİZ890-0 Thesis (Thesis Proposal) 0+1 30.0**

**FKG510 Pharmacobiotechnology 3+0 7.5**

General definitions of biotechnology, history, drugs and therapeutics obtained by fermentation techniques, industrial production of antibiotics and points to consider, microbial transformation techniques, microorganisms used in microbial transformations, mediums, practice and natural products used as raw materials.

**FKL501 Experimental Pharmacology 3+0 7.5**

Mentality experimental approaches, knowledge, information and its importance, Methods of information retrieving, magnetic media and internet and their importance for experiments, relationship of knowledge-question-hypothesis, importance of information prior to experimental manipulations, materials and experiments, importance of control group, experiments and planning, pharmacological manipulation techniques, in vivo manipulations, in vitro models, data collection and handling, calculations of data and importance of statistics, evaluation, interpretation of results, documentation, application of an experimental technique.

**FTK501 Advanced Toxicology 3+0 7.5**

General Concept and Principles in Toxicology: General Knowledge About Poisons: Intake, Absorption and the excretion of poisons, Metabolism of toxic substances: The Mechanisms of Effect of the Toxicants: Special Toxic Effects: Mutagenesis, Carcinogenesis and teratogenesis: Systemic Toxicology: Selective Toxicity: The Factors Affecting Toxicity: First Aid and Treatment Procedures in Acute Intoxications: Drug Toxicity: Drug Dependence: Factors causing dependence, Dependence types: Substances with Doping Effect Used in Sports.

**HAB521 Academic Writing Skills I 3+0 7.5**

Origins of Scientific Writing: Types of scientific papers, Manuscripts and thesis; Types of Article: Original research, Review article (PRISMA), Case report, Technical note, Letter to the editor; Thesis: Part of the Thesis, First section (front pages), Main section (introduction, method results, etc.), Last section, References and Attachments; Ethics: Rights and permissions, Ethics committee approval; Practical Use of Office Programs in Thesis Writing: Practical applications of Word and excel; Presentation of Findings in Different Shapes: Tables and figures.

**HAB522 High-Intensity Interval Training (HIIT) in Team Sports 3+0 7.5**

High-Intensity Interval Training (HIIT): Work interval intensity and duration, Relief interval intensity and duration, Exercise modality, Number of repetitions, Number of series, As well as the between-series recovery duration and intensity; Aerobic High-Intensity Training; Speed Endurance Maintenance Training; Speed Endurance Production Training; Repeated Sprint Training; High-Intensity Training Test Parameters: Laboratory testing, Field testing.

**HAB523 Academic Writing Skills II 3+0 7.5**

Parts of The Manuscript: Title page, Introduction, Methods, Results, Discussion, Conclusion, Acknowledgement, References; Other Topics: The abbreviations and usage; Applications of Software Used in Article Writing: Use of Photoshop program (presentation of findings), Use of some software (Endnote) in bibliography; The Cover Letter: Cover letter preparation; Answer to the reviewers: How to answer to the comments of reviewers; Ethics: The right to become a writer and author ranking.

**HAB524 Talent Identification And Development In Sports 3+0 7.5**

Biomotor Abilities in Development Stages: Speed, Strength, Endurance, Flexibility, and coordination development in children; Multi-development and Specialization; Talent Identification and Orientation Proper to Sports in Children; Talent Identification Models in Children: Different schools for talent identification, The aspect in Turkey for talent identification; Long-term Aims of Talent Identification.

**HAB526 Training Principles For Spine, Upper, and Lower Extremities 3+0 7.5**

Composition, Structure, and Biomechanical Behaviour of Connective Tissue; Posture and Body Mechanics; Training Specific to Proprioception and Functional Movement; Maintaining Training for Acute and Chronic Injuries of Spine, Pelvis, Head, Shoulder, Elbow, Wrist, Hand, Foot, Ankle, Knee, Hip, and Sacroiliac Joints in Sports; Evaluation of Throwing, Kicking, Gait, Running, and Sprinting Mechanics, Injury Prevention Training in Physically Active Individuals.

**HAB527 Antioxidants and Athletics Performance 3+0 7.5**

Radical Concept and Properties: Reactive oxygen species, Reactive nitrogen species; The Sources of Radical Production and Mechanism, The Effect of Exercise on Radical Production and Oxidative Stress, Radical Production And Cellular Protection: Antioxidant strategy, Antioxidant defense system, Antioxidant function of vitamins, Reversible and Irreversible reactions of antioxidants, Nutrient sources of antioxidants, Positive and negative effects of antioxidant supplementations to sportive performance, Pro-oxidant effect of antioxidants.

**HAB528 Current Trends In Strength Training 3+0 7.5**

New Trends in Training Intended for Strength Training: Combined training, Complex training, Contrast training, Compound training, Functional training, Eccentric training; Training with Current Devices Supported to Strength Development: Velocity based training, Isoinertial training, Electromyostimulation training, Vibration training.

**HAB529 Scientific Fundamentals Of Training 3+0 7.5**

Training Structure; Loading and Adaptation; Volume and Intensity; Effects of Training: Immediate, Residual, and Cumulative Effects; Structures, Types, Effective Factors, and Training in terms of Muscular Strength, Speed, Endurance and Flexibility; Training Structure: Unit, Session, Microcycle, Mesocycle, Phase, Period and Macrocycle Training Samples; Training Control Methods: Field and Laboratory Performance Tests.

**HAB531 Body Composition and Performance 3+0 7.5**

Body Composition; Body Fat Mass, Fat Free Mass; Body Composition Assessment: Total body, Body segmen; Common Techniques To Assess Body Composition; Hydrostatic Weighing, Bioelectrical Impedance Analysis, Air-Displacement Plethysmography, Dual-Energy X-ray Absorptiometry, Skinfold and Girth Measurements; Effect of Body Composition on Performance Sports; Individual Sports, Team Sports

**HAB532 Sports for Disability Persons 3+0 7.5**

History of disability sports, General rules of Paralympics games, Paralympics sport foundations, Definition of disability person and classification, Effect of exercise education in Disability persons, Physical adaptation programs for disability persons, Dance activities for disability persons, Adapted sport activities for different disability persons, Sport accident and rehabilitation for disability athletes, Doping for disability athletes, Specific Olympic.

**HAB533 Motivation in Sport 3+0 7.5**

Definition of motivation concept: Definition of spur, incentive, motive and need, Development of motivation, Personal motivation and corporation communication, Development of motivation theory, Process and concept theory in motivation, Usage techniques of motivation in sport, Encouragement tools which are getting motivation, Easy motivation methods which are using in corporation motivation, Important components in athlete motivation.

**HAB534 Movement And Training Principles 3+0 7.5**

Human Body and Functional Movements: Axes, Joints, Upper and lower extremity movements; Growing stages in children; Peak Height Velocity; Basic Movement Concepts and Mechanics; Types of Muscular Activities; Energy Systems; Maximal Oxygen Consumption; Homeostasis; Steady State; Oxygen Dept; Liquid Requirement, Thermoregulation; Internal and External Factors Influencing Training; Basic Principles and General Structure of Training.



<b>HAB535</b>	<b>Functional Anatomy</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB536</b>	<b>Experimental Approach to Exercise Neurophysiology</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB537</b>	<b>Introduction to Exercise Neurophysiology</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB538</b>	<b>The Fundamentals of Kinesiological Electromyography</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB539</b>	<b>Physiology I</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB540</b>	<b>Physiology II</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB541</b>	<b>Physical Appropriateness</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB542</b>	<b>Experimental Applications in Sportive Performance</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB543</b>	<b>Talent and Talent Identification for Sports in Children</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB544</b>	<b>Advanced Training Theory</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB545</b>	<b>Basic Training Theory</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB546</b>	<b>Monitoring Training and Performance in Athletes</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB547</b>	<b>Movement Science and Performance Training</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB548</b>	<b>Training Periodization in Team Sports</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB549</b>	<b>Analysis of Sportive Technique</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB550</b>	<b>Current Approaches and Corrective Exercises in Fitness Applications</b>	<b>2+1</b>	<b>7.5</b>
<b>HAB551</b>	<b>Periodization Methodologies in Football</b>	<b>3+0</b>	<b>7.5</b>

<b>HAB552</b>	<b>Practical Application to the Study of VO2 Kinetics</b>	<b>2+1</b>	<b>7.5</b>
<b>HAB553</b>	<b>Match and Player Analysis in Team Sports</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB555</b>	<b>Electrophysiological Training Methods in Sports</b>	<b>2+1</b>	<b>7.5</b>
<b>HAB556</b>	<b>Physical Activity and Technology Use</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB557</b>	<b>Oxygen Uptake Kinetics</b>	<b>2+1</b>	<b>7.5</b>
<b>HAB559</b>	<b>Acute and Chronic Adaptation to Exercise at High Altitude</b>	<b>2+1</b>	<b>7.5</b>
<b>HAB561</b>	<b>Exercise and Oxidative Stress</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB563</b>	<b>Current Literature in Movement and Training and Applied Project Development</b>	<b>2+1</b>	<b>7.5</b>
<b>HAB565</b>	<b>Physical Activity Recommendations and Assessment</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB567</b>	<b>Geriatrics and Physical Activity</b>	<b>3+0</b>	<b>7.5</b>
	Geriatrics and Physical Activity: Geriatrics and physical activity today, Demography of geriatrics, Physical changes due to aging in geriatrics, Physiological changes due to aging in geriatrics, Motor changes due to aging in geriatrics, Social and psychological changes due to aging in geriatrics, Physical activity in geriatrics on physical fitness effects, Types of physical activity in geriatrics, Planning and implementation of physical activity, Quantitative and qualitative research of the effects of physical activity on geriatric individuals.		
<b>HAB569</b>	<b>Applied Statistics</b>	<b>3+0</b>	<b>7.5</b>
	Scientific Research Process; Basic Statistical Concepts; Data analysis, Frequency distributions, Data sets; Population and sample; Mean; Sum of Squares, Variance, Standard Deviation, Standard Error, Confidence Interval, Test Statistic; One- and Two-Tailed Tests; Type 1 and Type 2 Errors; Effect Size; Statistical Power; Testing Normal Distribution, Homogeneity of Variances, Evaluation of Outliers, Starting to SPSS; Test Assumptions, Parametric and Non-Parametric tests, T-tests, ANOVA, Repeated Measures ANOVA, Mixed ANOVA; Wilcoxon Signed-Rank Test, Mann-Whitney U Test, Kruskal-Wallis Test, Friedman ANOVA; Correlation and Regression Analysis.		
<b>HAB571</b>	<b>Research Methods in Movement and Training Sciences</b>	<b>3+0</b>	<b>7.5</b>
	Stages of Research: Access to resources, Determining the topic, Determining the purpose, Defining the problem situation, Defining the problem question and hypothesis; Critical Reading: Introduction, Method, Findings, Discussion, Conclusion; Determination of the sample: Determination of participants, Number, Qualifications; Dependent and Independent Variables: Determination for the subject and purpose; Basic Research Methods Techniques: Scientific research methods, Types, Examples, Qualitative, Quantitative, Experimental, Quasi-Experimental; Scientific Research Ethics: Examples of research ethics problems in movement and exercise sciences: Preparing a Research Proposal: Preparing for a Seminar.		
<b>HAB592</b>	<b>Seminar</b>	<b>3+0</b>	<b>7.5</b>
<b>HAB622</b>	<b>Oxidative Stress Responses to Aerobic Exercise</b>	<b>3+0</b>	<b>7.5</b>

Hemoastase: The balance between oxidative stress and antioxidant defense system; Free Radical Production Mechanisms: Mechanism of free radical production during aerobic exercise, Structure of mitochondria, ATP production, Electron transport chain, Complex structures; Acute Aerobic Exercise And Free Radical Production; Chronic Aerobic Exercise And Free Radicals; The relationship between radical production and aerobic exercise with intensity, frequency and volume.

**HAB623                    Oxidative Stress Responses To Resistance Exercise                    3+0   7.5**

Mechanisms of Free Radical Production: Mechanism of free radical production during resistance (anaerobic) exercise, Production of xanthine and NADPH oxidase, Prostanoid mechanism, Ischemia reperfusion mechanism, Phagocytic respiratory burst activity, Acute resistance exercise and free radical production, Chronic resistance exercise and free radical; The relationship between radical production and intensity, frequency and volume of resistance exercise training.

**HAB624                    Muscle Damage Paradigm                    3+0   7.5**

Muscle Damage: Understanding the mechanism of muscle damage, Paradigm of exercise-induced muscle damage, Relationship between muscle damage and oxidative stress; Problem of muscle damage level; Types of muscle contraction: The relationship between different muscle contractions and muscle damage; Relationship between muscle damage, oxidative stress and performance; Muscle damage and antioxidant supplementation: The effect of acute and chronic antioxidant supplementations on muscle damage and oxidative stress level.

**HAB625                    Physiological Basis Of Human Performance                    3+0   7.5**

Physiological Changes related with Training: Cardiorespiratory Adaptations, Muscular Adaptations, Biochemical Adaptations, Effects of Different Training Types to Human Performance, Athlete Training, Top Level Athlete Training, Physiological Principles of Athletic Training in Adults: Fitness and Effects of Fitness to Performance, Importance of Weight Control in Performance.

**HAB626                    Fundamental Of High-Level Performance                    3+0   7.5**

**HAB627                    Training Periodization                    3+0   7.5**

Periodization Concept and Different Periodization Approaches; Microcycle, Mesocycle and Macrocycle Structures in Training Related to Loading and Fatigue; Active/Passive Rest; Relationships Among Loading, Recovery and Supercompensation; Adaptation to Training; Periodization in Team and Individual Sports; Periodization Strategies; Single- and Multi-Periodization, Problems and Solutions in Periodization; Tapering; Detraining and Retraining.

**HAB629                    Advanced Anatomy in Sports                    3+0   7.5**

Basic Terms of Kinesiology and Anatomy; Terms of Movement; Basic Anatomical Stance; Axis; Platform; Range of Motion; Tissue Mechanics; Neck Mechanics; Shoulder Mechanics; Thoracic Mechanics; Lumbar Mechanics; Hip Mechanics; Knee Mechanics; Mechanics of Resistance Training; Mechanics of Musculoskeletal Injury; Mechanics of Running; Mechanics of Hit; Mechanics of Kick; Applications to Daily Life; Mechanics of Lifting; Mechanics of Balance; Gait Analysis; Mechanics of Footwear.

**HAB630                    Adaptation to Strength Training                    3+0   7.5**

Characteristics of Neuromuscular System particular to Strength Training; Myogenic Effects of Strength Training and Neurogenic Effects of Strength Training; Alterations in Men related with Strength Training; Alterations in Women related with Strength Training; Alterations in Elder People related with Strength Training; Strength Training Specific to Sports; Effects of Nutrition to Strength Training Adaptation.

**HAB632                    Biostatistics                    3+0   7.5**

Biostatistics: Statistical decision theory: Hypothesis testing, Parametric and non parametric approaches, With large sample hypothesis testing, Hypothesis testing with small samples; Strength Testing; Chi Square Distribution: Chi square tests; Simple Linear Regression and Correlation Techniques, T Test; Analysis of Variance; Analysis of Covariance; Random Block Design; Factorial Experiments; Multivariate Statistical Tests; Factor Analysis; Multivariate Analysis of Variance; Multivariate Analysis of Covariance.

**HAB633                    Training Theory I                    3+0   7.5**

**HAB634                    Adaptation to Strength Training                    3+0   7.5**

<b>HAB635</b>	<b>Exercise Prescription</b>	<b>3+0 7.5</b>
<b>HAB636</b>	<b>Training Theory II</b>	<b>3+0 7.5</b>
<b>HAB637</b>	<b>Anti Aging and Exercise</b>	<b>3+0 7.5</b>
<b>HAB638</b>	<b>Exercise Approaches for Special Groups</b>	<b>3+0 7.5</b>
<b>HAB639</b>	<b>Performance Monitoring in Sport</b>	<b>2+1 7.5</b>
<b>HAB640</b>	<b>Sportive Technical Analysis Applications</b>	<b>2+1 7.5</b>
<b>HAB641</b>	<b>Biomechanics of Musculoskeletal System I</b>	<b>3+0 7.5</b>
<b>HAB642</b>	<b>Global Positioning System (GPS) and Sport Specific Testing</b>	<b>3+0 7.5</b>
<b>HAB643</b>	<b>Neuromuscular Adaptation and Fatigue</b>	<b>3+0 7.5</b>
<b>HAB644</b>	<b>Biomechanics of Musculoskeletal System II</b>	<b>3+0 7.5</b>
<b>HAB645</b>	<b>Training Load Monitorization and Field Test in Team Sports</b>	<b>1+2 7.5</b>
<b>HAB646</b>	<b>Electromyography Signal Processing</b>	<b>3+0 7.5</b>
<b>HAB647</b>	<b>Current Issues in Athletic Performance Enhancing</b>	<b>3+0 7.5</b>
	Current Issues in Athletic Performance Improvement: Identifying and selecting current athletic performance research in sports for presentation, discussion and solution purposes. In the field of athletic performance in sports, it is aimed that students have a deep knowledge of current issues by addressing the problems both in terms of content and values and have the vision to develop solution-oriented innovative issues.	
<b>HAB648</b>	<b>Strength and Conditioning Fundamentals for Tactical Forces and Civil Society Volunteers</b>	<b>3+0 7.5</b>
	The theoretical and practical applications of knowledge in tactical field of physical condition and strength for highly qualified individuals such as special forces, military forces, police forces, fire and rescue personnel. Fundamentals of optimal conditioning training specific to the tactical athlete population, multi-factor technical and tactical program needs, including nutritional requirements, physical fitness testing, exercise selection, biomechanical, physiological and metabolic needs, injury and disease risk, management and organization, program design and implementation optimize performance will help reduce the risk of injury and death.	
<b>HAB649</b>	<b>Recommendations for Physical Inactivity and Sedentary Behaviors</b>	<b>3+0 7.5</b>
	Physical Activity and Inactivity: Benefits of physical activity for social, psychological and physical health, Economic and social harms of physical inactivity; Sedentary Behaviors: Comparison of physical inactivity and sedentary concepts, Effects of sedentary behaviors on psychological, social and physical health; Changing Physical Inactivity and Sedentary Behaviors:	

Individual importance, Social importance, Economic importance, Importance for health; Recommendations for Changing Physical Inactivity and Sedentary Behaviors: Exercise selection, Behavior replacement, Individualized physical mobility strategies.

<b>HAB650</b>	<b>Physical Fitness Tests and Exercise Programming</b>	<b>3+0 7.5</b>
Active or Sedentary Lifestyle: Physical effects, social effects, psychological effects; Physical Fitness: All components and tests of physical fitness; Physical Fitness for Health: Cardiopulmonary fitness, Muscular fitness, Flexibility, Body composition; Physical Fitness for Sportive Performance: Balance, Coordination, Power, Agility, Reaction time, Speed; Exercise Programming: Individualized exercise programming, Grouped exercise programming, Exercise programming according to physical fitness, Programs for the development of health and sportive performances, maximal muscle strength and endurance, flexibility and cardiopulmonary development.		
<b>HAB692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>HAB701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>HAB702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>HAB790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>HAB890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>HAB890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>HAB901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>HAB902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>HEE501</b>	<b>Satellite Based Navigation Systems</b>	<b>3+0 7.5</b>
Basic Principles of Satellite Orbiting; GPS (Global Positioning System): Space segment, Signal types, Ground control segment, User segment, Signal processing in GPS receiver, Error sources, Signal formats; GLONASS (Global Navigation Satellite System); Galileo; COM-PASS and Other Satellite Navigation Systems; Precision and Reliability Augmentation Techniques in Satellite Navigation: Space-based augmentation techniques, Ground-based augmentation techniques, Aircraft-based augmentation techniques; Concept of CNC/ATM and Its Development.		
<b>HEE502</b>	<b>Sensors and Transducers</b>	<b>3+0 7.5</b>
Basic Principles: Basic elements and input/output configuration of measurement systems, Sensing and transducing principles, Units and standards, Error analysis, Uncertainty, Calibration; Behavioral Characteristics of Measurement Systems: Static and dynamic behavior, Response to different input types; Modelling: Mathematical model, Software simulation; Operating Principles and Construction Methods of Sensors/Transducers: Resistive, Inductive, Capacitive, Optic, Magnetic, Piezoelectric, Anemometer, Humidity sensors, Proximity sensors, Modern measurement systems: Digital transducers, Smart and micro-electronic sensors, Signal conditioning circuits, Sensor selection.		
<b>HEE511</b>	<b>Fundamental Measurement Methods in Aviation</b>	<b>3+0 7.5</b>
<b>HEE512</b>	<b>Aviation Applications with Matlab</b>	<b>3+0 7.5</b>

<b>HEE514</b>	<b>Fundamental Sensor Technologies</b>	<b>3+0 7.5</b>
<b>HEE592</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>HEE602</b>	<b>Signal Processing in Receivers of Satellite Based Navigation System</b>	<b>3+0 7.5</b>
<b>HEE610</b>	<b>Systems of Modern Gas Turbine Engines</b>	<b>3+0 7.5</b>
	Engine Control Systems in General; Thermal Management for Engines; Internal Air System; Active Clearance Control; Lubrication System Design and Operation; Fuel System Design and Operation; Speed and Thrust Control; Introduction to FADEC System; Future Trends in FADEC System Design; Thrust Reverser Control System; Engine Servo Control System; Mechanical Engine Controls; Variable Geometry System; Clearance Control System; Hydromechanical Control Unit; Power Management System; EEC Control System; Engine Condition Monitoring System; Engine Vibration System; Engine Electrical Wiring Harnesses.	
<b>HEE611</b>	<b>Space Propulsion Systems, Sensors and Instruments</b>	<b>3+0 7.5</b>
	Spacecraft Propulsion Systems: Applications, Classifications; Characteristic Parameters: Thermodynamics, gas dynamics and nozzles, Propulsion systems, Liquid propulsion systems, Solid propulsion systems, Hybrid propulsion systems, Other non-chemical propulsion systems, Electric propulsion systems, Ramjet and Scramjet; Space Propellants; Fundamentals of Orbital Mechanics: Introduction to Earth observation, Electromagnetic waves; Theory of the Earth Observation System; Sensors: Sensor electronics, Optical space sensor systems, Infrared sensors, Sensors for satellites status detection, Microwave sensor systems.	
<b>HEE613</b>	<b>Soft Computing in Aviation</b>	<b>3+0 7.5</b>
	Learning and types of learning, optimization techniques, introduction to neural networks, single layer perceptrons, multi-layer perceptrons, backpropagation algorithm, implementation of neural networks on control problems, fuzzy sets, operations on fuzzy sets, fuzzy relation and composition, fuzzy inference systems, fuzzy controllers, adaptive neuro-fuzzy inference systems (ANFIS), radial basis functions (RBF), genetic algorithms, other derivative-free global optimization methods.	
<b>HEE615</b>	<b>Dielectric Properties of Polymer Materials</b>	<b>3+0 7.5</b>
	Polymers: Basic Concepts, Classification of Polymers, Structure of Polymers; Dielectric Properties: Dielectric Constant, Dipole, Dipole Moment, Electrical Polarization, Classification of Dielectrics, Clausius-Mosotti-Lorentz-Lorenz Equation, Onsager Local Field, Dielectric Resting and Loss, Dielectric Properties of Different Materials; Experimental Studies.	
<b>HEE692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>HEE790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>HEE890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>HEE890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>HiD501</b>	<b>Watershed Hydrology</b>	<b>3+0 7.5</b>
	Overland Flows; Sediment Transport by Overland Flows; Subsurface Storm flow; Unsaturated Flow and Groundwater Flows; River Flow Modeling, Computer Models for Watershed Hydrology.	
<b>HTK501</b>	<b>Air Traffic Management and Aircraft Performance I</b>	<b>3+0 7.5</b>
	Air Traffic Management System; Aircraft Performances for Air Traffic Environment: Mission profile, Mission profile and aircraft movements, Air traffic control services in mission profile; Definitions of Speeds and Weights; Aero-Propulsive	

Models; General Equations of Motions; Level Flight Performances: Specific level flight performances for flight operations; Climb Performances: Specific climbing performances for flight operations; Descent Performances: Specific descending performances for flight operations; Take-off and Landing Performances: Specific take-off and landing performances for flight operations; Turning Performances: Specific turning performances for flight operations; Aircraft Trajectory: Trajectory prediction with Eurocontrol BADA model.

**HTK502                      Models and Simulation in Air Traffic Management I                      3+0    7.5**

Fundamentals of Simulation and Modelling; Discrete-event Simulation Methodology; Taxonomy and Comparison of ATM Simulation Tools; Data Collection and Processing; Model Construction: Airport and airspace modeling; Experiment Design: Construction of baseline and alternative scenarios; Simulation: Test and production runs, Troubleshooting; Applications: Capacity and delay analysis, Conflict detection and resolution; Post Simulation Analysis: Analysis of results, Documentation, Animations and presentation; Verification and validation of simulation models.

**HTK504                      Air Traffic Flow Management and Airspace Capacity Analysis                      3+0    7.5**

Components of Air Traffic Management: Airspace management, Air traffic services, Air traffic flow management; Functions of Air Traffic Management: Organization, Planning-Control, Co-ordination; Staffing; System of Air Traffic Management; Categorization of Problems in Air Traffic Management; Capacity: Definitions; Factors Determining Capacity: Airspace, Technical equipment, Aeroplane, Human performance, Procedure; Capacity Models; Literature Review; Scheduling Algorithm Method for Flow Planning; Short-term and Medium-term Conflict Models.

**HTK505                      Multi-Criteria Decision-Making                      3+0    7.5**

Basic concepts: Decision-making, Decision process, Model, Types of models; Mathematical Programming: Model studies, Solution methods, Multi-criteria; Multi-Objective Decision Making: Criteria, Objective; Analytical Hierarchy Process: Sub-Criteria, Alternatives, Divided comparison, Spare analyses, Sensitivity analysis; Analytical Network Processes: Cluster, Element, Internal dependence, External dependence, Un-weighted Matrix, Limit matrix; TOPSIS: Positive ideal solution, Negative ideal solution; ELECTRE: Normalization, Concordance indexes, Dominancy; Utility Functions.

**HTK506                      Statistical Analysis for Air Traffic System                      3+0    7.5**

Using Statistical Analysis in Air Traffic System Problems; Data Collection and Analysis; Basic Statistical Concepts: Summary of numerical knowledge, Probability, Sampling, Point forecast, Period forecast, Hypothesis testing, Correlation and regression analysis, Variance analysis; Using Softwares in Analysis; Flight Data Statistics Analysis for Specific Airport: Data collection, Categorization, Analysis, Reports.

**HTK507                      Research Methods for Air Traffic System                      3+0    7.5**

History of Research on Air Traffic Control Problems: Researches in the USA, NASA and FAA, European research and strategies, Researches in Turkey; Research Requirements and Needs; Vision of Research and Development; R&D Politics and Strategies; R&D Methodologies; R&D Resources: Human resources, Finance, Technical infrastructure, Technology-Knowledge, Regulations, etc.; Innovation and Entrepreneurship; Industrial and Intellectual Property Rights; R&D Culture and Education; R&D Organization and Collaboration; Development of R&D Software; Strategic Management of R&D; Relationship Between R&D and Economic Growth; Examination of New Developments in Air Traffic System; Research Cases.

**HTK508                      Human Factors in Air Traffic Control                      3+0    7.5**

Discussion of Relationship Between Safety and Human Factors in Air Traffic Management; General Concepts and Definitions; Safety Culture; Controller Performance and Affecting Factors: Individual differences, Information processing, Situational awareness, Organizational climate, Team work, Stress, Shiftwork, Workload; Human Error: Importance of human error in aviation, Definition and classification; Error Models; Communication: Communication process, Communication models and modes; Working Environment: Ergonomics, Equipment and tools, Automation, Human-Machine interface; Human Factors in Future Systems; Examination of Cases Related to Human Factors .

**HTK509                      Real Time Simulation and Data Analysis in Air Traffic Control                      3+0    7.5**

Basic Concepts: Definition of simulation, Using simulation in aviation, Air traffic management, air traffic control services, Non-radar control, Radar control, Area control services, Approach control services, Aerodrome control services; Simulation: Simulation techniques, Simulation requirements, Stage of preparing simulation, Real-time simulation, Using real-time simulation in education, Using real-time simulation in research, Methods for simulation techniques in non-radar environment, Methods for simulation techniques in radar environment; Assessment: Assessment and rating in simulation education, Exercises evaluation and assessment.

**HTK510                      Advanced Aircraft Controls and Navigation I                      3+0    7.5**

Basic Concepts; Introduction to Aircraft Dynamics: Static stability and control, Dynamic stability and control, Lateral modes; Advanced Dynamics and Simulation Modelling for Aircrafts; Basic Navigation Techniques; Modern Control and Navigation Techniques for Air Vehicles: Linear techniques, Non-linear techniques and optimal control techniques, Sensor fusion, Modern avionics systems, Flight testing and system identification, Case studies and projects.

<b>HTK511</b>	<b>Air Traffic System and Evaluation Criterion</b>	<b>3+0 7.5</b>
Concept of System; Concept of Transportation ve Systems; Air Transportation System and Sub-Systems; Elements of Air Transportation System; Importance of Air Transportation System; Definition of Air Traffic System; Functioning of Air Traffic System: Inputs of air traffic system; Processes in Air Traffic System, Outputs of Air Traffic System, Environment of Air Traffic System; Genel Specifications of Air traffic System; Place and Importance of Air Traffic System in Air Transportation System; Air Navigation Service Providers; Figures of Merit for Air Traffic Control Systems; Comparison of Air Navigation Service Providers Based on Figures of Merit.		
<b>HTK512</b>	<b>Performance Based Navigation and Design Methods</b>	<b>3+0 7.5</b>
Basic Definitions, The Concept of Performance Based Navigation (PBN): Lateral performance, Vertical performance; Specifications of Navigation; Required Navigation Performance (RNP); Types of RNP; RNP in the En-route and Terminal Control Area, Infrastructure of Navigation Aids; The Application of Navigation: Route Design Based on RNP and Point Merge System (PMS); RNP and PMS SIDs and STARs; Application of Performance-Based Route Design in Simulation Environment.		
<b>HTK513</b>	<b>Quantitative and Qalitative Research Methods in Air Traffic Control</b>	<b>3+0 7.5</b>
Introduction; History of Scientific Research; Related Concepts and Definitions; Quantitative Research Methods; Qualitative Research Methods; Mixed Research Methods; Scientific Re-search Ethics and Integrity; Quantitative Research Methods in Air Traffic Control; Qualitative Research Methods in Air Traffic Control; Sample Problems and Solutions, Reporting and Presentation; Discussions.		
<b>HTK515</b>	<b>Human-Computer Interactin in Air Traffic Control</b>	<b>3+0 7.5</b>
History of Human and Computer Interaction; Related Concepts and Definitions; Human Per-ception, Ergonomics, Cognition, and Psychology; User-Centered Design; Task Analysis in User Interface Design; Principles of User Interface Design; Components of User Interface Design; Interface Programming; System Evaluation; Accessible Design; Ergonomic issues in air traffic control, Ergonomic issues for equipment, Ergonomic issues for displays; Related Studies.		
<b>HTK517</b>	<b>Scientific Research Projects in Air Traffic Control</b>	<b>3+0 7.5</b>
Aims of Scientific Research Projects; Introduction to Scientific Research Projects; Project Abstract; Project Purpose; Project Scope; Project Literature; Original Value of Projects; Pro-ject Management; Project Work Packages; Project Opportunities; Added-Value of Projects; Success Criteria for Project; Project Budget; Project Management; Analysis and Evaluation of Current Projects; Evaluation of Student Projects; Discussion of Projects.		
<b>HTK519</b>	<b>Dynamic Airspace Management</b>	<b>3+0 7.5</b>
Introduction to Airspace Concepts: Demand and Capacity Relations in Air Traffic System; Airspace Structures: Adaptable airspace, Generic airspace, Conventional low altitude airspace, High altitude airspace, Super-density airspace strudtures; Dynamic Air Space Structures: Dynamic route planning, Dynamic sectorization; Simulation and Modelling of Dynamic Airspace Structures in the Air Traffic System; Next-Gen and SESAR Examples of Dynamic Air Space Management.		
<b>HTK520</b>	<b>Air Traffic Management and Environmental Impacts</b>	<b>3+0 7.5</b>
ATM and Environmental Impacts: Understanding of environmental issues relevant to aviation, The impacts of aviation on air quality and climate change; ATM and Environmental Impacts: Operational parameters, Aircraft emissions, Noise, Environmental impacts around airports, Landing and Take-off cycle, Environmental impacts during approach and climb phase, Noise abadement procedures; Environmental Assesment: The calculation of aircraft emissions, Emission estimation tools; Flight Efficiency; ATM factors affecting flight efficiency, Horizontal flight efficiency, Vertical flight efficiency; Operational improvements: CDO and CCO concepts, Direct routing.		
<b>HTK521</b>	<b>System Analysis and Desing</b>	<b>3+0 7.5</b>
System Concept and General System Theory: Introduction and Definitions; Information System and Information System Types: Information System Development Process, System Analyst Duties and Capabilities; Preliminary Investigation and Feasibility Analysis, System Proposal Preparation and Presentation, Systems Analysis, Difference Between the System Life Cycle and System Development Methodology; Systems Design; Systems Implementation, Process of Transition to a New System.		
<b>HTK522</b>	<b>Airspace Capacity and Traffic Flow Optimization</b>	<b>3+0 7.5</b>
<b>HTK524</b>	<b>Use of Decision Models for the Solutions of Air Traffic Management Problems</b>	<b>3+0 7.5</b>



<b>HTK592</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>HTK601</b>	<b>Air Traffic Management and Aircraft Performance II</b>	<b>3+0 7.5</b>
Introduction to Air Traffic Management and Aircraft Performance ICAO Annex 6; g Factor; Maximum Structural Weights; Maneuvering Envelope; Engine Limitations; Take-off Performance and Limitations, The factors of effecting performance; Cruise Performance, Cruise speeds, Cruise range and endurance, The factors of effecting cruise performance; Landing Performance and Limitations, The factors of effecting landing; Weight and Balance, The determination of center of gravity; Mission Profile, Operational analysis of flight phases; Pre-flight; Determination of Fuel; Aircraft Airworthiness.		
<b>HTK603</b>	<b>Models and Simulation in Air Traffic Management II</b>	<b>3+0 7.5</b>
Simulation Models in Air Traffic System Problems; Fundamentals of Simulation; Definitions; Real Time Simulation, Fast time simulation; TAAM Tool; Fast Time Simulation Tools for Air Traffic System Problems, SIMMOD, Definition of air traffic system capacity problems, Analysis of traffic structure, Exportation of sample airspace and airport data to SIMMOD environment, SIMMOD modelling for air traffic flow, SIMMOD outputs, Analysis of outputs.		
<b>HTK604</b>	<b>Aviation Safety Management Application</b>	<b>3+0 7.5</b>
Basic Concepts: Safety Culture; Basic Safety Management Rules and Procedures; The Effects of Safety Management Applications on Operators; Incident and Accident Investigations; Safety Policy: Policy Statement; Organizational Structure and Procedures; Safety Promotion: Culture; Training and Communication; Risk Management: Risk Identification; Risk Mitigation; Risk Assessment; Human Factors and Error Models; Safety Assurance: Internal and External Audits; Corrective Actions; Assessment of Safety Management Efforts.		
<b>HTK605</b>	<b>New Concepts and Visions in Air Traffic</b>	<b>3+0 7.5</b>
Related Literature of Air Traffic Management, Literature databases, Projects, ATM research and development seminars; Milestones of Air Traffic Management; The Structure of Modern Air Navigation System; New Projects and New Concepts, SESAR, Next-gen; The Problems Classifications of Air Traffic System; Technical Solutions of Airspace Management and Airport Design, Solutions of flow management, Airspace management strategies		
<b>HTK606</b>	<b>Advanced Aircraft Controls and Navigation II</b>	<b>3+0 7.5</b>
Introduction to Aircraft Dynamics, Basic principles, General Equations of Unsteady Motion, Longitudinal stability, Lateral stability; Navigation, Navigation techniques; Evaluation of real traffic environment, Aircraft Control, Open and Closed Loop Controls, Effects of Human Pilots; Advanced Aircraft Dynamics and Simulation Models, Analysis of current models; Sample Application for Each Students; Real time simulation for sample models; Real Time Trajectory Generation and Analysis; Conflict Detection and Resolution Models.		
<b>HTK607</b>	<b>Measuring of Quality and Costumer Satisfaction in Air Traffic Control Services</b>	<b>3+0 7.5</b>
Basic Concepts: Service, Air traffic control services, Quality, Customer; Service Quality: Significance of Measuring Service Quality, Models in measuring of service quality, Total perceived service quality, SERQUAL, SERVPERF; Customer Satisfaction: Inner Customer, Customer, Customer loyalty, The relationship between satisfaction and quality; Measurement Technics: Methods of Accepted All Over the World, Use of scales, Making of scale and assessment.		
<b>HTK609</b>	<b>Air Traffic Management and Environment</b>	<b>3+0 7.5</b>
Fundamental Combustion Thermodynamics; Emission Types: NOx, HC and CO; Greenhouse Gases; Contrails; Emission Mechanisms; Emission Regulations; Emission Inventory Investigations: ICAO, SAGE, AERO2K, DLR; Emission Measurements; Emission Abatement Techniques in Engines; Emission Analyses with Flight Data; Engine Power and Emissions; Effect of Flight Phase on Emissions: Cruise, Climb, Descent; Emission Estimations Based on Airport; Effects of Continuous Descent Approach on Aircraft Emissions and Fuel Consumption; Noise.		
<b>HTK610</b>	<b>Cost Analysis in Air Traffic Management</b>	<b>3+0 7.5</b>
Concept of Air Traffic Management; Developments and Innovations in Air Traffic Management in the World and Turkey; Place of Air Traffic Management in Air Transport; Service Principles in Air Traffic Management; Air Traffic Service Providers and General Features; Costs of Air Traffic Service Providers; Air Traffic Service Charges; Users and Customers in Air Traffic Management; General Characteristics of Air Traffic Management Users; Economic Characteristics and Cost Structures of Air Traffic Management Users; The Impact of Air Traffic Management on User Costs; Efforts to Reduce Costs Related to Air Traffic Management.		
<b>HTK611</b>	<b>Artificial Intelligence Applications in Air Traffic Control</b>	<b>3+0 7.5</b>

Definitions and Introduction; Concept of Artificial Intelligence; Artificial Intelligence Technologies; Expert Systems; Structure of Expert Systems; Artificial Neural Networks and Learning; Multilayer Perceptron; Artificial Neural Networks Applications; Genetic Algorithms; Functioning of Genetic Algorithms; Fuzzy Logic; Artificial Intelligence Applications for Air Traffic Control Systems; Neural Network Applications for Air Traffic Control Systems; Genetic Algorithm Applications for Air Traffic Control Systems.

**HTK612                    Metaheuristic Algorithms for Air Traffic Control                    3+0   7.5**

Aircraft Sequencing and Scheduling Problem: Airspace structure, Airport runway layout; Separations; Sequencing strategies, Busy day analysis; Statistical distribution determination; Aircraft Conflict Resolution Problem: Conflict geometries, Aircraft performance categories; Vectoring techniques, Airspeed change, Altitude change, Holding point, Path Extension; Airport Gate Assignment Problem: Movement area layout, Number of gates and parking stands, Operational constraints; Mathematical Programming Methods; Simulated Annealing; Particle Swarm Algorithm; Genetic and Evolutionary Algorithms; Ant Colony Algorithm; Taboo Search Algorithm; Greedy Algorithms.

**HTK613                    Universal Design in Air Traffic Control                    3+0   7.5**

Definitions; Introduction to Universal Design; History of Universal Design; Related Concepts and Definitions; Equitable Use; Flexibility in Use; Simple and Intuitive Use; Perceptible Information; Tolerance for Error; Low Physical Effort; Size and Space for Approach and Use; A Community of Learners; Learning Climate; Applications; Universal Design Approach for Air Traffic Control Systems; Analysis and Discussions.

**HTK615                    Critical Questioning in Air Traffic Control                    3+0   7.5**

Definitions and Aims; Introduction to Critical Thinking, History of Critical Thinking; Foundations of Critical Thinking; Creative Thinking; Higher-Order Thinking; Reasoning; Problem Solving; Decision Making; Analysis; Synthesis; Evaluation; Socrates Questioning; Decision Making Structure for Air Traffic Control Systems; Problem Detections and Solution Methods; Analysis of Solution Methods; Evaluations.

**HTK692                    Seminar                    3+0   7.5**

**HTK790                    Thesis                    0+1   30.0**

**HTK890                    Thesis                    0+1   30.0**

**HTK890-0                    Thesis (Thesis Proposal)                    0+1   30.0**

**içT503                    Design Theory I                    2+0   7.5**

The Design Concept; Design history, The Historical requirements, the contemporary formation The periodical Design, Knowledge, the knowledge theories, Design. The technical-technological relations, Design periodical Levels, Bauhaus and The faults, The Deficiencies. London Design Conference; Design-Art Conflict Design Theories; Dialectic Design, Pragmatics, Performance Tree Theory, Indicator Science Theory, Analytical Theories, Traditional Theories, The Basic Concept of The Design; The period the quantity , the quality, The phenomenon, the concept, the content, the abstract, the abstraction, the inspiration, the inversion. The creative, the aesthetic object, the aesthetic exceeding, The entropy, Eurytm. The Design-Site Requirements; The Design-Ecology, The Design-Usefulness The Site; The past, the present, the future-Designs.

**içT504                    Design Theory II                    2+0   7.5**

The analysis of the design period. The Design Steps; The problem, the Procedure and the method related to the problem. Collecting Again; The Research and the Sources Finding. Designing. Intellectual Animations, the Intellectual Simulation Techniques, Finding-Inspiration. Inspiration Finding Methods; Model (Design Summery), Model Development, Decision-Production; Perception Concept, General Approaches, Jung Concept, Freud Concept, Pavlov Concept, Gestalt Concept. Inventional Methods; Analogies, Brain Discussion, Synectic Technique, Lateral Technique. Design and Modern Trends; Performance, Happenings, Process Art, Action Art, Installation, postmodernism and design.

**içT507                    Furniture design and Conceptual Approaches                    3+0   7.5**

Different design methodologies on furniture design. Relation between designer-user-manufacturer according to manufacturing process. Interface between user and space.

<b>içT513</b>	<b>Design Studio I</b>	<b>3+0 7.5</b>
Forming a Design Problem that is Caused by Special Conditions with Different Reasons, Independents From Space, Time and has a Theoretical Base; Analyzing this Design Problem through Different Approaches and Theories that would be Gotten by Literature Researches; Developing Proposal for Solution to this Defined Design Problem through a Contemporary Approaches; Computer Aided Design and Presentation.		
<b>içT514</b>	<b>Design Studio II</b>	<b>3+0 7.5</b>
Forming a Design Problem through an Approach that Criticises Present Physical Environment, Defines Strong Spatial Relations; Analyzing this Design Problem through Different Approaches and Theories that would be Gotten by Literature Researches; Developing Proposal for Solution to this Defined Design Problem through Contemporary Approaches; Computer Aided Design and Presentation.		
<b>içT517</b>	<b>Professional Ethics</b>	<b>3+0 7.5</b>
Definition and Fundamentals; Ethics in Society and Universal Values; Definition of Social Responsibility; Ethics in Interior and Furniture Design: Ethical Values in Design Process, Ethical Values in Application Process, Ethical Values in Among Colleague; Privacy: Privacy and the Sanctity of Private Lives; Ethics in Visual and Print Media for Interiors; Principles in Professional Ethics.		
<b>içT518</b>	<b>Continuity in Interior and Environmental Design</b>	<b>3+0 7.5</b>
The concept of sustainability: Reasons, which make this concept; change in the public sense, change in the physical conditions and the reflections of these to the design. The need of sustainability in the physical environment; theories of urban design, Heidegger and the philosophy of architecture, Shultz and the theory of place, Lynch and the image of the city. The lesson will be supported with research, develop and evaluate in Eskisehir example.		
<b>içT519</b>	<b>Psychology and Space</b>	<b>3+0 7.5</b>
Psychology-Space Relations; Need to Territorial Space, Personality-Identity, Personal Distance, Social Distance, Territory, Privacy, Psychology of the User: Space Effects People, Examples on the Topic, House, Sacred Place and Working Space, Commercial Spaces; Analysis of Different Spaces and Users on this View; Psychology of the Designer, Different Designers and Their Approach.		
<b>içT521</b>	<b>20th Century Interior Design History</b>	<b>3+0 7.5</b>
Industrial Revolution and social-economic and technological changes in this period. Modernism (1856-1914) Avant-Garde (1915-1933)- Art Deco (1925-1945) After War Period (1945-1960) Anti Design Period (1965-1976) Postmodernism and influences of these periods on interior design.		
<b>içT524</b>	<b>Human/User Centered Space Design</b>	<b>3+0 7.5</b>
Contemporary Approaches to the Concept of Design: Origin of design, Historical overview of the perception of design; Design as a Process; Design Thinking: Design thinking in the historical process; Elements of Design Thinking; Human/User-Centered Design: User experience; Design Experience; Contextual Analysis of Factors Affecting the Experience; Designing Experience Environments: Analysis of theoretical approaches and case studies concerning experience environments.		
<b>içT525</b>	<b>Material Design</b>	<b>3+0 7.5</b>
Main Concepts of Material Design: Material, Component, Structure; Use of Materials in Interior Design: Finishing, Lighting, Equipment, Furniture; Material Types: Organic materials, Inorganic materials, Composite materials; Material Relations: Material and functionality, Material and aesthetics; Design Approaches: Modular design, Hybridization, Functional improvement, Aesthetical improvement; Techniques in Material Design: Molding, Forming, Subtraction, Addition, Multiplication, Disassembly, Compacting, Curing, Melting, Finishing.		
<b>içT527</b>	<b>Computer Aided Manufacturing and Practice</b>	<b>3+0 7.5</b>
<b>içT528</b>	<b>Composite Material Technology</b>	<b>3+0 7.5</b>
Research of Wooden Composite Materials Used in Interior Spaces; Plates produced by making wood chips or small-sized strips, Plates produced by transforming wood into fiber; Research of Plastic and Wood Composites: Examination of Layered Composite Materials: Examination of Laminated Composites: Test Techniques in Composite Materials: Production Regulations of Carbon Composite Materials: Use and Research of Bearing Wood Composites in Building Sector: Investigation of Adhesives and Binder Technologies Used in Composite Production: Concrete in Construction Sector and Its Application Areas: Investigation of Production Technology of Ceramic Matrix Composites.		
<b>içT529</b>	<b>Design Studies</b>	<b>3+0 7.5</b>

Design Problems; Design and Design Processes: Designer approaches to solving design problems, Innovative design methods; Design and Innovation relationship; Design Thinking; Empathise, Define, Ideate, Prototype, Test; Designer Responsibility; Social Responsibility Dimension of Design; Design Management: Criticism in the fields of design management, development of communication language used by management and design fields, interdisciplinary design management and decision making ability.

**içT531 Interior Space 3+0 7.5**

Interior Space Ergonomics: Lighting Methods; Design Problems; Design and Design Processes: Designer approaches in solving natural lighting problems, Innovative design methods in artificial lighting; Relationship between Anthropometry and Design: Kitchen Ergonomics: Relationship between Material Size and Ergonomics: Relationship between Noise and Acoustics in Interior Space: Furniture Ergonomics and Design Dimensions: Total Quality Management and Ergonomics: Office Design and the Concept of Ergonomics: Criticism of existing offices, Examination and interpretation of open office designs: Ergonomic Studies Related to Community and Space Psychology in the Pandemic Period.

**içT533 User Experience Research 3+0 7.5**

Design Concepts: Design, User, Design process, Design product; Current Design Approaches and Themes: Human (User)-Focused Design; Participatory design; Flexible design; Sustainability; Design for well-being, Inclusive design; User Research: Definition and approaches to user research, Quantitative and qualitative methods in user research, Ethical codes in user research, Analysis of user research, Reporting of user research; Research-based design; Developing a research-based interior design project proposal.

**içT552 Corporate Identity and Space Design 3+0 7.5**

Identity, Perception and Meaning Concepts; Symbolic Aesthetics and Expansions; Corporate Identity: The concept of corporate identity, The importance of corporate identity, Development of identity, Applications in the historical process, Corporate image and strategy; Brand and Space Experience; Reflection of Corporate Identity to Visual Identity: Visual application guides, Place identity, Architectural and interior design identity; Commercial Space Analysis: Commercial spaces offering service, product and experience.

**içT592 Seminar 3+0 7.5**

**içT601 Design Researches Workshop I 3+0 7.5**

Conceptual, And Theoretical Approaches To Design Concept: Historical view to fundamental questions of the design; Interdisciplinary relations, and interactions, Intellectual infrastructure of the design, Problems And Expansions To Be Occurred In The Near Future: Critical readings, Making infrastructure to an article via researching, determining, and evaluating design problems.

**içT602 Design Researches Workshop II 3+0 7.5**

Interaction of technology, and design concepts: Interaction of technology and human, design concept, development process of the design and usage of the technology for the application, New Tendency On The Design: New concepts, approaches, and production facilities, Making infrastructure to an article via researching, determining, and evaluating design problems.

**içT603 Spatial Relationships and Interfaces 3+0 7.5**

Theoretical approach on space and relations: Researching relationships between humans and relationship between places together through sociology, Relation, contradiction and harmony concepts; Reading of existing physical environment and place: Interdisciplinary different approaches and different readings, Historical and cultural continuity concepts and contributions of historical process to spatial reading, Requirements of multi-aspect readings; spatial relationship and spatial continuity: Different dimensions of spatial relationship, Concepts of spatial continuity and innerface at different scales, All innerfaces from scale of city to interior spaces, places, doors, windows, walls, halls,city walls, streets, avenues, etc.; Importance of spatial continuity and concept of integrated design at the spatial design,Importance of evaluating the interior design with these approach; Supporting this lesson with visual material and studies that are made by students through decisions and evaluations at the different scales.

**içT605 Globalisation, Identity and Design 3+0 7.5**

Culture as a dimension of globalisation. Importance of the culture in terms of the globalisation. Making infrastructure of the globalisation in the process of the Modernism-Postmodernism. Global culture and efficiency of the design. Importance of the global ethic, social ethic, cultural ethic in the design process. Culture-Identity and Design relations. Effects of the globalisation from personal identity to social identity and identity problem on design approaches.

**içT606 Aesthetic Criticism on Interior Design 3+0 7.5**

Appreciation judgement and norms (emotional, subjective, enjoyment, like), Value judgment and norms (social, objective), Reflection (Success at the reflecting truth, Success at reflection effect.), Expression (Success at expression and transfer, Originality, Sincerity, The power of the dream, Social, moral value of the reflex.), Aesthetic (Limitation with religious, moral, political, traditional values, limitation with only aesthetic.), Formal criticism, "New criticism" on Interior Design, Criticism in terms of design principles. (Balance, unity, wholeness, harmony, domination, reconciliation, originality.) Constructivist criticism (personal constructivism, social constructivism), Postmodern criticism (Postmodern information "chaos", Postmodern present, "Endness", Postmodern constructivism, "Isolation", Criticism of Noncriticism, ?Aesthetic and Nonaesthetic? dimensions and criticism.

**içT607 Earthquake Security and Space Design 3+0 7.5**

Living With Earthquake Consciousness: Earthquake security and space design; Nonstructural damages and life safety, Historical analysis based on concepts of spatial relationships and innerfaces, and house to reduce the nonstructural damages: Houses in ancient settlement, Houses in traditional Turkish city settlement, The effects of westernization period on the house space design and its usage, Changings on houses in the period of the republic, evaluation, conclusion, and suggestions for making data to the design problem.

**içT609 Analytical Approach on Interior Design 3+0 7.5**

Analytical Method: Definition, Process, Approaches in the historical process, Fields of the usage and the technics; Part-Whole with time, flexibility, structural component, short-term transformations, analysing of evolutionary long-term nontransformation principle, Analytical Evaluation Of The Visual And Spiritual Approaches On Interior Design; Analysing and Evaluating data.

**içT611 Consumption and Design 3+0 7.5**

Relationship between Production, Consumption and Design: Effects of production on design, Effects of consumption on design, Effects of design on consumption; Relationship between Producer, Consumer and Designer: Common design, Custom design, User design; Production Types: User production, Custom production, Mass production; Relationship between Consumption and Needs; Relationship between Consumption and Marketing; Need for Change in Products: Consumer trends, Market trends; Product Life Cycle: Production, Consumption, Disposal; Alternative Methods in Product Change: Repair, Do it yourself, Design it yourself, Reuse, Upcycle, Recycle.

**içT612 Formation of Determination of Semantic Quality in Interiors 3+0 7.5**

Interior Space: Definition, Components, Physical and semantic limitations; Semantic Subjectivity and Objectivity; Psychological Factors on Social and Cultural Body; Developing New Methods in Interior Design; Use of New Methods in Data Analysis.

**içT613 New Museology-Cultural Heritage and Museum Space Design 3+0 7.5**

Conceptual Change of Museum and Its Definition in the Historical Process: The concept of new museology: current expansions of museology science; Contemporary Museum and Its Relations with Cultural Heritage: Concepts of tangible and intangible cultural heritage and their effects on museum space design; Diversity of Interventions for Adaptations of Cultural Heritage Buildings to Contemporary Museum Function; Designing Museum Space as an Experience Environment: Design input for the museum space; Changing Design Approach for Museum Space from Modern to Postmodern Period: Characteristics of the concept of postmodern museum and analysis of other innovations related to understanding of contemporary museum.

**içT615 Lighting Design and Technology 3+0 7.5**

Definition of General Concepts of Interior Lighting Technology: Lighting Arrangements; Designer approaches in solving natural lighting problems, Innovative design methods in artificial lighting; Relationship between Lighting and Design: Effective Use of Lighting and Energy: Relationship between Visual Comfort and User: Relationship between Lighting and Sustainability in Interiors: Lighting Ergonomics and Design Measures: Design of Technical and Aesthetic Lighting Arrangements: Office Lighting and Application Designs: Kitchen Lighting and Criticism to Existing Designs: Use and Interpretation of Natural Lighting Technology with Sustainable Techniques: Light Pollution.

**içT616 Bending Furniture Design and Manufacturing Technology 3+0 7.5**

Definition of General Concepts of Bending Furniture: Bending Furniture Regulations; Using the steaming method, using lamination technology; Mechanical Properties of Bending Furniture: History of Bending Furniture and Its Effects in Our Country: Types of Solid Wood Used in Bending Furniture Technology: New Design Approaches in Bending Furniture: Design Analysis in Bending Furniture Examples Made in the 1900s: Modularity and Sustainability in Bending Furniture: Preparing a New Bending Furniture Design.

**içT617 User Experience Design Research 3+0 7.5**

User Experience Design; User Design Experience Process Components; User's Characteristics and Requirements; Human-Centered Design; Research Fundamentals and Methods: Quantitative research designs, Qualitative research designs, Mixed

research designs, Design based research and models; Usability Fundamentals and Testing, Prototyping; A/B Testing / Optimization; Current User Experience Research.

**içT619 Methodology for Design Research 3+0 7.5**

Research Definition and Purpose, Types and Paradigms of Research, Formulating Questions and Hypotheses, Sampling, Design, Method Selection, Literature Review, Source Evaluation, Bibliometrics, Metric Analysis, Quantitative Research: Surveys, Scales, Experimental Designs, Data Collection and Analysis, Qualitative Research: Interviews, Focus Groups, Ethnographic Observation, Ethics and Reporting.

**içT621 Housing and Changing Boundaries of the House 3+0 7.5**

Home, House and Housing; Forces Determining the House Form: Physical Forces, Social Forces; House and its environment; Boundary and the house, Inside-outside, inside-inside relationships, Historical development and borders; Conditions of Modernity: House and housing during the first half of the 20th century, House and its changing boundaries, Period samples; Modern Movement in Turkey: Changing relationships different examples of the period, Bahçelievler sample; Literature Studies and Spatial Analysis with Students.

**içT692 Seminar 3+0 7.5**

**içT790 Thesis 0+1 30.0**

**içT890 Thesis 0+1 30.0**

**içT890-0 Thesis (Thesis Proposal) 0+1 30.0**

**iLT551 Digital Radio and Podcast Applications 3+0 7.5**

What is a podcast? Development stages of podcast publishing; The use of podcast for educational purposes; Podcasts in the context of journalism; Review of podcasts on health, personal development, culture and arts; Interview in podcast broadcasts; Technologies used in podcast production; Topic selection and content creation; Practical podcast preparation and use of broadcasting platforms.

**iLT553 Data Mining and Applications 3+0 7.5**

Introduction to Data Mining; Data Mining Basic Concepts; Data Preprocessing Methods; Data Mining Application Environments: R Studio, Weka, Python, Matlab; Classification Algorithms, KNN Algorithm, Naive Bayes Algorithm, Decision trees; Classification Algorithms Application; Clustering Algorithms, K-means Algorithm, Hierarchical clustering; Cluster Algorithms Application; Association Rule, Market Basket Analysis, Apriori Algorithm; Association Rule Application; Introduction to Suggestion Systems, Suggestion system algorithms; Recommendation Systems Digital Marketing Applications; Data Mining in Social Media: Definition; Application areas; Application examples.

**iLT554 Digital Citizenship 3+0 7.5**

Impacts of digital technologies; Technology in work, education, health and relationships; Impacts of digital technologies; Environment, data, social media and technology in virtual environments; Digital citizenship indicators; Access and inclusion; Learning and creativity; Media and information literacy; Active participation, communication and collaboration; Ethics and awareness; Rights and responsibilities; Developing and using digital content; Privacy and security; Problem solving; Group Studies and Presentations.

**iLT555 Digital Audio Technology 3+0 7.5**

Definition and Basic Characteristics of Sound; Analog and Digital Audio Signal; Basic Characteristics of Digital Sound; Structural and Directional Characteristics of Microphones; Types of Audio Cables; Basic Working Principles of Sound Mixers; Recording Digital Audio; Digital Audio Formats; Editing of Digital Sound; Digital Sound Effects; Evaluation of Student Projects.

**iLT556 Big Data Applications 3+0 7.5**

Basic Concepts of Big Data: Big Data, Artificial Intelligence, Data Mining; Big Data Technologies and Application Areas; Big Data processing strategies; Big Data Economy: Advertising and Big Data, Intelligent Life Systems and Big Data; Big Data Application Channels; Big Data Models and Working Principles.

**iLT557 Digital Publishing Applications 3+0 7.5**

Publishing History and Digital Publishing; Types of Digital Publications: magazines, books, newspapers, catalogues; Digital Content Reader Devices; Digital Broadcast Formats: fixed, fluid, interactive; Digital Rights Management; Digital Publication Design: elements and principles; Digital Broadcast Production Tools; Fundamentals of Digital Broadcast Production; Multimedia Elements in Digital Broadcast Production; Digital Broadcast Production; Digital Content Publishing Environments; Digital Broadcast Marketing: planning; Digital Broadcast Marketing: tools and mediums; Digital Librarianship.

**iLT558 Statistics for Social Sciences 3+0 7.5**

The Role of Statistics in Behavioral Research, Research Designs, The Relationship Between Descriptive and Inferential Statistics, Research Designs in Behavioral Sciences, Types of Research Designs, Hypotheses, Variables, Quantification of Variables, Descriptive Statistics for Univariate Distributions: Frequency Distributions, Measures of Central Tendency and Variability, Normal Distribution, Statistics for the Joint Distribution, Statistical Inference by Intuition and in Behavioral Research, Hypothesis Testing, Error in Statistical Inference, Probability Theory and Mathematical Distributions, Decisions, Statistical Tests for Between-Groups/Within-Groups Design.

**iLT559 Media Analytics 3+0 7.5**

Introduction to New Media Analytics; Types of Analytics: Social Media Analytics, Web Analytics, Digital Broadcast Analytics; Basic Concepts: Client and Server Logs, Digital Data, Social Media, Value Creation; Individual-Institutional Measurement and Analytics; Applications of Web Analytics: Web Sites, Optimization, Performance, User Interactions, User Behavior, Comparison, Segmentation; Performance Indicators and Analytical Techniques: KPIs; Reporting of Analytics; Dashboards; Analytical Tools.

**iLT560 Digital Journalism 3+0 7.5**

Journalism, Digital Journalism and New Media; Changes in Journalism with Digitalization: History of digital journalism, Independence in digital journalism, Media convergence and journalism; The role of journalists in the production of meaning in the new media environment, the qualifications and skills expected of journalists; Legal Obligations in Digital Journalism; News in New Media; Data Reporting.

**iLT561 Digital Media and Artificial Intelligence 3+0 7.5**

Digital Media and Artificial Intelligence Basic Concepts: Digital Transformation and Communication, The Role of Artificial Intelligence in Media, Areas of Use of Artificial Intelligence in Media; Fundamentals of Digital Media and Artificial Intelligence: Machine Learning, Digital Media Types and Features, Role in Data Collection, Analysis and Communication; Artificial Intelligence and Content Production: Automated Content Generation, Chatbots and Communication, Synthetic Media and Ethics; Personalization and Consumer Behavior: Artificial Intelligence Supported Marketing, Artificial Intelligence in Digital Advertising, Content Production with Artificial Intelligence, Content Production and Management Processes, Content Analysis; Artificial Intelligence and Innovation, Innovative Applications, Future Trends; Media Content Development.

**iLT562 Web Design 3+0 7.5**

Web Design Basic Concepts: Web concept, Internet environment, Basic HTML structure; Introduction to HTML and Basic HTML Concepts; Introduction of HTML Editors: HTML editor applications, Online editor environments; Basic HTML Tags: Text tags, Link tags, Image video tags; HTML Text Styles; HTML Table Structure: Table tags; Table styles; Creating a table; HTML Form Design: Form tags, Form properties, Form creation; HTML Form application; Using Css with HTML: What is Css, Css definition methods; Css Applications; Working with Bootstrap CSS Framework; Using Javascript with HTML: Javascript language, Javascript definition; Javascript Applications; Web Application Examples.

**iLT563 Media Theories and Digital Literacy 3+0 7.5**

Mass Communication Process and Concepts; Concept of Digital Media; Development of the Internet, Traditional Media and New Media Differences, Online Communication, New Media and Information Society, Social Media Platforms as a Democratic and New Public Space, Citizen Journalism; Terms and Concepts in New Media; Virtual Reality, Virtual Communities, Network Society, Social Media, Digital Activism, Interaction, Social Media Phenomenon; Definition and Importance of Media Literacy; Security Threats and Precautions in Social Media, Cyber Crime and Cyber Bullying, Misinformation and Disinformation, Hate Speech and Privacy in New Media, Digital Literacy and Its Components, New Media Literacy and Critical Thinking.

**iLT564 Social Networking Approaches 3+0 7.5**

Social Networks: network science, components and measures; Network Theories: strength of weak ties, small world; Network Theories: structural gaps, balance/cognitive dissonance; Network Models; Network Types; Network Effects and Social Capital; Social Networks and Communication; Digital/Media literacy and fluency; Online Social Networks; Social

Networking Approaches; Social Network Analysis: software and data collection; Social Network Analysis: analysis and network visualization; Net Weaving; Social Network Synthesis.

**iLT565 Digital Visual Culture and Applications 3+0 7.5**

Visuality and Culture: Visual, Cultural, Visuality, Art, Culture, Technology and Visuality; Photography, Cinema, Video, Visuality Today, Media, New Media, Digitalization, Digital Visual Culture, Virtual Technologies, Virtual Environments, Visual Literacy, Visual Communication, Static and Motion Graphic, Visual Communication Design Language and Aesthetic Elements, Visual Communication Design Professional Tools, Online Helpful Visual Design Tools, Making Applications with Visual Communication Design Tools.

**iLT566 Digital Corporate Communication 3+0 7.5**

Basic Theories On Digital Communication; Digital Transformation and Corporate Communication; Corporate Communication and New Media; Transformation in Public Relations and Advertising; Digital Advertising, E-Mail Marketing; E-Commerce And Mobile Marketing; Digital Communication Campaign Strategy Formulation; Corporate Social Networks; Digital Content and Creativity; Digital Social Responsibility Projects; Digital Corporate Communication Campaign Management; Crisis Communication in the Digital Age; Project Presentations.

**iLT567 Digital Sociology 3+0 7.5**

Introduction to Digital Sociology; Digital Panopticism and Digital Society: The privacy problem of social media; Digital Identity; The Effects of Technology and Gender in Sociological Imagination; Rethinking Space In The Digital Age; Disparity In the Network Society: Evaluating theories of disparity in the digital age; The Role of Digital in Social Movements; Different Topics in the Digital Age: Digital health, digital education; Digital Storytelling Presentations.

**iLT568 Digital Game Design 3+0 7.5**

Digital Games; Game Engines; Introduction to Game Design; Game Controls; Animation; Visual Effects; Character and Asset design; Design of decor and vehicles; Open Source Modeling Program; Materials and rendering; Animation modules; Transition from Modeling Program to Game Engine; Game Level Design; Interface Design: Opening screen, Cinematics, Interface and interaction; Points system, Rewards and portable items.

**iLT569 Digital Media Ethics and Law 3+0 7.5**

Ethic; Communication Ethics; Ethics of Journalism; Hacker Culture and Technology Ethics; Digital Media and Ethics: Confidentiality of news sources in the digital age, Digital technologies news photography, Privacy of private life and digital privacy, freedom of expression and hate speech, presentation of alternative realities, Distinction between "private and usual public" aspects of people The anonymity of the participants; Data Ethics: Data collection from social media. Digital Media and the Law: Cyber crimes, the protection of personal data, intellectual property rights.

**iLT571 Research Methods and Applications in Communication Studies 3+0 7.5**

Science: Scientific Method, Scientific Research, Research Paradigms; Scientific Research Process: Problem Selection and Identification, Purpose, Importance, Assumptions, Limitations, Definitions; Related Literature Review: Introduction of Research Databases, Research Methods: Quantitative Research Method, Qualitative Research Method, Mixed Research Method, Scientific Research Process: Universe and Sampling, Data Collection Techniques in Qualitative and Quantitative Research, Features to be found in Measurement Tools: Validity; Reliability, Analysis in Quantitative and Qualitative Research, Reporting of Scientific Research; Credibility and Ethics in Qualitative Research, Examination of Published Qualitative Research Reports.

**iLT572 Digital Media and Content Development 3+0 7.5**

Digital Media and Content Development Basic Concepts: Digital Media Platforms, Content Types, Features; Target Audience Analysis: Target Audience Identification, Target Audience Expectation Analysis; Content Strategy Development: Planning, Strategic Intent, Themed Message, Digital Media Tools and Features; Research and Trend Analysis: Digital Platform Trends and Features; Visual Content Development; Publication Planning Strategy Development; Publication Calendar, Process Management and Application; Performance Analysis: Calculation of Interaction Rates, Data Interpretation and Evaluation.

**iLT574 Creative Scriptwriting and Digital Storytelling 3+0 7.5**

Basic Competencies and Features for Creative Writing; Elements that Improve and Obstruct Creativity, Basic Elements and Features of Narrative Expression, Theme Selection and Topic, Creating a Plot, Types of Conflict and Contradictions in the Story, Character Creation, Use of Space and Time in the Story, Function of Dialogue and Speech Pattern in the Story, Storytelling Techniques, Storytelling Application to Digital, Visual Language and Culture, Visual Storytelling, Visual Narrative Structure, New Media Technologies, Digital Story Types, Material Selection in Digital Story, Digital Story Design and Creation Process.

**iLT599 Term Project 3+0 0.0**



Designing a Scientific Research Project in a Selected Field; Reviewing the Literature and Determining the Research Topic; Determining the Problem Status; Determining Possible Research Questions; Determining the Method; Determining Data Collection Tools; Data Collection; Analyzing and Reporting the Data; Evaluation; Reporting and Finalizing the Project; Presenting the Project.

**iN\$503                      Advanced Foundation Engineering                      3+0   7.5**

Subsurface Exploration; Retaining Walls; Sheet Pile Walls; Braced Cuts; Piles for Lateral Deformation; Anchored Wall; Shallow Foundations; Footing; Mat Foundations; Deep Foundations; Pile Foundations; Drilled-Pier and Caisson Foundations; Foundations on Difficult Soil; Reinforced Earth Structures; Soil Improvement Techniques.

**iN\$504                      Soil Modeling                      3+0   7.5**

Introduction to Soil Modeling; Stress; Stain And Effective Stress; Elastic and Plastic Deformations; Yielding; Hardening and Plastic Flow; Ideal Elastic Behavior; Least-Plastic Behavior; Equilibrium and Compatibility; Relationships Between States of Stress and States of Strain; Two Dimensional States of Stress; Mohr's Circle of Stress; Principal Planes and Principal Strain Paths and Invariant; Elastic-Plastic Constitutive Modeling Soils; Soil Plasticity, Failure Criteria; Cauchy Elasticity and Modeling; Hyper Elasticity and Modeling; Critical State Model.

**iN\$505                      Slope Stability Analysis                      3+0   7.5**

Introduction to Slope Stability; Sampling and Laboratory Testing For Studies of Slope Stability; Field Assessment of Slope Stability; Methods of Stability Analysis; Slope Instrumentation and Monitoring; Types of Instrument; Planning and Design of the Monitoring Systems; Improvement of Slope Stability; Unloading; Buttrressing; Drainage; Reinforcement; Retaining Walls; Vegetation; Surface Slope Protection; Soil Hardening; Rock Slope Stabilization Methods.

**iN\$508                      Stochastic Methods in Hydrology                      3+0   7.5**

Principles of Probability Theory; Determination of Probability of Coincidence Events; Distribution of Variability Coincidence; Distribution of Frequencies; Principles of Statistics; Probability Distribution Function; Sampling Distributions and Statistic Hypothesis; Control of Hypothesis; Correlation and Regression; Hydrologic Processes; Classification of Stochastic Processes; Models of Flow Series; Stochastic Methods of Conservation Reservoir

**iN\$509                      River Hydraulics                      3+0   7.5**

Channel Flow and Its Classifications; Description; Types of Flow; River Morphology and Regime; River Survey; Open Channel and their Properties; Kind of Open Channel; Channel Geometry; Geometric Elements of Channel Section; Velocity Distribution in a Channel Section; Energy and Momentum Principles; Energy in Open Channel Flow; Specific Energy; Specific Force; Critical Flow; The Section Factor for Critical Flow Computation; Control of Flow; Flow Measurement; Flow Measuring Structures; Basic Parameters of Two-Phase Flow; Properties and Motion Forms of Fluid and Sediment; Dimensionless Parameters of Two-Phase Flow; Determination of Discharge of Bed Load; Suspended Load and Total Sedimentation; Sand Waves.

**iN\$510                      Economic Analysis of Engineering Systems                      3+0   7.5**

Goals of Engineering Economy; Usage of Resources; Basic Concepts of Engineering Economy; Determination of Choices; Unknown's And Risk; The Effect of Time at Engineering Economy; Parameters of Economic Analysis; Principles of Economic Comparison; Benefits; Determination of Benefits; Expenses; Environmental Impact Assessment; Studies of Environmental Impact Assessment; Optimization; Decision.

**iN\$511                      Flood Control                      3+0   7.5**

Flood Types; Historical Information About Floods; Damages and Losses Brought About By Floods; Relation Floods to Time; Flood Warnings; Remedies of Defense From Floods; Mathematical Modeling of Floods; Rainfall-Runoff Analysis; Infiltration Models; Hydrograph and Derivation of Unit Hydrograph; Flood Routing Trough Reservoir and Channels; Design of Spillway; Flood Measurement; Economic Analysis of Flood Control Project.

**iN\$513                      Dams                      3+0   7.5**

Introduction; Aims of Dams Construction; Hydrology in Dams; Element of Dam Engineering; General; Embankment dam and Types and Characteristic; Concrete Dam Types and Characteristic; Spillways; Outlets and Ancillary Works; Site Assessment and Selection of Dam Type; Load on Dams; Dam Outlet Works; Introduction; The Design Flood; Flood Routing; Sedimentation in Reservoirs; Cavitation; Gates and Wolves; Classification of Gates; Crest Gates; Hydrodynamic Forces Acting on Gates; Spillway; Motion of the Sediment in Dams; Properties of Rock in Foundation; Estimation of Dam Reservoirs Volume.

**iN\$514                      Planning and Design of Dams                      3+0   7.5**

Introduction; Classification of Dams; Parts of Dams; Planning of Dams; Feasibility Study; Planning Study; Construction of Dams; Evaluation of Time Schedule and Required Equipment; Diversion of River Flow; Foundation Treatment; Concrete Gravity Dams; Stability Criteria; Forces Acting on Gravity Dams; Arch Dams; Type of Arch Dams; Design of Arch Dams;

Buttress Dams; Design of Buttress Dams; Effect of Dams to Environments and Ecology; Sediment in Dams; Dam Geology; Dam Foundations; Derivation; Outlet Structures; Spillways; Dams Models; Heightening of Dams; Maintenance and Operation of Dams; Measurement Made on Dams and Failure of Dam.

**iN\$519                      Water Resources Systems    3+0 7.5**

Water Resources; Introduction; Historical Perspective on Water Resources; A Perspective on Earth and Universe; Water in the Earth Atmosphere System; Principles of Flow of Water; Water Economics; Water Law; System Analysis; Uncertainty and Reliability Analysis; Water Resources Quality; Water Quality; Lakes and Reservoirs; Groundwater; Wetland; Water Resources Supply System; Surface Water Resources System; Groundwater System; Water Treatment System; Water Distribution; Wastewater Collection Systems; Irrigation Systems; Importance of Water Resources Development; Sources of System and System Analysis; Cost-Benefit Analysis; Classical Optimization Methods; Linear Programming; Dynamic Programming; Simulation Sampling Methods; Multi-Purpose Programming; Decision Theory; Cost-Benefit Analysis According to Project Objectives and Feasibility Study.

**iN\$520                      Advanced Groundwater Hydrology    3+0 7.5**

Definitions and Equations of Groundwater Flow; One and Two Dimensional Steady Groundwater Flows and Their Analytical Solutions; One Dimensional Unsteady Groundwater Flows and Their Analytical Solutions; Numerical Solutions of Flow Equations: Finite Difference and Finite Element Methods; Unsaturated Flows Well Hydraulics; Introduction to Groundwater Contaminant Transport.

**iN\$522                      Matrix Methods for Computing Structural Systems    3+0 7.5**

Structural Analysis Versus Actual Response; Principle of Virtual Displacements; Principal of Virtual Forces; Betti's Law; Influence Coefficients. Force and Displacement; Transformations; Transformations of Member Flexibility and Stiffness; Fixed end Forces; Automated Matrix Displacement and Force Methods of Structural Analysis; Releases; Substructures; Nonlinear Analysis; Introduction To Finite Element Method (R).

**iN\$526                      Construction Management    3+0 7.5**

General Definitions and Introduction to Construction Management; Organizations of Construction Companies; Construction Field Management; Organization and Documentation; Project Management and Organization; Project Planning; Resource Analysis and Resources Management; Construction Machinery Usage; Internal Project Communication; Risk Management; Construction Bankruptcy; Construction Contract Systems and Type of Construction Contracts; Disagreement and Resolving Methods; Labor Relations and Labor Safety.

**iN\$528                      Construction Cost Analysis and Estimating    3+0 7.5**

Introduction to Construction Cost; Bidding Legislation: Bidding law and Applications; Bidding Types; Qualification for Projects; Preparing Optimum Bid Proposal; Bid Bond; Performance Bond; Exact Ending Cost; Project Acceptance; Punishment Application; Blueprint Reading; Quantity Takeoff; Estimate Application; Bidding Information Systems; Computer Based Bidding Management; Relationship Between Cost and Productivity; Cost Estimate Data Base Management.

**iN\$531                      Contract and Cost Management    3+0 7.5**

Introduction to Contract Management; Turkish Construction Contract Law; Construction Contract Evaluation; Contract Strategy; Contract Documents; Contract Selection; Contractor Rights; Effect Factors for Decision Support Level; Contract Types; Build Operate Transfer; Design Build Operate Transfer and Finance Build Operate Contract Applications; Resolving Methods for Contract Conflicts; Court Decisions; Contract Risk Evaluation.

**iN\$536                      Law in Construction Projects    3+0 7.5**

Introduction to Law in Construction Sector, Origins of the Construction Disputes, Construction Claims, Categories of Construction Problems, Resolution of Disputes, Productivity Dispute Relations, Disputes Arises From Project Change Orders, Reflections of Disputes to Parties.

**iN\$539                      Introduction to Finite Elements    3+0 7.5**

Approximate solution methods: Finite Difference, Finite Element Construction the solution by the Finite Element Method One and Two dimensional problem applications Time dependent one dimensional problems Introduction to nonlinear and three dimensional problems.

**iN\$540                      Advanced Highway Materials    3+0 7.5**

Nature, Sources And Uses of Bituminous Materials; Production And Classification of Asphalt; Detailed Analysis of Chemical Composition of Asphalts; Chemical And Physical Properties of Asphalt; Tests On Asphalt; Rheology And Behavior of Asphalt; Classification And Properties Of Mineral Aggregates; Tests On Aggregates; Calculation Methods For Aggregate Mixes; Types of Asphalt Aggregate Mixtures And Their Uses In Pavements; Significant Properties And Design



- iN\$551                      Repair and Strengthening of Structures                      3+0   7.5**  
Introduction; Assessment, Evaluation and Classification of Damage; Earthquake Damages: Wall damages, Slab, Beam, Column, Beam-Column Connections, Shear Wall and Foundation; General Principles of Repair: Repairing of Structural Elements; Repair and Strengthening Materials; Surface Preparation and the Use of Repair Mortars; Repair and Strengthening By Using Shot Crete, Epoxy Resin, Steel Plates and Carbon Fiber Reinforced Plastics; General Principles of Strengthening; Design of Strengthening Elements; Jacketing of Columns; Additional Shear Walls; Strengthening of Foundations; Strengthening Details of Structural Element; Repair and Strengthening of Masonry Structures; Rehabilitation of Structural Systems; Evaluation of Earthquake Safety of Available Structures.
- iN\$552                      Advanced Railway Design                      3+0   7.5**  
Rail transport systems; Types and features of rolling stocks; Generalized equation of train's motion; Propulsion resistances; Stages of train movements, acceleration, cruising and deceleration; Track layout and geometry; Sub grade and Drainage; Railway superstructure, sub-ballast, ballast, sleepers, rails and fastenings; Load distribution and wheel-rail interaction; Type of track cross-sections; Expansion and dilatation of rail; Railway track capacity; Advances in railway technology, high-speed rail, ballastless track system, 'smart' systems for vehicle and track health monitoring, advances in propulsion and energy sources, noise and vibration controls.
- iN\$553                      Advanced Highway Design                      3+0   7.5**  
Highway Systems; Characteristics of Vehicles and Drivers; Characteristics of Traffic; Climbing Lane Design; Geometric Characteristics of Highways: Route choice, Sight distance criterion, Zero Line application, Compound and reverse curves, Horizontal alignment; Special Applications About Transition Length and Super Elevation; Transition Curves; Spirals; Vertical Alignment; Cross Section Elements; Cross Section and Volume Calculations; Special Applications about Mass Diagrams; Cost of Hauling; Introduction to in Roads Software and a Basic Application; Types of Pavements; Properties of Asphalt Concrete; Properties of Portland Cement Concrete; Pavement Thickness Designation: AASHTO 2002 Design Methods (Flexible And Rigid), Other Pavement Design Approaches; Properties of Asphalt Concrete; Surface and Subsurface Drainage; Culvert Design.
- iN\$554                      International Construction Project Management                      3+0   7.5**  
Globalization; The Structure of the International Construction Industry; International Strategic Alliances; International Construction Project Finance; International Standards; FIDIC Contracts; Disputes and Resolution Methods; Risk Management in International Construction Projects; Cultural Differences in International Construction Projects; Human Resources Management in International Construction Projects; Models Used in Multi-National Companies; Project Management in different Countries; Case Studies.
- iN\$555                      Advanced Concrete Technology                      3+0   7.5**  
Introduction; Concrete Making Materials; Cements; Types of Cements; Portland Cement; Aggregates; Admixtures; Mixing Water; Concrete Casting; Cold Weather Concrete; Hot Weather Concrete; Mass Concrete; Roller Compacted Concrete; Self-Compacted Concrete; Replaced Aggregate Concrete; Underwater Concrete; Geopolymer Concrete; Fiber Reinforced Concrete.
- iN\$556                      Plastic Design of Steel Structures                      3+0   7.5**  
Introduction to Limit States Design; Comparison with Allowable Stress Design; Resistance Of Cross-Section Under Simple and Combined Forces; Interactions; Stability Controls; Limit Loads for Structural Systems; Mechanism and Step-By-Step Methods and Examples; Connections
- iN\$557                      Soil Structures and Ground Improvement Techniques                      3+0   7.5**  
Introduction; Retaining Structures; Earth Pressures; Effects of External Loads; Rigid Support Systems; The Mechanics and Construction of Reinforced Earth; Flexible Retaining Structures; Anchors; Calculation of Steel And Shot Crete Retaining Structures; Deep Vibro Techniques; Dynamic Compaction; Cement Grouting; Jet Grouting; Compaction Grouting; Lime And Lime/Cement Columns; In Situ Soil Mixing.
- iN\$558                      Hydrology of Floods and Droughts                      3+0   7.5**  
Hydrology of Floods: Introduction, The factors affecting flooding, rainfall-runoff relationships, methods of flood forecasting, regional flood frequency analysis, the displacement of flood, flood management. Hydrological drought: Input, Low flow and drought periods, low-flow analysis, analysis of the dry period, drought management.
- iN\$559                      Hydrologic Modeling                      3+0   7.5**  
Basin delineation and determination of basin characteristics using Geographic Information Systems; Introducing hydrologic model types; Examples and computer applications; Hydrologic modeling routines; Precipitation, soil, runoff, routing; Model calibration and validation concepts; Manual and automatic calibration; Objective function, optimization; Goodness of fit tests for model performance

- İNŞ560 Bituminous Mixtures Design and Technology 3+0 7.5**  
Selection of Aggregates and Binders for Asphalt Mixtures; Engineering Properties of Bituminous Mixtures and Their Relation to Pavement Performance; Conventional Mix Design Methods: Marshall design method; Developments in Bituminous Mixtures Technology: SUPERPAVE mix design method; Type of Bituminous Mixtures: Asphalt concrete mixtures, Surface coating, Stone mastic asphalt (SMA), Porous asphalt pavements, Sullury seal, Mastic asphalts; Methods of Recycling Asphalt Pavement; Mixture Production and Construction; Quality Control; Pavement Performance and Management; Pavement Maintenance and Rehabilitation.
- İNŞ561 Pavement Maintenance-Rehabilitation and Recycling Strategies 3+0 7.5**  
Flexible and Rigid Pavement Structure; Layers and Properties of Pavement; Properties of Subgrade Soil, Pavement Drainage; Pavement Distress: Definition, Development of mechanism; Preventative Maintenance Practices: Sealing cracks, Full-depth repair, Seal coating, Technology and tools, Examples of preventative maintenance program; Techniques for Reconstruction of Pavement; Recycling Pavement Materials: Recycling methods of asphalt pavements: Cold planning, Hot recycling, Hot in-place recycling, Cold in-place recycling, Full-depth reclamation.
- İNŞ562 Applications of Soil Dynamics 3+0 7.5**  
Introduction to Soil Dynamics; Properties of Dynamically Loaded Soils: Laboratory tests, Field tests; Foundation Vibration, Dynamic Bearing Capacity of Shallow Foundations; Lateral Earth Pressure and Designing Retaining Walls under Dynamic Loads; Settlement Analysis under Dynamic Loads; Machine Foundations on Pile Foundations; Seismic Analysis of Slopes and Fill.
- İNŞ563 Advances in Sediment Transport Research 3+0 7.5**  
Properties of Sediment; Hydraulics of Open Channel Flow; Characteristics of Turbulent Flow; Sediment Movement: State of the art in the initiation of granular material movement, Measures of sediment transport, Relationship between movable bed and turbulent flow, Up-to-date sediment transport rate calculations; Experimental Investigation of Sediment Transport in Laboratory and Field, New Methods; Interaction Between Sediment Transport and Erosion/Deposition and Details about Such Engineering Projects.
- İNŞ564 Materials Science of Concrete 3+0 7.5**  
Introduction: Concrete components and concrete formation phases; Void Structure of Cement Paste Phase, Gel formation; Internal Structure of Hardened Cement Paste; Nano-Micro, Meso and Macro Level Approaches in Concrete; Hardened Cement Paste-Aggregate Interface and Properties; Effect of Hardened Concrete Properties of Void Structure of Cement Paste; Inner Structure Factors Affecting Concrete Properties; Fresh Concrete Properties; Hardening Concrete Properties; Hardened Concrete Properties; Mechanics and Strain Properties of Concrete; Time-Dependent Behavior of Concrete: Creep and shrinkage; Fracture Mechanism of Concrete; Concrete Fatigue; Concrete Durability.
- İNŞ565 Cold-Formed Steel Structures 3+0 7.5**  
Introduction, General concepts; Manufacturing Process of Cold-Formed Steel; Design of Thin Planar Compression Members; Design of Cold-Formed Flexural Members; Design of Cold-Formed Members Subject to Concentric Compressional Load; Design of Cold-Formed Members Which May Be Subject to Torsional-Flexural Buckling; Design of Beam Columns, Connections; Current Design Codes for Cold-Formed Steel; Structural Behavior of Cold-Formed Steel.
- İNŞ566 Similarity and Model Theory 3+0 7.5**  
Basic Principles of Dimensional Analysis; Dimensions and Units; Conversion of Units; Dimensional Homogeneity; Dimensional Analysis and Buckingham Pi Theorem; Dimensional Analysis and Buckingham Pi Theorem; Dimensional Analysis and Rayleigh Method; Dimensional Analysis and Rayleigh Method; Model Theory; Similarity (Geometric, Kinematic and Dynamic); Similarity (Geometric, Kinematic and Dynamic); Hydraulic Models; Hydraulic Models; Sample Applications.
- İNŞ567 Experimental Methods in Advanced Fluid Mechanics 3+0 7.5**  
Principles of Advanced Fluid Mechanics: Hydraulics of pipe and open channel flows, Turbulent flow; Instrumentation and Techniques for Laboratory and Field Investigations of Flow Parameters: Experimental matrix and sensor selection, Principles for acquiring digital signal; Digital Signal Analysis: Exploratory data analysis, Analysis of data using probabilistic methods, Data visualization techniques, Engineering computing applications in hydraulic engineering using numerical computing software; Introduction to Numerical Modeling.
- İNŞ568 Special Concretes 3+0 7.5**  
Uses and Purposes of Special Concretes in Concrete Technology; Lightweight Concretes; Heavy Concretes; Self Compacting Concretes; Fiber Concretes; Shotcrete; Submerged Concrete Casting; Polymer Concretes; Roller Compacted Concrete; Vacuum Concrete; High Performance Concretes; Repair and Reinforcement Materials; Comparison of Turkish, European and American Standards in Special Concretes.

<b>iN\$569</b>	<b>Design of Composite Structures</b>	<b>3+0 7.5</b>
Behavior and Design of Steel-Concrete Composite Members for Buildings: Composite slabs, Beams, Columns and frames; Methods of Analysis and Design: Plastic moment of resistance, Elastic moment of resistance, Longitudinal shear, Vertical shear, Deflection, Vibration, Crack-width control, Transverse reinforcement, Punching shear, Full and partial shear composite behavior; Behavior and Design of Shear Connectors: Ductile and non-ductile connectors; Continuous Beams and Slabs; Lateral Buckling; Connections.		
<b>iN\$571</b>	<b>Geotechnical Engineering and Computer Applications</b>	<b>3+0 7.5</b>
Principles of Geotechnical Engineering and Applications; Definition of Application Methods: Design Criteria, Finite Element Method; Definition of Stability Problems and Solution Methods; Shallow and Deep Foundation Design and Computer Applications; Foundation Design Under Dynamic Loads and Computer Applications; Computer Applications for Designing Various Soil Structures.		
<b>iN\$573</b>	<b>Computer Programing for Structural Engineering</b>	<b>3+0 7.5</b>
<b>iN\$575</b>	<b>Rigid Pavements</b>	<b>3+0 7.5</b>
Introduction: History of rigid pavements and rigid pavement applications in our country, Selection of pavement type, The pros and cons of rigid pavements; Rigid Superstructure Properties; Surface properties, Geometric smoothness, Roughness, Wheel-surface adherence; Pavement Concrete: Properties of pavement concrete, Concrete mix design; Rigid Superstructure Design: Design methods, Stress distribution, Concrete slabs, Crack prevention, Joints and filler materials; Concrete Pavement Construction; Concrete Pavement Types: With joint and jointless concrete pavement applications, Continuously reinforced concrete pavement, Porous pavement, Stone block pavement; Failures in rigid pavements, Maintenance and repair.		
<b>iN\$577</b>	<b>Experimental Applications in Geotechnical Engineering</b>	<b>1+2 7.5</b>
<b>iN\$592</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>iN\$605</b>	<b>Mechanics of Continua I</b>	<b>3+0 7.5</b>
Tensors and Tensor Analysis; Strain (Coordinates, Base Vectors; Deformation Gradients and Tensors; Strain Tensors and Deformation Tensors; Strain Invariant and Principal Directions; Rotation; Area and Volume Changes); Motion (Motion; Time Rates of Vectors; Velocity end Acceleration, Material Derivative of the Element of arc; Surface and Volume; Kinematics of Line; Surface and Volume Integrals; Strain Rate); Stress (External and Internal Loads, Stress Hypothesis; Stress Tensor; Principles of Balance of Local Momentum).		
<b>iN\$606</b>	<b>Mechanics of Continua II</b>	<b>3+0 7.5</b>
Stress and Strain; Thermodynamics of Continuous Media (Principle of Conservation of Energy; Potential Energy and Strain Energy; Entropy; Principle of Entropy; Thermodynamics Restrictions on Elastic Solids and Viscous Fluids); Constitutive Equations (The Need For Constitutive Equations; Axioms of Constitutive Theory; Thermo mechanical Materials; Elastic Materials; Isotropic Elastic Materials; Stokesian Fluids; Thermo elastic Solids); Theory of Elasticity (Linear Constitutive Equations; Restrictions on Elastic Coefficients; Experimental Determination of Elastic Constants); Fluid Dynamics; Thermo elasticity.		
<b>iN\$607</b>	<b>Soil Behavior</b>	<b>3+0 7.5</b>
The nature of Soil; Bonding; Crystal Structure; and Surface Characteristics; Soil Mineralogy; Soil Formation and Soil Deposits; Determination of Soil Composition; Soil Water; Clay-Water-Electrolyte Systems; Soil Fabric and its Measurements; Soil Behavior; Soil Composition and Engineering Properties; Effective; Inter granular and Total Stress; Soil Structure and its Stability; Fabric; Structure Relationships; Volume Change Behavior; Strength and Deformation Behavior.		
<b>iN\$611</b>	<b>Earthquake Engineering</b>	<b>3+0 7.5</b>
Earthquake Mechanism; Spectrum Concept; Multi Degree of Freedom System; Modal Analysis in Earthquake Response; Earthquake Resistant Design; Main Philosophy of Earthquake Codes; Earthquake Codes and Design Criteria; Spectral Analysis of Structures and Simplified Approaches; Behavior of Reinforced Concrete Structures Subjected to Earthquake Ground Motion; Plastic Hinge Concept; Capacity Concept in Design; Earthquake Resistant Design; Safety to Earthquakes; Limit States; General Behavior of Structures; Structural Irregularities; Design Spectra; Elastic Equivalent Earthquake Load; Effect of Earthquake Load; Acceleration Spectrum; Ductility of Structures; Equivalent Earthquake Load; Modal		



Advantages of knowledge management to construction firms; Barriers to knowledge management in construction projects; Knowledge management applications in construction projects.

**iN\$629                      Pavement Management Systems                      3+0    7.5**

Introduction to Pavement Management; Inventory Techniques; Distress surveys, Pavement condition surveys, Strength surveys, Friction survey, Ride quality survey; System Maintenance Strategies; Needs determination, Linear programming in pavement management; Rehabilitation and Maintenance Strategies; Priority Programming in Rehabilitation and Maintenance: Prioritization by weighting and combining, Prioritization by analytical hierarchy process; Project Selection Techniques; Project level design, A framework for pavement design, Physical design inputs; Variability, Reliability and Risk in Pavement Management System; Generating Alternative Design Strategies.

**iN\$630                      Experimental and Computational Methods to Characterize Bituminous                      3+0    7.5**  
**Materials**

Introduction to the Design and Performance Prediction of Asphalt Mixtures; Experimental and Computational Methods Used to Characterize Mechanical Properties and Performance of Bituminous Materials; Performance Modeling at Different Length Scales, Micro and Mezzo Scale Characterization; Characterization of Mix Microstructure; Internal Micro-structure; Mechanisms of Distresses and Techniques to Characterize Distresses: Fatigue cracking, Moisture damage, Permanent deformation.

**iN\$631                      Design of Seismic Isolated Structures                      3+0    7.5**

Introduction: Basic concepts, History of seismic isolation; Principles of Seismic Isolation: Earthquake response spectra, Effects of seismic isolation, Linear and bilinear isolation systems, Energy dissipation; Analysis Methods in Isolated Structures: Modification of response spectrum, Time history analysis method; Isolator Devices: Friction pendulum systems, Lead rubber bearings; Mechanical Properties of Lead Rubber Bearings: Effect of loading history, Effect of velocity, Heating of lead core; Design of Elastomeric Bearings: Stability of elastomeric bearings, Design of reinforcing shims, Checks for design earthquake; Testing of Seismic Isolators; Prototype testing, Acceptance criteria.

**iN\$632                      Design of Ductile Steel Structures                      3+0    7.5**

Common Properties of Steel Materials; Plasticity; High and Low Cycle Fatigue; Material Models; Applications of Plastic Analysis (Capacity Design and Pushover Analysis); Ductile Behavior of Moment Frames Under Lateral Forces; Behavior of Beam-to- Column Connection and Their Ductile Design; Principles of Ductile Moment Frame Design; Seismic Limit State Approach; Seismic Load Reduction and Displacement Amplification Factors; Seismic Design Procedures in Modern Standards; Stability and Plastic Rotation Capacity of Steel Beams; Cyclic Beam Buckling; Passive Energy Dissipation Systems and Their Application in Structures.

**iN\$633                      Hydrological Forecasting and Early Warning Systems                      3+0    7.5**

Role of Real-Time Flood Forecasting and Warning in Flood Risk Management, Principles and Theory Underlying Flood Forecasting Methods, Overall System Design; Hydrological Data Systems: Monitoring systems, Data collection, Data processing, Data archiving; Precipitation Forecasting: Rainfall observations, Radar, Satellite products, Models; Real-Time Flood Forecasting Methods: Empirical, Transfer function, Rainfall runoff models, Flood routing models; Uncertainty in Flood Forecasts; Early Warning Systems: Flood forecast translation, Improvements in decision support systems; Data Assimilation: Combining data from different sources, Application of Kalman and ensemble Kalman filter; Case Studies for Real-Time Flood Forecasting and Warning Practice.

**iN\$635                      Seismic Performance Assessment of Buildings                      3+0    7.5**

Structural System: Structural members, Structural irregularities; Seismic Behavior of Buildings: Seismic hazard assessment, Strong ground motion properties, Structural damage, Non-structural damage; Structural Member Behavior: Material models, Moment curvature analysis, Interaction diagrams and surfaces; Structural Analysis: Linear elastic analysis, Modal analysis, Pushover analysis, Time history analysis; Condition Assessment: Building geometry, Member details, Material properties; Performance Assessment of Existing Buildings: Walk-down assessment, Preliminary assessment, Detailed assessment; Strengthening Methods; Component strengthening, System strengthening.

**iN\$636                      Experimental Design in Geotechnical Engineering                      3+0    7.5**

Explanation the Systematic of Experiments; Specification of Boundary Conditions; Presentation of Instrumentation Equipment; Triaxial Compression Tests and Analysis of the Results; Shear Box Experiment and Analysis of the Results; Standard Penetration Test and Related Correlations; Plate Load Test and Pile Load Test; Other In-situ Tests; CPT, CPTu, DMT, PMT, FVT; 3 Dimensional Design and Printer Technology; Problems Encountered in Experimental Studies; Case Studies for Laboratory Experiments; Case Studies for In-situ Experiments; Design of Experimental Model.

**iN\$637                      Remote Sensing and Geographic Information Systems Applications in                      3+0    7.5**  
**Water Resources**



Principles of Remote Sensing and Geographic Information Systems: Digital image interpretation and spatial data analysis; Mapping of Surface Water Systems; Determination of Evaporation, Soil Moisture and Snow Patterns; Hydrologic and Hydraulic Processes: Data collection, Data processing; Hydrologic/Hydraulic Modeling: Determination of flood magnitudes and flood risk zones, Developing decision support tools for water resources; Statistical Data Analysis/Uncertainty; Case Studies of RS/GIS Applications in Water Resources Management.

**iNŞ639 Experimental Design in Structural Engineering 3+0 7.5**

Introduction to Modal Testing; Applications of Modal Testing; Philosophy of Modal Testing; Fundamentals of Vibrations; Classification of Vibrations and Analysis Procedures; Free and Forced Vibration of Single Degree of Freedom Systems; Free and Forced Vibration of Multi Degree of Freedom Systems; Fourier Series Expansion; Fast Fourier Transform; Determination of Natural Frequencies and Mode Shapes; Vibration Measurements and Applications; Instrumentation; Data Acquisition Systems; Digital Signal Processing, Windowing, Filtering; Modeling, Model Refinement; Structural Damages and Identification Procedures.

**iNŞ642 Fluid Dynamics Simulation Based Design 3+0 7.5**

**iNŞ643 Seismic Isolator Tests, Characterization and Modeling 3+0 7.5**

Introduction to seismic isolation; Isolator devices; Mechanical characteristics and modeling of isolators; Code provisions for seismic isolation; Isolator tests: Prototype tests, Production control tests; Identification of isolator properties from test results: Computation of post-yield stiffness, Computation of equivalent damping ratio, Computation of equivalent friction coefficient, Comparison of existing definitions for computations; Sensitivity of isolator characteristics to loading protocol and environmental conditions: Loading rate, Axial load level, Low temperature.

**iNŞ645 Durability in Concrete Structures 3+0 7.5**

Water Damage in Concrete; Permeability: Permeability of cement paste and aggregate, Permeability of concrete; Effects Causing Deterioration of Concrete: Surface abrasion, Salt crystallization; Effect of Freezing: Frost resistance of aggregate and concrete, flaking; Fire Damage: Effect on cement paste, Effect on aggregate and concrete; Chemical Degradation: Hydrolysis of components, Expansion, Sulfate attack; Expansion Reactions: Alkali silica reaction, reactive aggregate and cement types; Hydration of MgO and CaO: Alkali carbonate reaction, Reacting aggregate and cement types; Reinforcement Corrosion: Concrete deterioration, Sea water effect.

**iNŞ647 Designing with Geosynthetics in Civil Engineering 3+0 7.5**

Geotekstil, geogrid ve geokompozitlerin özellikleri ve test metotları, Geotekstillerin dayanıklılığı,; Geotekstiller kullanılarak ayırma, şev, donatılı istinat duvarı, yumuşak zeminler üzerinde dolgu, filtrasyon ve drenaj tasarımı; Çöp deponi alanlarının tasarımı; Geotekstillerin dikimi ve geogridlerin üretimi; Geogrid ve geokompozitler ile tasarım.

**iNŞ692 Seminar 3+0 7.5**

**iNŞ790 Thesis 0+1 30.0**

**iNŞ890 Thesis 0+1 30.0**

**iNŞ890-0 Thesis (Thesis Proposal) 0+1 30.0**

**iST505 Econometric Analysis 3+0 7.5**

Simultaneous-Equation Models; Simultaneous Dependence of Economic Variables; Consequences of Simultaneous Relations; Solution to the Simultaneous-Equation Bias; Identification: the Problem of Identification; Formal Rules for Identification; Identifying Restrictions; Tests for Identifying Restrictions; Simultaneous-Equation Methods; Reduced-Form Method or Indirect Least Squares; The Method of Instrumental Variables; Two-Stage Least Squares; Mixed Estimation Methods; Mixed Estimation Methods; Restricted Least Squares; Pooling Cross-Section and Time-Series Data; Durbin S Generalized Least Squares; Theil and Goldbergers Mixed Linear Estimation; The Method of Principal Components.

**iST506 The Theory of Measure and Probability 3+0 7.5**

Lebesgue Measure of Plane Sets; The Concept of General Measure; Extension of Measure Defined on a Semiring to a Measure Defined on the Ring; Additivity and  $s$ -additivity of Measure; Measurable Functions; The Lebesgue Integral; Stieltjes Measures; The Lebesgue-Stieltjes Integral; Classification of random Variables for Distributions: Discrete, absolutely continuous and singular distributions; Applications of the Lebesgue-Stieltjes Integral to Probability Theory; Expressions of Mathematical Expectation and Variance of Random Variables by Lebesgue-Stieltjes Integral.

**iST507                    Circular Data Analysis                    3+0   7.5**

Circular Data: Diagrammatical representation, Forms of frequency distributions, Examples of directional data; Descriptive Statistics: Measures of location, Measures of concentration and dispersion, Trigonometric moments; Circular Probability Distributions: Uniform distribution, Cardioids distribution, wrapped normal distribution, circular normal distribution; Estimation of Parameters; Tests for Mean Direction and Concentration: Single sample tests, Two and multi-sample tests; Circular Correlation and Regression: Measures of Correlation, Regression models.

**iST510                    Nonparametric Statistical Techniques                    3+0   7.5**

The Properties of Nonparametric Techniques; Usage Purposes; Utilities; Limitations; One Sample Non Parametric Techniques; Binomial Test; Sign Test; Rank Sign Test of Wilcoxon; Runs Test; Independent Two samples; Median; Mann-Whitney; Small and Large Sample Tests of Kolmogorov-Smirnov; Dependent Two Sample Tests; Sign; Rank Sign test of Wilcoxon; McNemar Test for Repeated Data; Kruskal-wallis Test for a Few Samples.

**iST511                    Advanced Regression Analysis                    3+0   7.5**

Regression Analysis With Matrixes and General Regression Theory and Model Validity; Regression With Dummy Variables; Analysis of Covariance; Comparison of Homogeneity of Two Regression Equations; Examining the Error Terms and Regression Problems; Transportations Used in Regression Analysis; Multiple Colinearity Problem; Biased Estimation Techniques; Ridge Regression; Non-Linear Regression; Calibration; Prediction Intervals.

**iST512                    Artificial Neural Networks and Statistics                    3+0   7.5**

Description of Artificial Neural Networks (ANN): Network Architecture, Activation Function, Training Algorithm; Simple ANN Algorithms in Sample Classification: Hebb, Perceptron Net; Some Applications: Connections with Regression and other Statistics Methods; Delta Rule; Multi-layer Perceptron: Back Propagation Algorithm, Generalized Delta Rule; Nonlinear Regression and Multi-layer Perceptron.

**iST514                    Advanced Statistical Techniques for Researchers                    3+0   7.5**

Location and Dispersion measurements for Different Measures; Comparison of Sample Distribution With Theoretical Distribution; Contingency Table; Design; Investigation; Levels of Relations Between Variables; Relations Between Differently Measured Data Sets; Linear Regression and Correlation Coefficient; Estimation of the Population Parameters; Significance of Correlation Coefficients; Basics of Experimental Design.

**iST517                    Multiple Relation Techniques for Questionnaires Analysis                    3+0   7.5**

Dependent and Independent Variables and their Importance to be Identified in Surveys; Linear Relationships Between Variables; Qualitative and Quantitative Properties; Confidence Intervals for the Relationships; Examination and Interpretation; Inference; Some Special Properties of the Variables; Multi collinearity; Interpretation of the Results; Examination of the Applied and Interpreted Surveys; Critique and Review; Some Applications.

**iST520                    Maximum Entropy Method and Its Applications                    3+0   7.5**

Maximum entropy (MaxEnt) method, MaxEnt method for discrete random variables, MaxEnt method for continuous random variables. Entropy: Joint entropy and conditional entropy. Information: Relative entropy and information. The maximum entropy distribution, Application of MaxEnt Method, Application to statistics, Application to economics, Application to regional and urban planning.

**iST521                    Continuous Markov Processes                    3+0   7.5**

Stochastic Processes; Markov Processes; Poisson Processes; Markov Property; Properties of the Transition Probabilities; Ratio Matrix and Kolmogorov's Differential Equations; Limit Distribution; Birth and Death Processes; Pure Birth Processes; Branching Processes; Generating Processes in Branching Processes; Probability of Lost Call and Lost Call Time.

**iST522                    Stochastic Processes                    3+0   7.5**

Multi-Dimensional Stochastic Variables; Expected Values of Random Variables; Moment Generating Functions; Characteristic Functions; Limit Theorems about Probability Theory; Conditional Probabilities; Probability Generating Functions; Random Sums; Laplace Transforms of Probability Distributions; Stochastic Processes; Markov Chains for Discrete and Continuous Parameter Spaces: Transition probabilities, Probability matrices; Exponential Distribution and Poisson Process, Birth and Death Process; Queuing Theory and Models.

- iST523 Nonparametric Models With Spline Regression 3+0 7.5**  
Introduction to Nonparametric Regression; Roughness Penalty Approach in Regression; Spline Functions, Signifying Spline Functions as the Sum of Basis Functions; Introduction to R, Solution of Linear and Generalized Linear Models in R; Applications of Nonparametric and Semiparametric Models with Spline Regression in R.
- iST524 Generalized Additive Models With Spline Regression 3+0 7.5**  
Additive Models, Estimating Equations; Generalized Linear Models (GLMs); Generalized Additive Models (GAMs); Algorithms of GAM Solutions; Selection of Smoothing Parameters, Degrees of Freedom; Specification of Knots and Basis Functions; Additive and Generalized Additive Model Applications in R; Applications of Suitable Model Selection for A Specific Model.
- iST528 Probabilistic Mixture Theory 3+0 7.5**  
Lebesgue Measure; Lebesgue Integral; Stieltjes Measure; Lebesgue- Stieltjes Integral; Characteristic Functions of Random Variables; Definition of Mixture Distribution; Identifiability of Mixture Distribution Theorem; Poisson and Binomial Mixture Distribution; Normal Mixture Distribution; Exponential Mixture Distribution; Maximum Entropy Mixture Distribution; Parameter Estimation Methods for Mixture Distribution; Some Software for Mixture Distribution.
- iST530 Theory of Statistics 3+0 7.5**  
Probability theory. Probability distribution; Discrete and continuous distributions, multivariate distributions. Some inequalities; Markov, Chebyshev, Hölder, Minkovski, and Jensen. Principle of data reduction; the sufficient principle, likelihood principle. Point Estimation. Methods of finding an estimator; Method of moment, maximum likelihood asymptotic properties of maximum likelihood, fisher information matrix, Bayes estimators, invariant estimator. Methods of evaluating estimators; Mean square error, best unbiased estimators. Hypothesis testing; methods of finding test, likelihood ratio test, Walt test, Lagrange multipliers test, invariant test, bayesian test, asymptotic distribution of LRTs. Methods of evaluating test; Power function, unbiased and invariant test. Interval estimation; Methods of finding interval estimator.
- iST531 Linear Models 3+0 7.5**  
Concepts of Matrix Algebra; Orthogonality, eigenvalues and rank, idempotent matrices, derivatives of matrices and vectors. Quadratic Forms and their Distributions; Expectation and variance of quadratic forms, distributions of some special quadratic forms, independence of quadratic forms. Estimation in Full-Rank Model; Least squares estimators and maximum likelihood estimators, interval estimation, generalized least squares. Hypothesis Testing in Full-Rank Model; Model adequacy, partial and sequential tests, general hypothesis, likelihood ratio criteria. Estimation in Less-than-Full-Rank Model; Conditional inverse, a less than full rank model, estimability, estimating variance in less-than-full-rank model, interval estimation. Hypothesis Testing in Less-than-Full-Rank Model; Hypothesis testing in a general setting, one-way classification model, hypothesis testing on a treatment contrast, two factor design (fixed effect) with interaction and without interaction. Analysis of Covariance. I
- iST532 Fuzzy Statistical Methods 3+0 7.5**  
Aristotle Logic, Fuzzy Logic and Uncertainty; Possibility and Probability Theory; Basics of Fuzzy Set Theory: Fuzzy sets, Crisp sets, Fuzzy logic membership functions: Description of membership function; Fundamental Definitions in Fuzzy Set Theory: Support sets, Normality,  $\alpha$ -cuts, Fuzzy numbers, Convex sets; Fuzzy Sets Operations: Fuzzy union operators, Fuzzy intersection operators,  $\alpha$ -cuts set operations with fuzzy numbers; Fuzzy Inference Systems: Adaptive neuro fuzzy inference systems (ANFIS); Fuzzy Statistical Methods and Interdisciplinary Applications.
- iST533 Fundamentals Statistics 3+0 7.5**  
Definition of statistics and its functions: Obtaining data sets, Presentation, Examining the distributions; Sampling: Sampling errors, Inference; Hypothesis tests; Hypothesis tests for two populations; Comparison of the ratios; Hypothesis tests for large and small sample sizes; Chi-square distribution and Chi-square test for relations between the qualitative variables, Definition of Correlation; Simple linear correlation coefficient and its function, Regression coefficient and its function, Determination coefficient, T and F tests.
- iST536 Statistical Softwares 3+0 7.5**  
Software for Data Analysis; Introduction; Statistical software; Introduction to Minitab; Running Minitab; Minitab Menus; Data input; Data Copy; Data Import and Export; Ordering of Data; Calculator; Data Simulation; Matrix; Calculation of Descriptive Statistics; Graphs; Time Series Graphics; Probability Plots; Commands in Minitab; Saving to Output File; Introduction to SPSS; SPSS Menus; Data Input; Data Copy; Determination of Variables; Add New Variable; Remove Variable; Calculate; Cross Tabulation.
- iST537 Actuarial Models 3+0 7.5**  
Calculation of Premiums: Individual and pooled risk models; Measuring Risk: Coherent risk measures; Dependence Between Risks: Sklars representation theorem; Premiums for Deductibles and Maximum Limits; Calculation of Bühlmann

Premiums; Extreme Value Analysis; Generalized Additive Loss Models; Testing Fit of Loss Models by Kolmogorov-Smirnov Test; Measuring Risk with MCMC Methods; Analyzing Loss Tables; SAS Applications.

**iST539 Statistical Simulation 3+0 7.5**

Concepts of System, Model and Simulation; Random Number Generators: Linear congruential generators; Examination of Some Properties of the Generated Numbers: Run and Gap tests; Generation of Random Numbers from Probability Distribution: Inverse transformation, acceptance-rejection and decomposition methods; Simulation of Some Discrete and Continuous Distributions and Matlab Applications: Binom, Poisson, Gamma; Univariate and Multivariate Normal Distribution; Simulation for Statistical Inference and Matlab Applications: Parameter estimation, Hypothesis test and some applications; Bootstrap and Jackknife Methods and Matlab Applications; Monte Carlo Integration.

**iST540 Robust Statistical Methods and Applications 3+0 7.5**

Robustluğun Matematiksel Araçları: İstatistiksel fonksiyonel; Fisher Tutarlılık; Differansiyellenebilir İstatistiksel Fonksiyoneller; Robustluğu Ölçme: Etki fonksiyonu; Kırılma Noktası; Robustluk ve Etkinlik Dengesi; Bir Parametrenin Robust Tahmini: M-tahmin edicileri; L-Tahmin Edicileri; Doğrusal Modellerde Robust Tahmin Ediciler: M-tahmin edicileri; GM-Tahmin Edicileri; MM- Tahmin Edicileri; En Küçük Medyan Kareler (LTS) Tahmin Edicileri; Robust Yöntemlerin Bazı Büyük Örneklem Özellikleri; MATLAB ve R Programları ile Uygulamalar.

**iST541 Time Series Analysis with Application 3+0 7.5**

Fundamental Concepts of Time Series; Time series components/trend, Seasonality, ACF-PACF/autocorrelation tests Bartlett, Box-Pierce Q, Ljung-Box Q, AR-MA-ARMA models and Box-Jenkins methodology; Stationary and Unit Root Tests; Applications with E-views; Structural Break and Structural Break Tests; Applications with E-views; Co-integration and Co-integration Tests; Applications with E-views; Error Correction Models; Causality in Time Series; Granger Causality; VAR Models, Choice of Degree in a VAR Model; Control of Sufficiency; VAR Impact-Response Function; Vector Error Correction Models.

**iST542 Sampling Theory and Methods 3+0 7.5**

Basit Rastgele Örneklemede Ana Kütle Ortalaması ve Toplamının Tahmini; Güven Aralıkları ve Örneklem Genişliği; Eşit Olmayan Olasılıklı Örnekleme; Yardımcı Veri ve Oransal Tahmin; Yardımcı Veri ve Regresyon Tahmini; Tabakalı Örnekleme; Küme Örnekleme ve Sistemik Örnekleme; Çok-aşamalı Düzenler; İki-Evreli Örnekleme; Örnekleme Araştırmasında Uygulamalı Problemler; Yakala-Tekrar Yakala Örnekleme, Rastgele yanıt modeli.

**iST543 Statistics I 3+0 7.5**

Statistics II: Statistics Definition, History, General Information About the Area; Responsive and Non-Responsive Averages: Arithmetic, Geometric, Harmonic, Quadratic, Mode, Median, Quartiles; Variability: Variance, Standard Deviation, Coefficient of Variation; Variables Discrete Probability Distributions: Binomial, Poisson; Continuous Probability Distributions of Variables: Normal Distribution; Symmetry, Asymmetry, and Kurtosis Taper; Moment: Regression Analysis, Categorical Data Analysis, Chi-Square Test.

**iST544 Nonparametric Regression Models 3+0 7.5**

Basic Concepts: Nonparametric regression; Density Function: Univariate Case, Multivariate Case, Graphical display, Comparison with histogram; Kernel Density Estimation: Properties and applications; K- Nearest Neighbour Density Estimation; Comparison between Kernel Estimation and K- Nearest Neighbour Density Estimation; Splines: Smoothing splines, Regression splines; Local Polynomial Regression.

**iST545 Statistical Analysis with Statistical Packages 3+0 7.5**

Introduction to Statistical Packages for Statistical Analysis; An Overview of the Software Menu; Data Entry and Variable Definitions; Survey Data, Frequency Tables and Cross-table Entries; Arranging, Processing and Storing Data; Calculation of Descriptive Statistics and Graphic Illustrations; Parametric Tests: Z and Student's t tests, One-way analysis of variance, Two-way analysis of variance; Nonparametric Tests: Chi-square tests, One sample tests, Independent two sample tests, Paired samples tests; Regression and Correlation Analysis..

**iST551 Applied Multivariate Statistical Analysis 3+0 7.5**

**iST552 R For Data Science 3+0 7.5**

**iST553 Time Series Analysis with Application 3+0 7.5**

Fundamental concepts of Time Series; Time series components: Trend, seasonality; ACF-PACF and Autocorrelation Tests: Bartlett test, Box-Pierce Q test, Ljung-Box Q test; AR-MA-ARMA Models and Box-Jenkins Methodology; Stationary and Unit Root Tests; Applications with E-views; Structural Break and Structural Break Tests; Applications with E-views; Co-integration and Co-integration Tests; Applications with E-views; Error Correction Models; Causality in Time Series: Granger causality; VAR Models: The Choice of the Degree of a VAR Model, The control of the sufficiency; VAR Impact-Response Function; Vector Error Correction Models.

**iST554                    Intelligent Optimization Techniques                    3+0   7.5**

**iST555                    Machine Learning with R                    3+0   7.5**

Overview In Machine Learning Basics: Evaluation of basic algorithms, Train and test data sets, Overtraining, Accuracy and confusion matrix and other metrics, ROC; Conditional Probabilities: Conditional expectations and loss function, Discriminative approaches (QDA, LDA), Naive Bayes algorithms, Simple linear regression, Smoothing and matrix algebra: Distance, Cross-validation; K-Nearest Neighbour; Support Vector Machine; Classification; Classification with Two Classes; Random Forest; Principal Component Analysis; K-means Algorithm.

**iST556                    Statistics                    3+0   7.5**

Statistics and Data Science Definitions; Introduction to Data Analysis: Graphical and Numerical Summary, Raw Data, Analysis-ready Data; Probability: Randomness and Probability Measurement; Random Variables and Characteristics: Random Variable and Probability Distribution, Probability Function, Cumulative Distribution Function; Normal Distribution, T, F, and Chi-square Distributions; Parameter Estimation and Applications: Point Estimation, Interval Estimation; Hypothesis Testing and Applications; Model Estimation and Applications; Regression Analysis and Applications: Correlation and Regression Analysis, Assumptions, Linear Regression Analysis, Nonlinear Regression Analysis; Statistical Classification Techniques, Decision Trees, and Applications: Classification, Clustering; Variance Analysis and Applications: ANOVA.

**iST557                    Explainable Artificial Intelligence                    3+0   7.5**

**iST559                    Data Science with Julia                    3+0   7.5**

**iST592                    Seminar                    3+0   7.5**

**iST604                    Econometric Models                    3+0   7.5**

Traditional Econometric Methodology; The Traditional View of Econometric Modeling; Under fitting a Model; Over fitting a Model; Tests of Specification Errors. Alternative Econometric Methodologies; Learner's Approach to Model Selection; Hendry's Approach to Model Selection. Selected Diagnostic Tests; The Discrimination Approach; The Discerning Approach. Logit; Probit and Tobit Models.

**iST608                    Mathematical Methods of Statistics                    3+0   7.5**

Line Integrals; Functions of Complex Variables; Derivative and Integral; Power Series; Characteristic Functions of Distributions; Inverse Transformations for Characteristic Functions; Uniqueness Theorem for Characteristic Functions; Continuity Theorem for Characteristic Function in  $R^1$  and  $R^n$ ; Some Convergence Theorems; The Normal Distribution in  $R^n$  and Some Distributions Connected with Them; Tests of Goodness of Fit; Pearson Theorem.

**iST610                    Conjoint Analysis                    3+0   7.5**

Some Concept Related to Conjoint Analysis: Factor (Attribute), Interattribute correlation, Level, Orthogonality, Trade-off method; Comparing Conjoint Analysis with Other Multivariate Methods; Stages of Conjoint Analysis: Research question and objectives, Designing a conjoint analysis experiment, Assumptions of conjoint analysis, Estimating the conjoint model and assessing overall fit, Interpreting the results, Validation of the conjoint results; Conjoint Analysis with a Large Number of Factor.

**iST611                    Pearson System I                    3+0   7.5**

Statistics and Decision Making Theory; Explaining the Decision Problem; Solution Stages in the Decision Problem; Univariate Frequency Distributions; Frequency Distributions; Moments; Density Functions; Pearson System in Frequency Distributions; Obtaining the Common Equation of the Pearson System; Obtaining the Basic Types of the System By the

Common Equation; Type I (First Main Type); Type IV (Second Main Type); Type VI (Third Main Type); Proofs of the Main Types; Applications.

**iST612 Pearson System II 3+0 7.5**

Obtaining the Transition Types in Pearson System; Transition Types Which is Produced From the First Main Type Type II; Type VIII; Type IX; Type XII; Transition Function Related to the Second Main Type; Type VII; Transition Function Related to the Third Main Type; Type XI; Special Case of the Type II (Normal Curve); Transition Types Between Main Functions; Type III; Special Case of the Type III; Type X; Type V; Moments of the Overall Types and Obtaining Pearson Criteria; Applications About Transition Types.

**iST613 Artificial Neural Networks and Statistical Models I 3+0 7.5**

Single-Layer Neural Networks, Perceptron; Multi-Layer Feed-Forward Neural Networks: Back-Propagation Algorithms and Statistical Pattern Recognition; Recurrent Neural Networks and Training Algorithms for Pattern Association: Heteroassociative Memory Neural Network; Autoassociative Net; Elman and Hopfield's Net, Bidirectional Associative Memory (BAM).

**iST614 Artificial Neural Networks and Statistical Models II 3+0 7.5**

Radial-Basis Function Networks: Exact Interpolation, Regularization Theory, Relation to Kernel Regression, Comparison with MLP; NN Based on Competition, Fixed-Weight Competitive Nets; Kohonen Self-Organizing Maps; Learning Vector Quantization; Counterpropagation; Adaptive Resonance Theory: ART I, ART II.

**iST615 Mathematics Foundation in Regression Analysis I 3+0 7.5**

Elements of Matrix Analysis: Generalized Inverse matrices; Idempotent Matrices; Vector, Matrix Norms. General Linear Systems: Gauss Transformation; LU Factorization, Pivoting, Permutations Matrices. Special Linear Systems: LDMT and LDLT Factorization; Banded, Block Systems. Orthogonalization: Householder and Givens Matrices; QR Factorization; The Full Rank and the Rank Deficient LS Problems. The Symmetric and Unsymmetric Eigenvalue Problems: Properties and Decompositions; The Jacobi Methods; Computing the SVD; The Hessenberg and Real Schur Forms; The Practical QR Algorithm.

**iST616 Mathematics Foundation in Regression Analysis II 3+0 7.5**

Matrix Computations in Linear Regression: Kronecker Products and the Vec and Vech Operators; Generalized QR factorization; Applications for Ordinary and Generalized Least Squares and SUR models. Mathematics Foundation in Nonparametric Regression: A Roughness Penalty Approach; Smoothing and Regression Splines, Kernel Regression and Corresponding Mathematics Concept and Operations; Choosing the Smoothing Parameter. Additive and Generalized Additive Regression's Models (GAM): Estimating Equations for Additive Models and its Numerical Solutions.; Fisher Scoring for GAM; Local-Scoring Procedure; A Roughness Penalty Approach; Choosing the Smoothing Parameters.

**iST617 Modern Regression Techniques 3+0 7.5**

Linear Regression Analysis; History; Estimation of Coefficients; Model and Model Checking; Least Squares Minimization; Least Absolute Deviations (L<sub>1</sub>) Regression; Introduction; Algorithms for Line Fitting; Problems in Algorithms; Estimation of Coefficients; M-Regression: a Regression Sample; Lagorithm for Minimization; Line Fitting; Tests for Coefficients; Nonparametric Regression; Line Fitting; Tests for Coefficients; Bayesian Regression; Bayes Approach; Line Fitting; Tests for Coefficients; Ridge Regression; Line Fitting; Standardization; Multi Colliniarity; Comparison of Techniques; Comparison Properties; Samples.

**iST618 Information Theory and Statistics 3+0 7.5**

The Method of Types; The Law of Large Numbers; Universal Source Coding; Large Deviation Theory; Examples of Sanov's Theorem; The Conditional Limit Theorem; Hypothesis Testing; Stein's Lemma; Chernoff Bound; Lempel-Ziv Coding; Fisher Information and the Cramer-Rao Inequality.

**iST621 Advanced Circular Data Analysis 3+0 7.5**

Nonparametric Testing Procedures: Single Sample Tests, Two Sample Tests; Distributions on Spheres: Spherical Data, Descriptive Measures, Distributions for Spherical Data; Some Inferences for Spherical Data; Circular Correlation and Regression: Measures of Correlation, Regression Models, Bivariate Distributions, Circular Time Series; Modern Methodology in Circular Data Analysis: Outliers, Robust Methods, Bootstrap Methods; General Sample Spaces; Shape Analysis.

**iST622 Fuzzy Neural Integrated Systems 3+0 7.5**

Basic Operations in Fuzzy Sets; Expansion of Fuzzy Set Concept; Fuzzy Relation; Fuzzy Arithmetic; Fundamentals of Fuzzy Logic; Fundamentals of Fuzzy Logic Control Systems; Projection Methodology; Integrated Fuzzy Systems and Artificial Neural Networks: Basic Concepts; Reasons for Integrating; The Equivalence of Fuzzy Inference Systems and Artificial Neural Networks; Neural-Network-Based Fuzzy Systems: Neural Realization of Basic Fuzzy Logic Operations;

Neural-Network-Based Fuzzy Logic Inference; Neural-Network-Based Fuzzy Modeling; Neural Fuzzy Controllers: Types of Neural Fuzzy Controllers; Structure Learning for Neural Fuzzy Controllers.

**iST623                      Fuzzy Artificial Neural Networks                      3+0    7.5**

Types of Fuzzy Neurons; Fuzzification of Neural Network Models: Fuzzy Perception; Fuzzy Classification with the Back Propagation Network; Fuzzy Associative Memories; Fuzzy Kohonen Networks; Neural Networks with Fuzzy Training; Neural Networks with Fuzzy Teaching Input; Neural Networks with Fuzzy Parameters; Fuzzy Control for Learning Parameter Adaptation; Fuzzy Neural Classification; Fuzzy Neural Clustering.

**iST625                      Entropy Optimization Methods With Applications                      3+0    7.5**

Entropy and Information for Discrete Systems; Conditional Entropy and Mutual Information; Entropy and Information for Continuous Systems; The Method of Variations in Problems with Fixed Boundaries; Variation and its Properties; Euler Equations; Variational Problems Involving a Conditional Extremum; Contraction Mappings; Newton's Method for Lagrange Multipliers; Jaynes' Maximum Entropy Principle with Statistical Applications; Kullback's Minimum Cross-Entropy Principle with Applications.

**iST626                      Numerical Methods in Modeling with Entropy Optimization Distributions                      3+0    7.5**

Introduction To Numerical Methods; Linear Equations and Solution Methods for Linear Equations; Nonlinear Equations; Solution Methods for Nonlinear Equations; Numerical Integration Methods; Maximum Entropy Methods for Discrete and Continuous Random Variables; Estimation of Parameters of Statistical Distribution Based on Maximum Entropy Methods; Minimum Cross Entropy Methods for Discrete and Continuous Random Variables; Estimation of Parameters of Statistical Distribution Based on Minimum Cross Entropy Methods.

**iST627                      Fundamentals of Stochastic Differential Equations                      3+0    7.5**

A Hilbert Space of Random Variables; Convergence of Sequences of Random Variables, Exercises; Discrete stochastic processes; Continuous Stochastic Processes; A Hilbert space of stochastic processes, Exercises; Stochastic Integrals of the form  $\int_0^t \phi(s) dW(s)$ , Definition of Brownian motion and its properties, Wiener integral, Conditional expectation, Martingales, Ito stochastic integrals, Approximation of stochastic integrals, Stochastic differential and Ito's formula, Ito's formula for martingales, Applications of Ito formula, Stratonovich stochastic integrals; Multidimensional Ito's formula, Exercises.

**iST628                      Stochastic Differential Equations and Applications                      3+0    7.5**

Properties of Solutions to SDE, Some Examples, Bellman-Gronwall Inequality, Existence and Uniqueness Theorem, Ito's Formula and Exact Solutions; Approximating SDE, Systems of SDE; Markov Property, Solutions of SDE, Diffusion Processes, Kolmogorov (Fokker-Plank) Equations, Stability; Parameter Estimation for SDE, Linear SDE, Feynman-Kac Formula, SDE Models in Physical Systems, in Finance and in Biology.

**iST629                      Stochastic Modeling and Analysis                      3+0    7.5**

Stochastic Processes: Probability, Distribution And Distribution Function; Expectation, Variance and Covariance; Independence and Dependence; Expectation And Covariance Function for Stochastic Processes; Dependence for Stochastic Processes: Stationary Increments, Independent Increments; Brownian Motion: Defining Properties; Processes Derived from Brownian Motion; Simulation of Brownian Sample Paths; Systems with Stochastic Inputs and the Power Spectrum; Continuity for Stochastic Processes; Differentiation for Stochastic Processes; Integration for Stochastic Processes; Applications.

**iST631                      Robust Statistical Methods                      3+0    7.5**

Comparison of Classical and Robust Approaches; Robust Estimates of Location and Scale; Measuring Robustness: Influence function, Breakdown point; Balancing Robustness and Efficiency; Some Robust Estimation Methods: Trimmed least squares, M-estimation, Least absolute deviations (LAD), Least median squares (LTS), Weighted least squares; Partially Adaptive Estimation; Robust Estimation for Regression Model and Parameters of Distributions; Applications in Matlab Program.

**iST632                      Statistics II                      3+0    7.5**

Statistics II: Statistical Decision Theory: Hypothesis Testing, Parametric and Non-Parametric Approaches, With Large Sample Hypothesis Testing, Hypothesis Testing With Small Samples; Strength Testing; Chi-Square Distribution: Chi-Square Tests; Simple Linear Regression and Correlation Techniques, T-Test; Analysis of Variance; Analysis of Covariance; Random Block Design; Factorial Experiments; Multivariate Statistical Tests; Factor Analysis; Multivariate Analysis of Variance; Multivariate Analysis of Covariance.

**iST633                      Data Visualization                      3+0    7.5**

Some Milestones in the History of Statistical Graphics; Introduction to Visual Literacy: Graphic elements and color theory; Tufte's Principles of Scientific Graphics; Visualization of Temporal Data; Visualization of Spatial Data; Multivariate Data Analysis; Cluster Analysis: Hierarchical and non-hierarchical; Dimension Reduction Methods: Principle component

analysis, Correspondence analysis and related methods; Visualization of Textual Data; Networks, Hierarchies and Trees; Big Data Visualization Challenges; Dynamic and Interactive Graphics.

**iST635                    Advanced Theory of Statistics                    3+0    7.5**

Location-scale families, Exponential families, Sufficient statistics, Factorization criterion, Minimally sufficient statistics, Completeness, Convex loss functions, Uniformly minimum variance unbiased (UMVU) estimator, Locally minimum variance unbiased estimator (LMVU), Deriving UMVU estimators, Nonparametric families, Information inequality, Invariance and equivariance, Minimum risk equivariant (MRE) estimator, Principle of equivariance, Bayes estimator, Uniformly most powerful tests (UMP), Neyman Pearson Lemma, p-value, Monotone likelihood ratio, Likelihood ratio test, Unbiasedness for hypothesis testing, UMP tests for multiparameter exponential families

**iST636                    Econometric Modelling                    3+0    7.5**

Introduction to Econometrics; Linear Regression Models; Nonlinear Regression Models; Spatial Regression Models; Model Selection Criteria; Truncated and Censored Data; Regression Models for Count Data; Truncated Regression; Censored Regression; Censoring and Truncation in Models; Bias Correction Methods; Simulation and Real Life Applications in Matlab Program.

**iST637                    Stochastic Differential Equations I                    3+0    7.5**

Hilbert Space of Random Variables; Hilbert Space of Stochastic Processes; Stochastic Integrals of the Form  $\int_0^t f(s, \omega) ds$ ; Ito  $\int$  Stochastic Integrals, Approximation of Stochastic Integrals; Stochastic Differentials and Ito  $\int$ 's Formula; Stratonovich Stochastic Integrals; Existence of the Unique Solution of SDE; Properties of Solutions to Stochastic Differential Equations; Ito  $\int$ 's Formula and Exact Solutions; Approximating Stochastic Differential Equations; Kolmogorov (Fokker-Plank) Equation; Maximum Likelihood Estimation Method; A Non-parametric Estimation Method.

**iST638                    Stochastic Differential Equations II                    3+0    7.5**

Introduction to Modelling by Stochastic Differential Equations; Population Examples in Biology; General Model of Two Interacting Populations; Epidemic Model; Predator-Prey Model; Persistence-Time Estimation; A Population Model with Time Delay; A Model Including Environmental Variability; Stochastic Finance Models; A Stock-Price Model; Option Pricing; Interest Rates; A Goodness of Fit Test for SDE Model; Alternate Equivalent SDE Models.

**iST639                    Fuzzy Statistics and Probability                    3+0    7.5**

Introduction: Crisp sets and Fuzzy sets, Fuzzy sets operations, Fuzzy numbers: Type-1 fuzzy numbers, Type-2 fuzzy numbers, Intuitionistic fuzzy numbers, Hesitant fuzzy numbers, Fuzzy central tendency measures: Fuzzy arithmetic mean, Fuzzy mode, Fuzzy median, Fuzzy dispersion measures: Fuzzy standard deviation and fuzzy variance, Fuzzy random variables, Fuzzy probability, Fuzzy discrete distributions: Fuzzy binomial distribution, Fuzzy poisson distribution, Fuzzy continuous distribution: Fuzzy normal distribution, Fuzzy uniform distribution, Fuzzy exponential distribution, Fuzzy confidence interval: Mean and variance, Intuitionistic fuzzy confidence interval.

**iST640                    Advanced Experimental Design                    3+0    7.5**

Factorial Models with Mixed Levels; Factors at Two and Three Levels; Factors at Two and Four Levels, Nested and Split-Plot Designs; The Two-Stage Nested Design; The M-Stage Nested Design; The Split-Plot Design; The Split-Split-Plot Design; Response Surface Methods; Location of the Stationary Point; Response Surface Characterization; Ridge Systems; Multiple Responses; Experimental Designs for Fitting Response Surface; Mixture Experiments; Evolutionary Operation; Taguchi's Distributions in Experimental Design.

**iST641                    Advanced Nonparametric Regression Models                    3+0    7.5**

Basic Concepts: Linear regression model, Additive regression models, Generalized additive models; Solution Algorithms of the Generalized Additive Models; Selection of the Smoothing Parameters; Degrees of Freedom; Basis Functions; Determining the Number of Knots and the Basis Functions; Hypothesis Testing; Model Selection; Applications of the Generalized Additive Regression Models.

**iST642                    Modeling with Stochastic Differential Equations                    3+0    7.5**

**iST647                    Reliability Theory                    3+0    7.5**

**iST649                    Stochastic Differential Equations                    3+0    7.5**



<b>iST692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>iST790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>iST890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>iST890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>işL508</b>	<b>Human Resources Strategies and Applications</b>	<b>3+0 7.5</b>
Establishing human resources department applications, human resources planning strategies, recruitment strategies, selection strategies, orientation strategies, training strategies, performance appraisal strategies, career planning strategies, job safety and health strategies, discipline strategies, employer-employee relations strategies, compensation management strategies and applications.		
<b>işL578</b>	<b>Sport and Facility Business</b>	<b>3+0 6.0</b>
The structure of the sports industry; Basic concepts of business; Entrepreneurship in sports business ; Sports business and investment activities ; Business management functions and management in sports business; Marketing functions and strategies in sports business; Production services and its functions in sports business; Financing functions of sports business; Human resource management in sports business; Public relations in sports business Use of technology in sports business.		
<b>İTB501</b>	<b>Biotechnology</b>	<b>3+0 7.5</b>
History of Biotechnology; Recombinant DNA Technology, Manipulation of Prokaryotic Gene Expression, Production of Protein in Eukaryotic Cells, Development and Use of Genetically Modified Plants and Animals, High Protein Production in Recombinant Microorganisms; Fermentation Technology and Regulation, Isolation and Protection of Metabolism in Microorganisms, Preferable Commercial Features of Microorganisms, Coulter Collection; Enzyme Technology; DNA Sensors, Molecular Diagnosis, Gene Therapy in Human Somatic Cells, Genetic Practices in Food Technologies; Gene Engineering, Genetic Transformation Systems, Bioinsecticides; Social Dimension of Biotechnology; Patents and Brands.		
<b>İTB503</b>	<b>Biotechnology Laboratory Techniques I</b>	<b>3+0 7.5</b>
Biosafety; Basic Principles of Spectroscopy, UV and Visible Molecular Absorption Spectroscopy, Basic Procedures of Mass Spectroscopy, IR Spectroscopy, Nuclear Magnetic Resonance Spectroscopy (NMR), Chromatographic Analysis Techniques and Separation Procedures, GC, GC-MS, Thermal Analysis Techniques (TG, DTA, DSC), Preparation of Natural Compounds for Structural Analysis, Scanning Electron Microscopy and Microanalysis.		
<b>İTB504</b>	<b>Biotechnology Laboratory Techniques II</b>	<b>3+0 7.5</b>
Bacterial Evaluation Techniques, Biomonitoring, Cell Culture Techniques, Purification of Proteins and Analysis Methods, ELISA, DNA and RNA Isolation and Analysis Methods, Principles of PCR, DNA Fingerprints, In Vitro Transcription, In Vitro Mutation, Recombinant DNA Techniques.		
<b>İTB505</b>	<b>Biomaterials</b>	<b>3+0 7.5</b>
Introduction, Use of Alumina and Zirconia in Implants, Introduction to Bio-active Glasses; Production, Composition, Properties, Reaction Kinetics and Clinical Applications, A/W Glass-Ceramics; Processes, Properties and Clinical Applications, Ceravital Bio-Active Glass-Ceramics, Machinable Phosphate Based Glass-Ceramics, Dense Hydroxyapatite, Porous Hydroxyapatite, Surface Coatings, Bioceramic Composites, Biometals, Characterisation of Biomaterials		
<b>İTB506</b>	<b>Drug Design and Application</b>	<b>3+0 7.5</b>
Planning Drug Development, Chemical Development, Formulation Development, Characteristics of Drug Development: Electronic Properties, Ionization Constants, Hydrophobic Interactions, Steric Parameters, Hydrophobic Interactions and Lipophilicity, Partition Constants as Lipophilicity Index, Effects of Ionization on Partition Constant, Suggestion of Lipophilicity, Suggestion of Ionization, Suggestion of Steric Parameters. Prediction of Drug Receptor Relationship, Prediction of Mutagenesis, Ligand Bonding Studies, Biological Evaluation: Ligand Bonding, Secondary Messenger Measurements, Measurement of Functional Activity, Quantification of Agonist Activity, Quantification of Antagonist Activity, in Vivo Tests, SAR and QSAR Linear Regression and Multiple Linear Regression.		
<b>İTB507</b>	<b>Biometer</b>	<b>3+0 7.5</b>

Data Understanding in Biological Research. Calculation of Descriptive Statistics, Introduction to Probability Distribution; Binom and Poisson Distribution, Normal Distribution and Its Application. Sampling Techniques, Estimation, Tests for Statistical Hypotheses, ANOVA, Regression Analysis, Spatial Analysis, Allometry

**iTB508 Applications of High Performance Liquid Chromatography in Biotechnology 3+0 7.5**

Important Parameters for Application of HPLC in Biotechnology; Sample Collection and Preparation; Characteristics of Sample and Standards; Selection of Column, Detector, Mobile Phase and Other Important Subjects; Position of HPLC in Purification of Enzymes; Importance of HPLC in Waste Water; Analysis of Protein and Peptide in HPLC and Applications; Applications of HPLC for Terpenoids.

**iTB509 Biotechnological Production of Medicine Raw Materials 3+0 7.5**

Presences of Secondary Metabolites and Biotechnological Examples; Biotechnological Utilization of Plant Genetic Resources for the Production of Phytopharmaceuticals; Methods for the Biotechnological Pathway for the Active Natural or Semi-Synthetic Derivatives; Analytical and Preparative Methods by Structural Elucidation and Characterization After Biotechnological Production of Important Commercial Secondary Metabolites; Magnetic Force Microscopy (MFM), Scanning hall aygitt microscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM)

**iTB510 Biosensors and Their Basic Principles 3+0 7.5**

**iTB511 DNA Vaccines and Viral Vector 3+0 7.5**

Nucleic Acid Vaccines: DNA vaccines, RNA vaccines; Biological, Chemical and Physical Methods of DNA Vaccination; Viral Vectors: Poxviruses, Adenoviruses, Herpesviruses, Adeno-Associated viruses; Viral Vector Systems: Manufacture and stability, Safety, Effect of immunity, Therapeutic payload; Mechanism of DNA Vaccines in Cells; Routes of Immunization; Limitations of Plasmid DNA Immunogens.

**iTB513 Antisense Technology and its Applications 3+0 7.5**

Antisense Technology and Its Applications: Antisense oligonucleotides, RNA interference, Gene silencing mechanisms; miRNA and Production; Areas of Use of miRNA; siRNA and Production; Areas of Use of siRNA; In Vitro and In Vivo Stability of siRNA; Encapsulation of siRNA with Drug Delivery Systems; RNA Vaccines; Using of Antisense Technology in Cancer Therapy; Assessment of Antisense Technology.

**iTB515 Microorganisms in Bioelectrochemical Systems 3+0 7.5**

Fuel Cells and Bioelectricity; Microbial Energy Production from Biomass; Enzymatic Fuel Cells; Survey of Direct Electron Transfer from Microbes; Genetically Modified Microorganisms for Bioelectrochemical Systems; Organics Oxidation; Fundamentals of Benthic Microbial Fuel Cells; Microbial Fuel Cells for Biochemical Oxygen Demand; Integrating Bioelectrochemical Systems into Wastewater and Sludge Treatment.

**iTB517 Biosafety in Microbiology Laboratory 3+0 7.5**

Concept of Biosafety; Importance of Biosafety in Microbiology Laboratories; International Standards and Regulations on Laboratory Safety; Biosafety Levels and Infectious Agents; Laboratory-Acquired Infections; Protection of Workers from Biological Risk Factors; Principles of Laboratory Cleaning, Disinfection and Decontamination: Medical Wastes and Their Destruction; Symbols and Warnings Used in Laboratory Safety; Design of a Safe Microbiology Laboratory.

**iTB519 Microbial Bioremediation and Biodegradation 3+0 7.5**

Definition and Types of Bioremediation; Bioremediation Strategies: In situ bioremediation, Ex situ bioremediation; Bioremediation in Aquatic and Terrestrial Systems; Groundwater Bioremediation; Bioremediation of Petroleum Hydrocarbons; Definition and Types of Biodegradation; Biodegradation Applications; Microbial Sources; Use of Genetically Modified Microorganisms.

**iTB521 Microbial Biotechnology 3+0 7.5**

Microbial Diversity; Microbial Growth Kinetics; Bioinformatic Applications in Microbiological Research; Food Products Involving Microorganisms and Their Products; Pharmaceutical Products Obtained Through the Use of Microorganisms; Importance of Omics in Drug Discovery (Genomics, Transcriptomics, Proteomics, Metabolomics); Model Microorganisms used in the Pharmaceutical Industry; Techniques Used in Microbial Biotechnology in the Pharmaceutical Industry; Biotechnology of Microbial Primary Metabolites; Biotechnology of Microbial Secondary Metabolites; Microorganisms and Environmental Biotechnology; Recombinant DNA Technology.

**iTB523 Molecular Pharmacological Methods 2+1 7.5**

Use of Cell Culture Methods in Evaluation of Drug Effects: Cytotoxicity, Real time cell proliferation analysis, Cell cycles and Apoptotic analysis, Neuronal differentiation, Wound healing; Molecular Cell Mechanisms, Related Genes and Products; DNA, RNA and Protein Isolations from Tissue, Blood and Cell Culture; Western Blood Analysis; Gene Polymorphism and Drug Effects; PCR, RFLP and Gel Electrophoresis Applications; cDNA and RT-PCR; RNAi, Gene Array and Microarray Technology in Pharmacological Studies; Use of ELISA, Immunohistochemistry, Immunofluorescence and Immunoprecipitation Methods in Evaluation of Drug Effects.

**İTB525 Introduction to Synthetic Biology and Metabolic Engineering 3+0 7.5**

The Basics of Synthetic Biology and Metabolic Engineering; Applications; Tools and Techniques; Understanding Cellular Systems for Biotechnological Applications; Re-Design of Metabolic Pathways in Biological Systems; Creating Cell Factories; Protein Engineering; Synthetic Biology and Metabolic Engineering Applications for Biofuel Production; Production of Secondary Metabolites; Production of Pharmaceuticals; Insulin Sample; Artemisin Sample; Project Design; Future of Synthetic Biology and Metabolic Engineering in Turkey.

**İTB526 Advanced Chromatographic Techniques 3+0 7.5**

Classification of Chromatographic Techniques; Instrumental Chromatographic Methods; Gas Chromatography (GC) and Hybrid Systems; Supercritical Fluid Chromatography (SFC); High Performance Liquid Chromatography (HPLC) and Hybrid Systems; Method Development in Liquid Chromatography (LC); Micro-Nano LC; Fast Protein Liquid Chromatography (FPLC) and Ultra Fast Liquid Chromatography (UFLC) Systems; Application Fields of HPLC: Chromatographic analysis of biomolecules, Drugs and pesticides; Qualitative and Quantitative Analysis Evaluation: Validation.

**İTB527 Biological Screening Tests of Natural Products 3+0 7.5**

Natural Products and their Sources; Chemistry of Natural Compounds; Antimicrobial Screening Tests: Dilution and Diffusion methods, CLSI and EUCAST; Mechanisms of Action; Natural Anticancer Products; Cancer and cancer therapy; Mechanisms of Action; Anticancer Screening Tests: Preclinical, Cell-based and genotoxicity screening tests; Toxicogenomic Screening Tools; Free Radicals and Antioxidants; Antioxidant Activity Screening Methods.

**İTB529 Separation and Purification Techniques of Biomolecules 3+0 7.5**

An Overview of Biological Separation and Purification Techniques: Definition, Application areas; Properties of Purification Techniques; Cell Disruption: Physical methods, Chemical methods; Separation and Purification Techniques: Centrifugation techniques, Filtration, Precipitation; Chromatographic Methods: Ion exchange chromatography, Gel filtration chromatography, Hydrophobic interaction chromatography, Adsorption chromatography, Affinity chromatography, High performance liquid chromatography; Purity Analysis: Spectrophotometric analysis, Electrophoretic analysis.

**İTB531 Electrochemical Biosensors 3+0 7.5**

Definition, structure and classification of biosensors; Advantages and application areas of biosensors; Introduction to electrochemical biosensors; Conductometric biosensors and Potentiometric biosensors; Amperometric biosensors; Performance criteria of electrochemical biosensors; Enzyme-based electrochemical biosensors; Use of nanomaterials in electrochemical biosensors; Use of conductive polymers in electrochemical biosensors; Transducers used in electrochemical biosensors; Preparation of electrochemical biosensors and immobilization of biomaterial; Recent developments in electrochemical biosensors and scientific discussion

**İTB533 Gas Chromatography and Applications in Biotechnology 2+1 7.5**

Fundamental Principles of Gas Chromatography; Components of Gas Chromatography; Injection Systems; Columns: Types of columns, Column Materials; Detectors: Flame ionization detector, Thermal conductivity detector; Mass spectrometer; Ionization; Mass Analyzer; Analysis: Selecting and preparation of samples, Method development for temperature programming, Qualitative analysis, Quantitative analysis.

**İTB535 Gene Therapy Techniques 3+0 7.5**

**İTB592 Seminar 3+0 7.5**

**İTB790 Thesis 0+1 30.0**

**İTE502 Sustainable Energy Management 3+0 7.5**

Global Energy Policies and Sustainability; Energy and Environment Approaches in the World: European Union and Turkey, Energy-environment relationship, Development plans, Global warming and climate change; Kyoto Protocol: Carbon footprint, Carbon management and planning, Environmental impact assessment; Environmental Impact Assessment Laws and Regulations; Environmental Impacts of Conventional Energy Sources; Energy Management and Environmental Impacts: Energy saving and efficiency.

**İTE503 Energy Economics 3+0 7.5**

Basic Concepts of Economics; Energy and Economic Dimensions; Economic Analysis of Energy Projects; Financing of Energy Projects; Alternative Energy Sources; Energy Investment Planning: Tariffing and Pricing; Energy Cost Analysis; Energy Trading; Energy Derivatives Markets; Global Energy Potential: Supply and Demand; Energy Balance; Global Energy Markets; Regional Views for the Next 30 Years: Prevailing Trends and Forecasts; Energy Indicators; Energy Policy Analysis and Modeling; Energy and Economic Growth; Liberalization and Competition Arrangements in Energy Markets; Energy and Sustainable Development.

**İTE505 Renewable Energy Sources 3+0 7.5**

Solar Energy: Solar angles, Solar radiation intensity, Solar collectors, Solar power plants, Heating-cooling applications; Geothermal Energy: Electricity generation, Potential of geothermal energy; Wind Power: Wind turbines; Hydrogen Energy: Energy system, Electricity generation; Wave-Tidal Energy: Electricity generation; Biomass Energy: Biochemical conversion processes.

**İTE516 Petroleum Refinery Engineering 3+0 7.5**

History and Development of Refining; Petroleum Refinery; Formation and Content of Crude Oil; Classification of Crude Oil; Distillation of Crude Oil; Acquirement of Light Hydrocarbon; Naphtha Hydrogenation; Evaluation of gasoline; Assessment of Gasoline; Acquirement of Aromatic Hydrocarbons; Thermal Cracking; Acquirement of Gas; Obtaining of Cracking Gasoline; Isomerization of Butane; Alkylation; Extraction of Furfural; Hydrogenation of Lubricating Oil; Lubricating Oil and Obtainment of Wax; Removal of Asphalt with Propane; Coking; Asphalt Processing; Wastewater Treatment.

**İTE517 Cable Grouping Technique and Quality Control 3+0 7.5**

Cable grouping introduction, Cable types and materials; Terminals, Sockets types and materials; Storage and entry quality control process in the cable bundling industry; Cable cutting process and cable cutting machines; Presses, dies and terminal fastening process; Soldering and heat shrink tube process, Tensile testing and crimping; Workflow design, workstation distribution and assembly process; Process control process in cable bundling industry; Injection processes in cable grouping; Grouping Boards and Test Control; Final inspection process and packaging in the cable bundling industry; Sample preparation and PPAP / Production Part Approval Process; Cable bundling industry application areas.

**İTE518 Using of Coal and Coal Technologies 3+0 7.5**

Coal Formation Petrography and Classification of Coal; Physical Properties of Coal and Other Technological Properties; Thermal Properties of Coal; Methods of Coal Production and Effect of Coal Quality; Desulphurisation of Coal: Combustion of Coal; Preparation of Coal-Water Mixtures and Combustion of coal-Water Mixtures; Coking of Coal; Pyrolysis of Coal; Low Temperature Carbonisation of Coal; Gasification of Coal; Underground Gasification of Coal; Coal Liquefaction.

**İTE519 Solar Energy and its Applications 3+0 7.5**

Solar Energy; Geometry and Angles of the Sun; Basic Calculations of Solar Energy: Extraterrestrial solar radiation and its calculation, Solar radiation on the earth surface and its calculation; Solar Radiation Measurements; Photovoltaics: Structure of the photovoltaics and production of electricity; Solar energy collectors: Plane collectors, Vacuum collectors, Systems with condenser; Storage systems of solar energy: Heat energy storage systems, Electrical energy storage systems; Solar energy potential in Turkey; Solar energy applications: Cooling, Water distillation, Drying, Greenhouse heating, Cookers, Steam and electricity production, Indoor air heating.

**İTE520 Electrochemical Energy Conversion Systems 3+0 7.5**

Basic Principles of Electrochemistry; Effect of Concentration on Electrode Potentials: Nerst equation; Concentration Batteries and Electrolysis; Electrochemical Energy Storage; Batteries and Their Working Principles; Accumulators and Their Working Principles; Fuel Cells and Their Working Principles; Electrodes Used in Fuel Cells and Their Properties; Membranes Used in Fuel Cells and Their Properties; Fuels Used in Fuel Cells and Their Properties; Supercapacitors; Electrochemical Hydrogen Production; Areas of Use of Batteries and Accumulators; Areas of Use of Fuel Cells.

**İTE521 Fuels and Combustion Technology 3+0 7.5**

Fundamentals of Fuels and Combustion Technology; Classification of Natural Fuels; Secondary Fuels; Pulverized Coal, Smokeless Fuel, Chemistry and Technology of Semi- Coke and Coke Production; Liquid and Gaseous Fuels; Combustion Chemistry and Technology; Environmental Impacts and Mitigation Developments Regarding Negative Effects of Solid and Liquid Fuels; Solid, Liquid and Gaseous Fuels Analysis and Quality Control.

- İTE522 Renewable Energy Sources and Smart Grids 3+0 7.5**  
 Renewable Energy Sources and Renewable Energy Supply; Electricity Production Methods, Materials Used; Conventional Energy Provision Systems, Materials Used; Benchmarking of Renewable and Conventional Energy Production; Conventional Electricity Network Lines and Smart Grids; Smart Grid Applications; Smart Grid and Its Use in Turkey; Smart Grids in the World; Future of Electrical Energy Management Systems.
- İTE523 Coal Processing Technologies 3+0 7.5**  
 The Place of Coal in Energy Resources of the World and Turkey; Sampling; Coal Classification; Physical and Chemical Properties of Coal; Inorganic Materials in Coals; Introduction to Coal Preparation and Coal Technology: Washability curves of coals, Preparation of coal for utilization; Coal Concentration: Physical, physicochemical, chemical and biological concentration; Coal Technology: Coking of coal, Coal liquefaction, Gasification of coal, Briquetting of coal.
- İTE524 Energy Audit for Buildings 3+0 7.5**  
 Energy Efficiency Regulations; Standards for Energy Efficiency; Regulations for Energy Audit; Energy Audit Reports; Energy Policies and Energy Management Systems; Examples of Energy Management in the World; Building Energy Identity Documents; Measurement Tools and Metrics Used in Energy Audits; Energy Efficiency for Electric Motors and Instruments; Energy Saving; Examples of Building Energy Audit; Studies on Energy Audit and Energy Efficiency.
- İTE525 Management of Energy Plant Wastes 3+0 7.5**  
 Introduction to Waste Management in Power Plants: Concept of waste, Classification and characterization of wastes; Characterization and Management of Thermal Power Plant Wastes: Management of flue gas and bottom ash wastes; Characterization and Management of Hydraulic Power Plant Wastes; Characterization and Management of Nuclear Power Plant Wastes: Management of production and concentration of nuclear fuel wastes, Determinations of environmental risks in nuclear power plant locations, Determinations of security risks in nuclear power plants; Characterization and Management of Renewable Power Plant Wastes; National and International Legislation about Waste Management.
- İTE526 Wind Energy 4+0 7.5**  
 Introduction to Wind Energy, Structure and Variety of Wind Turbines; Aerodynamics of Horizontal-axis Wind Turbines; Relationship between Wind Speed and Power, Effects of Atmospheric Conditions on Wind Turbines, Calculation of Rotor Efficiency, Generator Systems for Wind Turbines; Speed Control for Maximum Power Operation; Wind Farms; Statistical Distributions of Wind Speed; Forecasting Wind Energy and Capacity Factors; Wind Energy Economics; Wind Power Grid Integration.
- İTE527 Energy Efficient Lighting Technologies 3+0 7.5**  
 Photometric Quantities; Light Production Technologies; Lighting Components: Lighting sources, Luminaires, Lighting accessories; Automation and Control Strategies; Lighting Calculation Methods; Energy Efficiency Regulations about Lighting; Economic Analyses and Calculation of Payback Periods in Lighting Systems; Energy Efficient Lighting Technologies for Industrial Plants, Building and Transport.
- İTE528 Nuclear Energy and Politics 3+0 7.5**  
 Energy consumption, depletion of reserves, environmental impacts; Source of nuclear energy; Types of nuclear fuel; Nuclear fission and uranium fission; Nuclear power production; Nuclear waste management: Radiation protection standards, Radiations and radioactive materials, Reliability and qualitative risk evaluation, Safety measures in nuclear power plants; Site selection for nuclear power plants and licensing them; Nuclear energy policies of Turkey; Nuclear energy policies of the European Union; Nuclear energy policies in other countries.
- İTE529 Different Energy Sources, Sustainability and Life Cycle Assessment 3+0 7.5**  
 Different Energy Sources: Conventional energy sources, Renewable energy sources; Clean Production and Pollution Prevention: Clean production techniques, Pollution prevention planning; Sustainability: Sustainability concept, Relationship between clean production and sustainability; Life Cycle Assessment (LCA): Concept and history; LCA Methodology: LCA and ISO 14040 standards, Goal and scope definition, Inventory analysis, Impact assessment, Interpretation; LCA Software and Applications; Carbon Footprint Measurement Using LCA Approach.
- İTE530 Energy Storage Devices and Applications 3+0 7.5**
- İTE531 Waste-to-Energy Systems Credit 3+0 7.5**  
 Principles of Waste Management; Relationship Between Waste Management and Energy; Thermal Conversion Technologies: Fundamentals of thermal processes, Mass and energy balances of waste combustion, Incineration, Pyrolysis, Gasification, Energy from thermal conversion processes; Biological Conversion Technologies: Aerobic and anaerobic

composting processes and technologies, Energy from biological conversion processes; Landfills: Landfill design, Energy from landfill gas; Comparison of Waste-to-Energy Processes.

**İTE532 Electromagnetic Energy: From Motors to Laser 3+0 7.5**

**İTE533 Conventional Energy Resources 3+0 7.5**

Energy, Classification of Energy and Importance of Energy; Energy Resources in Turkey and in the World and Their Potentials; Formation, Properties and Preparation of Coals: Formation and structure of coals, Properties of coals, Production methods of coals, Areas of usage of coals and coal technologies; Areas of Usage of Coal: Thermal processes for coals in power plants, heating and industry; Petroleum Production: Theories of petroleum formation, Petroleum reservoirs, Physical and chemical properties of petroleum, Petroleum supply in the nature, Petroleum prospecting, Production, transport, storage and refinery processes of petroleum; Petroleum Refining Processes: Raw petroleum distillation column and products.

**İTE534 Wind Turbine Design and Manufacturing Processes 3+0 7.5**

Wind energy formation and evaluation; Wind Turbine and types; Parts of Wind Turbines; Blade design and blade design profiles in Wind Turbines; Blade material selection and blade manufacturing process; Tower and Rotor Designs of Wind Turbines; Material selection and manufacturing process for Tower and Rotor; Tail mechanism and design; Tail design profiles; material selection and manufacture; Safety mechanisms of wind turbines; bearing, gearbox, generator and brake systems used in wind turbines; Water Pumping System by wind energy (Wind Pump); Performance and cost evaluation in Wind Turbines.

**İTE535 Power Plants and Generation Systems 3+0 7.5**

Electrical Systems; Thermodynamics and Power Plant Cycle Analysis; Combustion Processes of Fossil Fuels; Steam Generators; Gas Turbines; Rankine and Brayton Cycles; Working Principles of Conventional Power Plants: Steam Turbine, Natural Gas, Nuclear, and Hydro Power Plant: Working Principles of Conventional Power Plants: Wind, Solar, Wave, Bioenergy, and Geothermal Energy Generation Systems; Electrical Energy Cost Calculation.

**İTE536 The Physics of Energy 3+0 7.5**

Units and scaling systems used in energy systems; Mechanical Energy in the Macroscopic World, Electromagnetic Energy, Waves and Light; Heat and Thermal Energy, Heat Transfer; Introduction to Quantum Physics in the Microscopic World; Entropy and Temperature; Examination of the Nature of Energy in Matter; Thermal Energy Conversion; Working principles of Internal Combustion Engines; Phase change energy transformations.

**İTE592 Seminar 3+0 7.5**

**İTE599 Semester Project 3+0 0.0**

**İTE601 Biomass and Conversion Technology 3+0 7.5**

Energy potential of biomass; Types of biomass; Structure and properties of biomass; Biomass burning technologies; Physical conversion processes; Behavior of biomass components in physical transformation processes; Obtaining various chemicals from biomass; Gasification of biomass; Liquefaction of biomass; Pyrolysis of biomass; Activated carbon production from biomass; Production of synthetic liquid fuels; Production of organic chemicals.

**İTE602 Environmental and Economic Impacts of Nuclear Energy 3+0 7.5**

General principles of nuclear energy; Nuclear Reactors; Nuclear fuel circle; Radioactive waste types; Radioactive waste management; Nuclear security; International nuclear regulations; Nuclear energy and sustainable development; Components of sustainable development applicable to nuclear energy; Effects of nuclear energy on the environment; Effects of nuclear energy on human health; National and international developments in the field of nuclear energy.

**İTE604 Smart Grid Optimization 3+0 7.5**

Elements of the power grid and measurement technologies: generation, transmission, distribution, and end-user; Basic concepts of power, load models, load flow analysis; Elements of power networks and data analysis: introduction to state estimation; Elements of computation and decision support tools: classical optimization methods, evolutionary computational techniques, Elements of distributed energy resources (DER) and grid integration: renewable energy, energy storage; solar energy, wind energy, biomass, hydropower, geothermal and fuel cell; effect of electric vehicles (EVs). Energy management and optimization in the smart grid; microgrids; Transmission-Distribution-Generation optimization, Demand management.

- İTE605 Electric Power Generation, Transmission and Distribution 3+0 7.5**  
Electrical Energy: Basic concepts, Methods of generating electrical energy, Generators; Thermal and Geothermal Power Plants: Basic concepts, Energy generation; Nuclear Power Plants: Source of nuclear energy, Nuclear reactors and their classification; Hydroelectric Power Plants: Structure of the power plant and energy generation, types of power plants and turbines; Electricity Generation from Wind Energy: Wind turbine components and energy generation; Hybrid Electric Power Generation Systems: Technology and design; Electric Power Transmission and Distribution: Classification of grids, Transmission lines, Transformer centers and equipments, Electric power distribution.
- İTE606 Energy and Natural Resources Security 3+0 7.5**  
Energy and Natural Resources; Global Energy Potential; Global Energy Markets; Natural Resources and Energy Indicators; Energy and Sustainable Growth; Conservation and Importance of Global Energy Resources and Natural Resources; Importance of Caspian and Middle East Basin in terms of Natural Resources and Energy; Regional Outlooks for Natural Resources: The prevailing trends and forecasts.
- İTE607 Characterization of Materials Used in Energy Applications 3+0 7.5**  
Resistance measurements: Two-point method, Four-point method, Six-point method; Carrier characteristics; Mobility measures: Hall mobility, Conductivity Mobility; Capacitance voltage characteristic; Current voltage characteristic; Contacts: Ohmic contact, Schottky contact; Magnetic field dependent measurements: Magnetoresistance, Magneto-optics; Photoluminescence; Temperature dependent measurement techniques.
- İTE608 Electrochemical Energy Conversion and Storage 3+0 7.5**  
Electrochemical Energy Conversion Reactions; Energy Storage Methods and Techniques; Materials Used for Electrochemical Energy Conversion; Fuel Cells; Batteries; Conductive Polymers; Production and Characterization Techniques of Materials Used for Electrochemical Energy Conversion; Application Areas of Electrochemical Storage Methods; Electrochemical Energy Conservation and Conversion.
- İTE610 Environment and Textile 3+0 7.5**  
Trends in Production and Consumption of Textile Products: Textile in Circular Economy, Eco-Design of Products, Application of Ecological Design Principles to Textile Products; Environmental Performance: Energy Use and Production, Water Use, Chemicals, Waste Generation, Flow Scenarios and Waste Hierarchy; Environment and Climate Impact: Raw Material Use, Water Use, Land Use, Greenhouse Gas Emissions, Waste, Wastewater, Microplastics and Microfibers; Circularity-oriented Practices: Recycling and Reuse, Optimized Resource Use, Recovery Methods, Fiber Material Recycling, Bio-Fuel Production from Textile Waste.
- İTE612 Carbon Tax and Applications 3+0 7.5**  
Importance of Renewable Energy Resources; Types of Renewable Energy Resources (Wind, Solar, Wave, Bioenergy and Geothermal Energy etc.); Climate Change; Agreements Addressing the Climate Crisis; Carbon Footprint and Calculations; What is Carbon Tax?; Carbon Tax at the Border; Carbon Tax Applications in the World; Carbon Tax Applications in Turkey; Carbon Tax Returns; Carbon Tax Environmental Calculations; Carbon Tax Cost Calculations.
- İTE692 Seminar 3+0 7.5**  
Research Proposal; Preparing a research proposal; Research methods; Qualitative and Quantitative Methods; Mixed Method; Determining the Research Topic; Literature Review; The Problem in Quantitative Research; Goal; Importance; Assumptions; Limitations; Definitions; Research Subject in Qualitative Research: Purpose, Importance, Assumptions; Preparing a Research Proposal Report; Public presentation.
- İTE790 Thesis 0+1 30.0**
- İTE890 Thesis 0+1 30.0**  
Exchange information with the student on his/her areas of interest in order to define the scope of the thesis; Evaluate the literature survey the student has done on the proposed research topic; Evaluate ideas the student has put forward on his/her research topic; Decide on the ideas to be used in the thesis work; Decide on a research plan and equipment to be used in the thesis work in the light of the literature survey; Define experimental parameters to be used in the thesis work; Carry out studies for the supply of materials to be used in the thesis work; Determining the parameters related to the applications; Carrying out the necessary steps, and applications.
- İTE890-0 Thesis (Thesis Proposal) 0+1 30.0**  
Determination of the Ph.D. research subject; Writing and development of Ph.D. research subject based on the literature; Preparation; Defence of Ph.D. thesis subject proposal; Correction on the proposal; Presentation and submission of the report.

- İTN501 Atom and Molecular Structure 3+0 7.5**  
 Structure of Atoms, Periodic Properties of Elements, Electronic Structure of Elements, Chemical Bonds, Interactions Between Particles, Geometry of Molecules, Attraction Forces Between Molecules, Description of Molecules, Doped Structures and k.p. Calculations of These Structures, Diffusion Equations, Solutions of Boltzman Equations, Basics of Quantum Physics, Photoelectricity, Matter and Wave, Principles of Uncertainty, Schrödinger Equation, Angular Momentum and Spin, Perturbation Theory, Variation Method, Symmetry and Transformations.
- İTN502 Nanotechnology 3+0 7.5**  
 Introduction to Nanotechnology, Nanobiology, Nanochemistry, Nanotechnology and Nanomedicine, Nanomaterials, Synthesis of Nanomaterials, Characterisation of Nanomaterials, Nanodevices, NEMS based Nanotechnology, Nanostorage, Nanorecognition
- İTN503 Applications of Nanotechnology 3+0 7.5**  
 Electronics; Nanotubes for Nanoelectronics, Vacuum Nanoelectronics, DNA Electronics, Nanoelectromechanical Systems, Molecular Electronic Devices; Health, Nanotechnology and Nanomedicine, Medical Nanomaterials, Biotechnology Devices, Medical Nanorobotics, Polymeric Nanoparticles for Drug and Gene Delivery, Pharmaceutical Nanotechnology, Biocompatible Core-Shell Nanoparticles, Nanocrystals of Poorly Soluble Drugs, Nanoparticles as Drug Delivery Systems, Nanomagnetism for Biomedical Applications ; Physics; Chemistry; Nanochemistry, Sol-Gel Chemistry, Techniques in Electrochemical Nanotechnology, Polymer Nanostructures, Nanostructured Bipolar Organic Polymers; Engineering; Electronic, Computer, Construction, Material, Chemistry, Genetic and Gene Engineering
- İTN504 (Eng) Mathematical Applications in Nanotechnology 3+0 7.5**  
 Fundamental Concepts: Vector differential operators, Gradient, Divergence and curl of scalar/vector fields; Vector integral calculus, Green's theorem in plane, Divergence theorem, Stokes's theorem; A brief introduction to partial differential equations, Three fundamental equations, Fourier's method, Basics of integral transforms; Quantum Concepts: Schrödinger equation, Plane wave solutions, Quantum wells, Quantum tunnelling, Eigenvalue problem, Solution of the hydrogen atom; A Brief Account of Elasticity: Stress and strain, Relations in elasticity, Deformations and dynamical behaviour of solids; Essential Concepts in Nanoindentation; Nanoindentation of Thin Films.
- İTN505 Nanocharacterisation I 3+0 7.5**  
 Structural Characterization of Nanomaterials, Thermal Conductivity of Semiconductor Nanostructures, Characterization of Magnetic and Electronic Properties, Characterization of Nanostructured Materials by X-Ray Photoelectron Spectroscopy, X-Ray Microscopy and Nanodiffraction, X-Ray Characterization of Nanomaterials, Raman Spectroscopy
- İTN506 Nanocharacterisation II 3+0 7.5**  
 Crystallography and Shape of Nanoparticles; Microscopic Techniques; Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM), Scanning Probe Microscopy, Magnetic Force Microscopy (MFM), Scanning Hall Aygıtı Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM)
- İTN507 Nanomaterials 3+0 7.5**  
 Metal, Ceramic, Organic Molecular Group, Polimeric or Composite Materials, Nanoparticles, Nanotubes, Nanoporous Materials, Nanoporous Carbons, Nanomembranes, Nanofluids, Nanocontainers, Nanocapsules, Nanocables and Nanojunctions, Ferroelectric Nanomaterials, Nanowires, Nanoceramics (Ceramic Nanopowders), Nanobiomaterials, Nanotransistors, Nanofibers, Nanocrystals, Nanostructured Metals and Alloys, Magnetic Nanomaterials (Soft and Hard), Bismuth Nanostructured Materials, Superhard Nanocomposites, Polymeric Nanomaterials, Protein-Doped Nanoporous Silica Gels, C60-Based Materials, Colloidal Gold, Dye/Inorganic Nanocomposites, Metal Nano-Optics, Multifunctional Nanocomposites, Nanostructured Thin Films, Quantum Dots, Nanolayers, Nanocomposites
- İTN508 Synthesis of Nanomaterials 3+0 7.5**  
 Chemical Synthesis of Nanoparticles; Synthesis of Nanomaterials Using Microemulsion Process; Sol-Gel Method; Liposomes; Nanostructures Created by Lasers; Solid-State Synthesis of Carbon Nanotubes; Carbon Nanotube Synthesis by Arc Discharge Technique; Catalytic Synthesis of Carbon Nanotubes and Nanofibers; Synthesis of Inorganic Nanowires and Nanotubes; Synthetic Nanoinorganics by Biomolecular Templating; UHV-SPM Nanofabrication; Electrochemical Synthesis of Semiconductor and Metal Nanowires; Nanopowders Produced Using Microreactors; Nanocrystalline Ceramics by Mechanical Activation; Formation of Nanostructured Polymers.
- İTN509 Nano-Biotechnology 3+0 7.5**  
 Bionanodevices; Bionanomotors; Biological Nanomaterials; Biological Molecules in Nanodevices; Biogenic Nanoparticles; Bioelectronics; Nanobiosensors; Nanoanalysis of Biomaterials,
- İTN510 Structure Property Relationship in Nanomaterials 3+0 7.5**



Photochemistry; Photoconductivity; Photodynamic; Electrochemistry of Nanomaterials; Dynamic Processes in Magnetic Nanostructures; Diffusion in Nanomaterials; Nanoscale Heat Transfer; Catalysis by Gold Nanoparticles; Transport in Semiconductor Nanostructures; Transition Metal Atoms on Nanocarbon Surfaces; Nanomechanics of Nanoscale Materials; Nanodeposition of Soft Materials; Nanocatalysis; Electronic Structure of Semiconductor Nanoparticles; Kinetics in Nanostructured Materials; Mechanical Behavior of Nanomaterials

**İTN511 Properties of Nanomaterials 3+0 7.5**  
Dielectric Properties of Nanomaterials, Characterization of Magnetic and Electronic Properties, Optical Properties of Nanomaterials, Thermodynamics Properties of Nanomaterials, Superplasticity of Nanoceramics

**İTN512 Nanodevices and Design 3+0 7.5**  
Semiconductor Nanodevice Modeling; Single-Electron Devices; Single-Electron Transistors; Single-Electron Dynamics; Nanorobotics and Nanomanipulation; Mechanical Molecular Nanodevices; Nanocomputers: Theoretical Models; Optical Fibers for Nanodevices; Photochemical Molecular Devices; DNA-Based Nanodevices; Gas-Based Nanodevices; Micro and Nanomechanics

**İTN513 Nanotechnology Applications in Textiles 3+0 7.5**  
Classification of Textile Materials; Textile Fibers and Properties; Type of Yarns and Spinning Systems; Nanotechnology Applications in Fibers and Yarns Production: Nanofibres; Electro spinning and Nanoadditives Used in Fiber Production; Textile Fabrics and Production Methods; Textile Finishing; Fabric Dyeing and Printing Technologies; Nanotechnology Applications in Textile Finishing: Water and oil repellency; Soil Release; Antimicrobial and Flame Retardant Finishes; Physical and Chemical Testing of Textiles; Characterization of Nanomaterials Applied on Textile Materials; Analyzing Textiles By SEM; Some Commercial Textile Products Based on Nanotechnology.

**İTN514 Nanomagnetism and Applications 3+0 7.5**  
Introduction to magnetism; Magnetostatics; Micro-magnetism, domains and hysteresis; Nanoscale-magnetism; Experimental methods in nanoscale; Micro- and Nanoscale Magnetic materials; Application of soft magnets; Application of hard magnets; Application of magnetic nanoparticles; Application of magnetic nanoscale thin films; Spin Electronics, magnetic recording and memory; Special topics; Samples of industrial devices.

**İTN515 Epitaxial Crystal Structures and Applications 3+0 7.5**  
Fundamentals of Ultra-High Vacuum: Vacuum chamber, Vacuum components, Vacuum gauges, Vacuum pumps, Temperature readers, Substrate holders, Extra accessories; Epitaxial Crystal Growth Techniques; Conditions for Epitaxial Crystal Growth; 2D Epitaxial Crystal Structures; 3D Epitaxial Crystal Structures; Characterization Techniques for Epitaxial Crystal Structures; Applications of Epitaxial Crystal Structures.

**İTN517 Photovoltaic Technologies and Applications 4+0 7.5**  
Introduction to Photovoltaics: Past and present of photovoltaic technology; Photovoltaic Materials and Concept of P-N Junction; Physics of Solar Cells; Solar Cell Design and Optimization Rules; Crystalline and Thin Film Solar Cell Technologies; Very High Efficiency Multi-Junction Solar Cells and Concentrated Photovoltaics; Electrolyte and Organic Based Solar Cells; Characterization of Solar Cells and Modules; Economics of Photovoltaic Technologies; Terrestrial and Space Applications; Electrochemical Storage for Photovoltaics; Photovoltaics in Architecture.

**İTN518 (Eng) Experimental Techniques for Nanotechnology 3+0 7.5**  
The Theory of Basic Processing Techniques: Diffusion, Oxidation, Photolithography, Chemical vapor deposition, Physical vapor deposition, Etching and metallization; Wave-Particle Duality: Photoelectric effect, X-ray diffraction, Compton effect, Related characterization techniques; Semiconductor Materials: Their properties and production techniques; Solid State Devices Basic Physics: Transistors, LEDs, Solar cells, Photodetectors and their fabrication techniques; Thin Films: Fabrication techniques, Vacuum technology, Growth mechanisms, Film characterization techniques, Surface treatments.

**İTN519 (Eng) Introduction to Nanoscience and Nanotechnology 3+0 7.5**  
Historical Perspective of Nanotechnology; From Micro to Nanosystems; Introduction to the Concept of Nanoscience and Nanotechnology; Properties of Nanostructured Materials: Quantum dots, Quantum wires, Quantum wells; Synthesis of Nanomaterials; Electronic and Optical Properties of Selected Nanomaterials; Nanoscale Biomimetic Devices and Systems; Nanomaterials for Drug Delivery; Impact of Nanotechnology on the Environment.

**İTN520 (Eng) Synthesis of Nanoparticles 3+0 7.5**  
Introduction to Nanoparticle Synthesis; Bottom-Up and Top-Down Syntheses; Solid Phase Synthesis; Mechanical Activation; Liquid Phase Synthesis; Hydrothermal Method; Solvothermal Method; Synthesis of Nanomaterials Using Microemulsion Process; Sol-Gel Method; Vapor Phase Fabrication; Spray Pyrolysis; Chemical Vapor Deposition; Synthetic Nanoinorganics by Biomolecular Templating; UHV-SPM Nanofabrication; Electrochemical Synthesis of Semiconductor and Metal Nanowires.

**iTN521 (Eng) Nanotechnology and Society 3+0 7.5**

Leaps in the History of Science and Technology; Nanotechnology: What is nanotechnology? Emerging applications of nanotechnology, Opportunities and challenges, Benefits and risks, Consumer products; Health and Safety Impact from Nanoparticles: Health issues, Environmental issues; Social Issues; Relation Between Technological and Social Changes; Social Acceptance of New Technologies, Public perception and understanding of nanotechnology; Impact of Nanotechnology; Socioeconomic Impacts, Education, Potential benefits and risks for developing countries; Government Support and Regulation of Risk; Nanoethics.

**iTN522 (Eng) Introduction to Micro and Nano Fabrication 3+0 7.5**

Cleanroom Environment, Safety and processing; Micro-nano Metrology; Silicon: Material Properties, Crystal structure, Growth, Wafers; Thin-Film Processes: PVD, CVD, PECVD, ALD; Thin-Film Materials and Processes: Metallic thin films, Oxide and nitride thin films, Polymer films, Stresses, Coverage metallic thin films, Oxide and nitride thin films, Polymer films; Pattern Generation and Optical Lithography: Photomasks as tools, Lithography process flow, Alignment and overlay, Exposure; Etching: Etching profiles, Anisotropic and isotropic wet etching, Plasma etching (RIE), Isotropic dry etching, Ion beam etching; Thermal Oxidation; Nano and Micro-Fabrication Equipment.

**iTN523 (Eng) Physics and Technology for Infrared Detection 3+0 7.5**

Electromagnetic Spectrum and Infrared Radiation: Atmospheric transmission and windows; Radiometry: Solid angle, Radiance, Emissivity, Planck's law and black body radiation; Optical Detection Processes; Thermal Detectors: Bolometers, Pyroelectric detectors, Thermoelectric detectors; Photon Detectors: Photoconductors, Photovoltaics, Detector types; Noise in Optical Detection: Noise sources and types; Figures of Merit in Optic Detectors: Responsivity, Signal-to-noise ratio, Noise equivalent power, Detectivity, BLIP and JOLI performance; Imaging Systems: Focal plane arrays.

**iTN524 (Eng) Semiconductor Materials and Devices in Nanotechnology 3+0 7.5**

Semiconductor Materials: Crystal Structure, Energy Bands, Density of States; Conduction Mechanism: Carrier Concentration, Donors and Acceptors, Mobility, Resistivity; Hall Effect, Carrier Diffusion, Generation and recombination processes; P-N Junction, Current-voltage characteristics; Transistors, LEDs, Solar cells, Photodetectors and their fabrication techniques; Thin films: Fabrication techniques, Vacuum technology, Growth mechanisms, Film characterization techniques, Surface treatments.

**iTN525 (Eng) Nano-Electronic Devices 3+0 7.5**

Introduction to Nanoelectronics and Nanoelectronics Roadmap: Electronic history, Scaling criteria, Emerging new nanoelectronic devices and concept of mesoscopic structures; Basic Semiconductor Device Physics and Device Architectures; Material Aspects of Nanoelectronics: Junction formation and gating; Fabrication Techniques for Nanoelectronic Devices; Electrical and Transport Properties of Nanostructures; Nanoscale Transistors: Devices, Circuits and systems; Nanoelectronic Memories; Carbon Nanotube and Graphene Electronics; Spintronics: Materials and applications in nanoelectronics; Concepts for Emerging Systems and Architectures.

**iTN527 (Eng) Basic Characterization Techniques in Nanotechnology 3+0 7.5**

An introduction to the techniques for materials characterization; Scanning probe techniques: Scanning tunneling microscope (STM), Atomic force microscopy (AFM); Imaging characterization techniques: Optical microscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM); X-ray photoelectron spectroscopy (XPS); Secondary ion mass spectrometry (SIMS); Raman spectroscopy.

**iTN528 (Eng) Nanotechnology Sensors 3+0 7.5**

**iTN529 (Eng) Machine Learning 3+0 7.5**

Introduction: Machine learning concepts, Software tools; Supervised Learning: k-NN, Linear methods, Naive Bayes classifier, SVM, Decision trees, Ensemble methods, Artificial neural networks; Dataset Transformations; Model Evaluation; Feature Selection; Unsupervised Methods: Clustering, Anomaly detection, PCA; Reinforcement Learning; Deep Learning: Convolutional neural networks, Recurrent neural networks, Autoencoders, Generative models

**iTN530 (Eng) Nanobiosensors 3+0 7.5**

**iTN531 (Eng) Computational Approaches in Nanomaterials 3+0 7.5**

Introduction to Modelling Materials; Scale and dimensionality of nanomaterials; Simulation methods for different time and length scales; Useful Concepts in Molecular Modelling; Empirical Force Field Models: Molecular Mechanics; ab initio

Methods, Density Functional Theory and Solid-state Quantum Mechanics Minimisation and Related Methods for Exploring the Energy Surface: Global and Local Optimisations; Global Optimisation methods: Genetic algorithm, basin hopping method, simulated annealing; Monte-Carlo simulation methods; Molecular Dynamics simulation methods; Overview of application areas of modelling materials in nanotechnology.

**İTN532 (Eng) X-Ray Diffraction in Analysis of Thin Films 3+0 7.5**

Crystal structures: Crystal systems, Miller indices, Lattice planes and directions, Crystal defects; Semiconductor heterostructures; Properties of X-rays: Spectrum, Absorption of X-rays, X-ray diffraction, Interaction with matter, Penetration depth; Components of X-ray diffractometer: Geometry of X-ray Diffractometer, X-ray source, Sample stage, Optics, Detector; Thin Film Applications: Rocking curve, Grazing incidence-exit, X-ray reflectivity, Reciprocal space map.

**İTN533 (Eng) Nanotechnology and Biological Applications 3+0 7.5**

Introduction to nanotechnology and its history; Structure of bionanomaterials: Nanoparticles, Nanorods, Nanowires, Nanofilms; Nanoparticle Production Methods for Different Application Areas; Properties of Bionanomaterials: Characteristics, Identification, Toxicity, Usage of bionanomaterials in disease and health; Medical Nanotechnology and Applications: Biosensor and nanochip applications, Targeted therapy; Electron Microscopic Method in Characterization of Nanoparticle: Size, Surface, Ultrastructure; Overview of Bionanomaterial Cytotoxicity Studies in Nanotechnology.

**İTN534 (Eng) Chemistry and Applications of Organic Electronic Materials 3+0 7.5**

Synthesis of organic materials (based on): Thiophenes, Tetrathiafulvalenes, Polyacetylenes, Poly(p-phenylene)s, Heteroaromatic materials; Low Band Conducting Materials; Polyphenylenevinylene Materials; Macrocyclic Metal Complexes; Fullerenes (C60) and Their Optoelectronic Properties; Application of Conjugated Systems: Solar cells, Light emitting diodes, Electrochromic devices.

**İTN535 (Eng) Transparent Ceramic and Glass-Ceramic Materials 3+0 7.5**

Structural Conditions for Transparency; Introduction to Glass-ceramic Materials; Structure of Glass-ceramics: Transparent nano-crystalline glass-ceramics; Applications of transparent glass-ceramics; Recent Examples to Transparent Glass-ceramics and Their Processing Methods: Sintered aluminate glass-ceramics, Infrared transmitting glass-ceramics, Ce: YAG glass-ceramics for lighting; Introduction to Transparent Ceramic Materials; Optical Transmission Analysis; Characterization of Transparent Ceramics and Glass-ceramics by X-ray Diffraction and Electron Microscopy Methods.

**İTN536 (Eng) Atomistic Simulation Laboratory 2+1 7.5**

**İTN537 (Eng) Deep Learning and Artificial Neural Networks 3+0 7.5**

**İTN592 Seminar 3+0 7.5**

**İTN592 (Eng) Seminar 3+0 7.5**

**İTN609 (Eng) Fundamentals of Semiconductor Devices and Technology 3+0 7.5**

Elements of Quantum Mechanics: Basic formalism and Schrödinger equation, Particle in a box and quantum mechanical confinement; Energy-Band Theory: Kronig-Penney model, Particle motion and effective mass, E-k diagrams, Density of states, Fermi function; Semiconductors: Fundamentals, Doped-undoped structures, Fermi level, Electron and hole densities, Generation-recombination processes, Carrier transport; Devices and Operation Basics: P-n junction, Metal-oxide semiconductors, Bipolar junction transistors; Quantum Structures: Quantum wells, Quantum wires, Quantum dots.

**İTN610 (Eng) Nano Imaging and Nano Analysis 3+0 7.5**

Introduction to Nano Imaging and Nano Analysis: Requirements, Resolutions, Limitations; Specimen-Solid Interaction; Parts of Electron Microscopes: Gun, Lenses, Vacuum; Nano Imaging Techniques: Secondary electrons and in-lens imaging, Backscattered, Angular selective backscattered and energy selective backscattered electron imaging, Bright field, Dark field and high angle annular dark field imaging; Nano Chemical Analysis: Energy and wavelength dispersive x-ray analysis, Analysis with electron energy loss spectrometry; Nano Phase Analysis: Diffraction, Electron backscattered diffraction, Precession electron diffraction.

**İTN611 (Eng) Applied Quantum Mechanics 3+0 7.5**

Quantum Mechanics and Technology; The Mathematical Formulation of Quantum Mechanics; Particles in Potentials; Tunneling and Applications in Technology; Hydrogen Atom Problem: Applications to doping and excitons in semiconductors; Physical Symetries and Conservation Laws: Band edges states in optical materials; Identical Particles and Second Quantization: Phonon, Plasmon, Polaron, Magnon; Time Dependent Problems: Electron-photon interactions (light absorptions and emissions), Electron-phonon interactions.

**iTN612 (Eng) Molecular Beam Epitaxy:Principles and Applications 3+0 7.5**

Epitaxy and Epitaxy Techniques; Molecular Beam Epitaxy: Fundamentals, Historical background; Physics of Epitaxy of Nanostructures: Quantum dots, Quantum wires, Quantum wells; In Situ Analytical Methods: Mass spectrometry, Surface analysis, Optical reflectance; Lattice Matching Considerations: Natural lattice matching, Forced lattice matching, Mismatched epitaxy; Overview of the Technology and Applications of Epitaxy.

**iTN613 (Eng) Photovoltaics and Solar Energy Materials 3+0 7.5**

Introduction to Photovoltaic and Solar Energy: The past and present of Photovoltaic technology, Photovoltaics: Terrastrial and space applications; Physics of Solar Cells: Concept of p-n junction under dark and illumination, Solar cell design, Characterization and optimization; Material Choices and Solar Cell Generations; Crystalline Material Solar Cells; Inorganic Thin Film Solar Cells; Thin Film Solar Cells Based on Organic and Electrolyte Based Materials; Third and Next Generation Solar Cell Concepts: Emerging new materiald based on nanotechnology in solar energy harvesting.

**iTN614 (Eng) Nuclear Magnetic Resonance Spectroscopy 3+0 7.5**

The Physical Basis of NMR Spectroscopy: Nuclear angular momentum and magnetic moment, Nuclei in a static magnetic field, The chemical shift: 1H and 13C chemical shifts of compounds, Spin-spin coupling and mechanisms: Spectrum analysis: Assignment of 1H and 13C signals: Relaxation mechanisms: Two dimensional NMR spectroscopy: Dynamic NMR spectroscopy: Interpretation of NMR spectra.

**iTN615 (Eng) Electron Backscattered Diffractometry 3+0 7.5**

Capabilities and Limitations of Electron Backscattered Diffractometry: Components of an electron backscattered diffractometry, Generation of diffraction patterns in electron backscattered diffractometry, Spatial resolution, The hough transformation, Indexing; Characterization and Representation of Texture: Euler angles, Rotations and orientations, Pole figures, Discrete orientations, Orientation distribution functions; Applications: Quantitative texture analysis, Grain boundary misorientation analysis, Phase analysis, Interpretation of line and planar defects, Stereological analysis.

**iTN617 (Eng) Advanced Topics in Nanotechnology 3+0 7.5**

Different Types of Materials in the Nanotechnology; Hybrid Inorganic-Organic Electronics, Shedding light on nanoscale materials; Nanophotonics; Plasmonics; Nano-Devices Based on Understanding the Device Physics as Well as the Nanofabrication Techniques Required to Construct Them; Nanostructured Thermoelectric Structures; The Different Dimensions of Nanotechnology: Zero dimensional, One dimensional, Two dimensional and three dimensional nano materials; State-of-the-Arts Devices; Future Trends.

**iTN619 (Eng) Computation,Simulation and Modelling in Nanotechnology 3+0 7.5**

Computer Simulation and Modelling to Predict the Physical Properties of Materials; Density Functional Theory; Prediction of Electronic, Mechanical, Dynamical and thermal properties of nanomaterials via density functional theory simulations; Molecular Dynamics Simulations and Classical Force Fields; Classical Force Field Generation for Nanomaterials; Prediction of Mechanical and Thermal Properties of Nanomaterials Via Molecular Dynamics Simulations.

**iTN620 (Eng) Properties and Synthesis of Carbon Nanomaterials 3+0 7.5**

Introduction to Carbon Element: Carbon hybridization and carbon allotropes; Graphite: Crystal structure and physical properties; Diamond: Crystal structure and physical properties; Nano Forms of Carbon: Types and Quantum Confinement in Carbon Nanomaterials; Fullerenes: Structure, Properties, Synthesis methods and applications; Carbon Nanotubes: Structure, Properties, Synthesis methods and applications; Graphene-Based Materials: Structure, Properties, Synthesis methods and applications; Nanodiamond: Structure, Properties, Synthesis methods and applications; Amorphous Nanocarbons.

**iTN621 (Eng) Focussed Ion Beam Techniques for Nanofabrication 3+0 7.5**

Introduction to Focused Ion Beams (FIB); Ion/Matter Interaction; Imaging With Ions; Micro and Nanofabrication: Milling and deposition for prototyping; SEM Sample Preparation for 2D Imaging and 3D Tomography; 2D and 3D Chemical Maps; 2D and 3D Phase Maps; Ion Implantation Damage and Redeposition During Ion Milling; He Ion Microscopy; Specimen Preparation for Scanning Transmission Electron Microscopy and Atom Probe Tomography; Applications of FIB; FIB/SIMS; Laser + FIB/SEM; Plasma FIB.

**iTN622 (Eng) Soft Materials 3+0 7.5**

Basic Concepts in Materials Chemistry; Forces Between Atoms and Molecules: Strong intermolecular forces, Weak intermolecular forces; Polymeric Materials: Polymer synthesis, Structure, properties and morphology of polymers, Characterization of polymers, Polymer physics; Colloidal Materials; Self-assembly; Liquid Crystals; Biological Soft Materials; Applications of Soft Materials in Nanotechnology.

**iTN623 (Eng) Reticular Materials 3+0 7.5**

Metal-Organic Frameworks: Emergence of metal-organic frameworks, Determination and design of porosity, Building units of MOFs, Binary metal-organic frameworks, Complexity and heterogeneity in MOFs, Functionalization of MOFs; Covalent Organic Frameworks: Historical perspective on the discovery of covalent organic frameworks, Linkages in covalent organic frameworks, Reticular design of covalent organic frameworks; Applications of Reticular Materials: Basics of gas sorption and separation in MOFs, Hydrogen and methane storage in MOFs; Zeolitic Imidazolate Frameworks.

**iTN625 (Eng) Advanced Functional Materials 3+0 7.5**

**iTN692 (Eng) Seminar 3+0 7.5**

**iTN790 Thesis 0+1 30.0**

**iTN790 (Eng) Thesis 0+1 30.0**

**iTN890 (Eng) Thesis 0+1 30.0**

**iTN890-0 Thesis (Thesis Proposal) 0+1 30.0  
(Eng)**

**KiM501 Selected Topics in Organic Chemistry I 3+0 7.5**

General Principles of Kinetics and Thermodynamics and Chemical Reactivity; Aromaticity; Antiaromaticity; Hyperconjugation; Tautomerism; Hydrogen Bonding; EDA Complexes; Complexes of Crown Ethers and Related Compounds; Phase Transfer Catalysis; Classification of Reaction Mechanisms and Fundamental Reaction Mechanism Types; Basic Factors Influencing Acidity and Basicity.

**KiM502 Selected Topics in Organic Chemistry II 3+0 7.5**

Methods for Identification of Organic Reaction Mechanisms; Primary and Secondary Kinetic Isotope Effects; Stereochemical Proofs; Isolation of Reaction Intermediates; Substituent Effects; Chemistry of Organic Compounds Containing Boron; Phosphorus and Sulphur; Pericyclic Reactions; Radical Reactions; Photochemistry; Molecular Rearrangements; Oxidation Reduction Reactions.

**KiM504 Chemical Kinetics 3+0 7.5**

Reactions Rate and Order; Zero, First-, Second-, Third Order Rate Equations; Kinetics of Complex Reactions; Kinetics of Chain Reactions, Molecular Reaction Dynamics; Collision Theory, Activated Complex Theory; Molecular Activation and Types; Intermolecular Energy Transfer; Catalysis; Heterogeneous Catalysis; Homogeneous Catalysis; Fundamentals of Enzyme Kinetics.

**KiM506 Polymer Chemistry 3+0 7.5**

Concepts and Definitions; Classification of Polymers; Polymer Molecular Weights and Their Determination; Polymer Isomerism; Thermal Transitions and Mechanical Behavior; Step-Growth Polymerization; Chain- Growth Polymerization; Ionic and Coordinated Polymerization; Copolymers.

**KiM509 Carbon-Carbon Bond Formation 3+0 7.5**

Carbonion Alkylation; Enolate Alkylation; Acetylides-Cyanide Alkylation; Organometallic Alkylation; Addition to Carbonyl; Replacement Reactions; Aldol and Related Reactions; Claisen and Related Reactions; Organometallic Reactions; Wittig



Adsorption and Surface Phenomenon; Adsorption; Adsorption of Gases on Solids; Heat of Adsorption; Physical Adsorption; Chemical Adsorption; Monolayer Adsorption; Multilayer Adsorption; Adsorption Isotherms; Langmuir Adsorption Isotherm; The BET and Other Isotherms; Surface Area Determination; The Solid-Liquid Interface-Adsorption from Solution; Interactions at Solid-Solution Interface; Capillarity: Surface Tension and Surface Free Energy; Surface Films; Wetting and Detergency.

**KiM522                    Bioanalytical Chemistry                    3+0   7.5**

Introduction to Bioanalytical Chemistry; Physical, Chemical and Biological Properties of Biomolecules; Biological Sampling and Points to Consider While Working with Biomolecules; Bioanalytical Sample Preparation Techniques; Choice of Appropriate Analysis Method by Using Properties of Biomolecules; Analysis of Biomolecules by SDS and Gel Electrophoresis Methods; Analysis of Biomolecules by Capillary Electrophoresis Techniques; Analysis of Biomolecules by HPLC and FPLC Methods; Analysis of Biomolecules by Hybrid MS Techniques; Analysis of Biomolecules by MALDI-TOF-MS; Analysis of Biomolecules by Other Methods; Bioanalytical Validation.

**KiM523                    Complex Equilibria in Analytical Chemistry                    3+0   7.5**

Mathematical Methods Used in Equilibrium Calculations; Mass and Charge Balances, Proton Condition; Strong and Weak Acids-Bases; Buffer Solutions and Logarithmic Concentration Diagrams; Hydrolysis of Salts of Weak Acids and Bases; Polyprotic Acids and Bases; Logarithmic concentration diagrams of solutions of polyprotic salts; Mixture of Two Weak Monoprotic Acids and Multiple Buffer Systems; Solubility of Polyprotic Acid Salts; Precipitation and Solubility: Separation with precipitation, Precipitation titrations; Solubility of Weak Monoprotic Acid Salts.

**KiM524                    Bioinorganic Chemistry                    3+0   7.5**

Biological Functions of Inorganic Elements; Biological Ligands for Metal Ions; Metals at the Center of Photosynthesis; Catalyses through Hemoproteins; Iron-Containing Biological Proteins; Nickel-Containing Enzymes; Copper-containing Protein; Biological Functions of Transition Metals; Zinc and Enzymatic Catalysis; Biomimic Chemistry; Biominerals; Bioinorganic Chemistry of the Toxic Metals; Chemotherapy, Imaging and Other Applications of the Nonessential Elements.

**KiM525                    Quantum Chemistry                    3+0   7.5**

Introduction to Quantum Chemistry; Traveling Waves and Equations; Electromagnetic Theory; Quantum Mechanics of Some Simple Systems; The One-Dimensional Harmonic Oscillator; The Quantum Mechanics Applications of Atoms; The Particle in a One-Dimensional Box; The Particle in a One-Dimensional Box for Wave Functionals and Momentum; The Hydrogen Atoms for Quantum Chemistry; Introduction to Some Concepts of Quantum Mechanics and the Theoretical Basis of the Chemical Bonds; Introduction to Some Chemical Bonds of Molecular Orbitals as Linear Combinations of Atomic Orbitals (LCAO) and Basics Procedure for Quantum Mechanical Mixing of a Atomic Orbitals Solution for Molecular Orbital Functions; Determination of the Molecular Orbitals Wave Functions; Approach LCAO Methods for the P-Bond Systems; Electron Density; Charge Density; Bond Order.

**KiM526                    Microwave Organic Synthesis                    3+0   7.5**

Microwave Assisted Organic Chemistry (MAOS) A Brief History; Microwave Theory; Microwave Equipments; Microwave Processing Techniques; Designing Reaction using Microwave; Comparison of Microwave Synthesis and Conventional Synthesis; Practical Applications of CEM Discover Microwave Equipment.

**KiM529                    Catalytic Chemistry                    3+0   7.5**

Catalysis in Solutions; Acid-base Catalysis; Catalysis By Electron Transfer; Organometallic Catalysis; Catalysis By Macromolecules; Phase Transfer Catalysis; Catalysis By Enzymes; Structure of Enzymes; Reactions Catalyzed By Enzymes; Catalysis By Polymers; Structures of Polymers; Other Polymer Catalysis; Catalysis on Surfaces; Surface Structures; Adsorption, Surface Catalysis; Catalysis on Metal Surfaces; Other Metal Catalysis.

**KiM531                    Modern Analysis Methods I                    3+0   7.5**

Introduction to Molecular Spectroscopy and Differences With Atomic Spectroscopy; Infrared (IR) Spectroscopy and Applications; Microwave Spectroscopy; Raman Spectroscopy and CARS Applications; Electron Spin Resonance Spectroscopy; New Applications of NMR Spectroscopy; Dynamic Nuclear Magnetic Resonance; Double Resonance Technique; NO Technique; NMR With Solid Samples; <sup>13</sup>C-NMR; <sup>19</sup>F-NMR And <sup>31</sup>P-NMR Spectroscopy; Thermal Analysis Methods; Thermogravimetry; Differential Thermal Analysis.

**KiM532                    Modern Analysis Methods II                    3+0   3.0**

Theory of Atomic Spectroscopy; Atomic Absorption Spectrometry and Applications; Atomic Emission Spectroscopy and Applications; Atomic Fluorescence Spectrometry and Applications; Laser Source Atomic Spectroscopy and Applications, X-Ray Spectrometry; Mössbauer Spectroscopy, ESCA Spectroscopy and Applications; Radiochemical Methods; Spectroscopy, Neutron Activation Analysis and Other Nuclear Techniques.

**KiM533                    Electroanalytical Chemistry                    3+0   7.5**

Principles of Electroanalytical Methods; Electrochemical Cells; Cell and Electrode Potentials; Electrode Types; Potentiometric Methods; Potentiometric Titrations; Voltammetric Methods; Linear-Sweep Voltammetry; Cyclic Voltammetry; Polarographic Methods; Puls Polarography; Alternative Current Polarography; Stripping Methods; Analytical Applications; Amperometric and Coulometric Methods; Amperometric and Coulometric Titrations; Conductometric Methods; Measurement of Conductance; Conductometric Titrations; Spectroelectrochemistry.

**KiM534 Organometallic Chemistry 3+0 7.5**

Overview of Organometallic Chemistry; Fundamentals of Structure and Bonding; Electron Rule; Carbonyl Ligands; Pi Ligands; Other Important Ligands; Organometallic Reactions I; Organometallic Reactions II; Homogeneous Catalysis; Transitions Metal-Carbene and Transitions-Metal Carbyne Complexes; Applications of Organometallic Chemistry to Organic Synthesis; Other Applications of Organometallic Chemistry.

**KiM535 Data Analysis in Chemistry 3+0 7.5**

Basic Statistics: a Review; Errors; Accuracy; Precision; Reducing Systematic Errors; Mean and Standard Deviation; Distribution of Random Errors; Reliability of Results; Confidence Interval; Comparison of Results; The T-Test; Analysis of Variance; Signal Detection and Manipulation; Signal Detection; Point Estimation of the Detection Limit; The Wilcoxon Test; Signal Manipulation; Curve Fitting; Smoothing of Data; Least-Squares Polynomial Smoothing; Differentiation of the Signal; Calibration and Chemical Analysis; Comparison With Standards; Constructing a Calibration Curve; Utilizing the Calibration Curve for Chemical Analysis; Resolution of Analytical Signals; Exploratory Data Analysis: Processing Techniques; Graphical Methods; Partial Least Squares Path Modelling; Control and Optimization.

**KiM536 Chromatographic Techniques 3+0 7.5**

Introduction to Chromatographic Techniques; Classification of Chromatographic Techniques; Planar Chromatographic Techniques and Applications; Gas Chromatography and Hybrid Systems; Supercritical Fluid Chromatography; Gel Permeation Chromatography and Applications; Electrochromatographic Methods; Gel Electrophoresis; Capillary Electrophoresis and Applications

**KiM537 Organic Macro Molecules 3+0 7.5**

Enzymes, Non-enzyme Soluble Proteins; Calcium Binding Proteins; Integral Membrane Proteins; DNA, RNA, Protein Complex to Nucleic Acid; Virus Components, Immune System, Toxins, Carbohydrates; Unusual Tertiary and Quaternary Structures; Protein Crystals; History of Earliest Crystallographic Structures.

**KiM539 Quantitative Structure Property Relationship 3+0 7.5**

Molecular mechanics, ab initio, and semi-empirical calculations.

**KiM550 Reagents In Organic Synthesis 3+0 7.5**

Oxidizing and Reducing Reagents; Oxidizing and Reducing Reagents; Classification and Reactions; Activating Agents and Protecting Groups; Reagents and protecting groups for elimination reactions, Acylation, Ether formation, Protection of diols, Amines, Carbonyl groups and reagents, Sulfonylation reagents; Reagents and Catalysts for C-C Bond Formation: Acetylenes and allenes, Aluminum, Boron, Copper, Cyano, Isocyanato, Diazo, Azido, Dienes, Dienophiles, Enolates, Epoxides, Halo compounds, Imines, Ketenes, Lithium, Magnesium, Phosphorus, Sulfur, Zinc, Nickel; Acidic and Basic Reagents; Acidic and Basic Catalysts; Using Lewis Acid; Hydrolyses and Enzymatic Reagents.

**KiM551 Sensors and Their Applications 3+0 7.5**

Sensor Technology; Introduction to Chemical Sensors; Optical Methods and Sensors: Sensor techniques in optics, evanescent waves, spectroscopy, surface plasmon resonance, Fiber Optics; Mass Sensitive Sensors: piezoelectric sensors, quartz crystal microbalance, Surface Acoustic Waves; Biosensors: Biomaterials for biosensors, enzymes, enzyme structure, antibodies, antibody structure, production of antibodies, detection of antibody-antigen binding, immobilization techniques of biomolecules, Preparation Techniques of Chemical Sensors, Evaluation of Sensor Signal, General Analytical Applications.

**KiM558 Biochromatography 3+0 7.5**

Theory of Biochromatography; Gel Filtration; Ion Exchange Interaction Biochromatography; Hydrophobic Interaction Chromatography Of Proteins; Affinity Chromatography; Dye Ligand Affinity Chromatography; Immobilized Synthetic Dyes in Affinity Chromatography; Immobilized Pseudospesific Ligands In Affinity Chromatography; Immobilized Metal-Ion Affinity Chromatography; Intelligent Polymers, Imprinted Polymers; Biomedical Applications of Biochromatography.

**KiM560 Alternative Reaction Systems 3+0 7.5**

Ionic Liquids; Physical properties of ionic liquids, synthesis of ionic liquids, Multiphasic Solvent Systems; Aqueous biphasic systems, Fluorous biphasic systems, Properties of perfluorinated solvents, Triphasic systems, Supercritical Fluids; Physical properties of supercritical fluids, Chemical reactions in supercritical media, Catalytic Reactions In Alternative Reaction



Systems; Hydrogenation, Hydroformylation, Diels-Alder, Oxidation, Carbon-Carbon Bond Formation, Metathesis, Polymerization

**KiM561 Novel Tendencies in Liquid Chromatography 3+0 7.5**

Introduction to High Performance Liquid Chromatography (HPLC); Development of Method in Liquid Chromatography (LC); Qualitative and Quantative Analysis; Column Preparation Techniques in LC; Micro-Nano LC; Fast Protein Liquid Chromatography (FPLC) and Ultra Fast Liquid Chromatography (UFLC) Systems; Researching of Other Novel LC Techniques; Evaluation of Analysis in LC; Applications of LC.

**KiM562 Inorganic Polymers 3+0 7.5**

Definition and classification of inorganic polymers; Polymeric sulfur, selenium, tellurium; Linear polyphosphates, polyphosphazenes, polycarboranes, poly(sulfurnitride); Chalcogen glasses Borate, borophosphate and borosilicate glasses; Boron-nitride and phosphor-oxynitride polymers; Crystalline silicates and aluminum phosphates; Synthetic inorganic fibers; Technological applications of inorganic polymers.

**KiM563 Natural Product Synthesis I 3+0 7.5**

Total Synthesis of Carbohydrates; Total Synthesis of Prostaglandins; Total Synthesis of Pyrrole Pigments; Total Synthesis of Nucleic Acids; Total Synthesis of Antibiotics; Synthesis of Monoterpenes; Total Synthesis of Sesquiterpenes; Synthesis of Triterpenes; Naturally Occurring Aromatic Steroids; Total Syntheses of Isoquinoline Alkaloids; Synthesis of Indole Alkaloids; Alkaloid Synthesis; Synthesis of Insect Pheromones; Total Synthesis of Cannabinoids; Total Synthesis of Ionophores; Synthesis of Prostaglandins; Synthesis of Monoterpene.

**KiM564 Natural Product Synthesis II 3+0 7.5**

Total Synthesis of Macrocyclic Lactones; Synthesis of the Leukotrienes; Synthesis of Monoterpenes; Total Synthesis of Aromatic Steroids; Gene Synthesis; Total Synthesis of Triterpenes; Total Synthesis of Carbohydrates; Total Synthesis of Pyrrole Pigments; Total Synthesis of Tri- and Tetracyclic Diterpenes; Synthesis of Polysaccharides; Total Synthesis of Naturally Occurring Quinones; Total Synthesis of Spiroketal-Containing Natural Products; Synthesis of Insect Pheromones; Acyclic Sesquiterpenes; Monocyclic Sesquiterpenes; Bicyclic Sesquiterpenes; Tricyclic Sesquiterpenes.

**KiM565 Literature Search in Chemistry 3+0 7.5**

Search for Authors by Using SciFinder Program; Search for Patents by Using SciFinder Program; Search for Journals by Using SciFinder Program; Search by Topics by Using SciFinder Program; Search for Chemical Substances by Using SciFinder Program; Search for Reactions by Using SciFinder Program; Chemical Abstract Search in Library; Search for Topics Using Web of Science; Search for Authors by Using Web of Science; Search for Citations by Using Web of Science; Getting Data from Council of Higher Education and The Scientific and Technological Research Council of Turkey; Using other Search Engines.

**KiM566 Stereo Selective Reactions and Practical Approach 3+0 7.5**

General Concepts of Stereoselective Synthesis; Characterization of Stereoisomers; Analysis of Conformation and Configuration; Stereoselective Catalytic Reductions; Stereoselective Non-Catalytic Reductions; Stereoselective Oxidations; Stereoselective Carbon-Carbon Bond Forming Reactions by Nucleophilic Addition to Carbonyl Groups; Stereoselective Carbon-Carbon Bond Forming Reactions; Stereoselective Carbon-Carbon Bond Formation by Pericyclic Reactions; Stereoselective Formation of Carbon-Heteroatom Bonds; Stereoselective Formation of Carbon-Nitrogen Carbon-Phosphorus; Carbon-Oxygen; Carbon- Sulfur and Carbon-Halogen Bonds.

**KiM567 Applications of Computational Chemistry 3+0 7.5**

ChemOffice Package Program: Molecule drawing with ChemDraw programme; Molecule drawing and the data preparation with chem3D programme; Mopac Package Program: Calculations with mopac programme in chem3D; Calculations with mopac2009 programme; Cache Package Program: Semi-empirical and ab initio; Spartan Package Program: Semi-empirical and ab initio; Gabedit Program: Mopac and gaussian; Gaussian Package Program; GaussView Package Program; Other Computing Programs.

**KiM568 Solvent-free Organic Synthesis 3+0 7.5**

Solvent-Free Reduction; Solvent-Free Oxidation; Solvent-Free Carbon-Carbon Bond Formation; Solvent-Free Carbon-Nitrogen Bond Formation; Solvent-Free Carbon-Oxygen Bond Formation; Solvent-Free Carbon-Sulphur Bond Formation; Solvent-Free Carbon-Phosphorus Bond Formation; Solvent-Free Carbon-Halogen Bond Formation; Solvent-Free Nitrogen-Nitrogen Bond Formation; Solvent-Free Rearrangement; Solvent-Free Elimination; Solvent-Free Hydrolysis; Solvent-Free Protection; Solvent-Free Deprotection; Solvent-Free Reactions under Microwave Irradiation.

**KiM569 Structure Determination of Organic Chemistry 3+0 7.5**

Separation and purification of organic compounds; Determination of physical characteristics; Elemental analysis of organic compounds; The general principle of Ultraviolet (UV), Infrared (IR), nuclear magnetic resonance (NMR) and mass

spectroscopy methods; Importance of structural analysis of organic compounds; Interpretation of NMR; IR and UV spectra together; Structure determination applications of selected specific examples using NMR, IR, UV, and mass spectroscopy.

**KiM571                    Molecular and Cellular Biochemistry                    3+0    7.5**

Foundations of Biochemistry; Principles of Bioenergetics; Glycolysis, Gluconeogenesis; Principles of Metabolic Regulation: Regulation of metabolic pathways, Coordinated regulation of glycolysis and gluconeogenesis, Analysis of metabolic control; The Citric Acid Cycle; Fatty Acid Catabolism: Digestion, mobilization and transport of fats, Oxidation of fatty acids, Ketone bodies; Amino Acid Oxidation and Production of Urea; Carbohydrate Synthesis in Plants and Bacteria; Lipid Biosynthesis; Biosynthesis of Amino Acids, Nucleotides; DNA Metabolism; RNA Metabolism; Protein Metabolism; Regulation of Gene Expression.

**KiM583                    Modern Analysis Methods I                    3+0    7.5**

Theory of Atomic Spectroscopy; Atomic Absorption Spectrometry and Applications; Atomic Emission Spectroscopy and Applications; Atomic Fluorescence Spectrometry and Applications; Laser Source Atomic Spectroscopy and Applications, X-Ray Spectrometry; Mössbauer Spectroscopy, ESCA Spectroscopy and Applications; Radiochemical Methods; - Spectroscopy; Neutron Activation Analysis and Other Nuclear Techniques.

**KiM584                    Modern Analysis Methods II                    3+0    7.5**

Introduction to Molecular Spectroscopy and Differences With Atomic Spectroscopy; Infrared (IR) Spectroscopy and Applications; Microwave Spectroscopy; Raman Spectroscopy and CARS Applications; Electron Spin Resonance Spectroscopy; New Applications of NMR Spectroscopy; Dynamic Nuclear Magnetic Resonance; Double Resonance Technique; NO Technique; NMR With Solid Samples; <sup>13</sup>C-NMR; <sup>19</sup>F-NMR and <sup>31</sup>P-NMR Spectroscopy; Thermal Analysis Methods; Thermogravimetry; Differential Thermal Analysis.

**KiM585                    Name Reactions in Organic Chemistry                    3+0    6.0**

Name Reactions in the Chemistry of Heterocyclic Compounds; Displacement Reactions; Addition Reactions; Coupling Reactions; Name Reactions for the Formation of Olefins; Aldehyde-Ketone Reactions; Condensation Reactions; Cyclic Reactions to Ring Formation; Reduction-Oxidation Reactions; Reactions of Amines.

**KiM586                    Sensor Technology                    3+0    6.0**

Introduction to Sensor Technology; Types of Sensors; Chemical Sensors; Chemical Sensor Components; Electrochemical Sensors; Biosensors; Biomaterials for Biosensors; Molecular Recognition; Quartz Crystal Microbalance; Surface Plasmon Resonance Spectroscopy; Reflectometric Interference Spectroscopy; Analytic Applications.

**KiM587                    Alternative Reaction Systems                    3+0    6.0**

Ionic Liquids: Physical properties of ionic liquids, Synthesis of ionic liquids; Multiphasic Solvent Systems: Aqueous biphasic systems, Fluorous biphasic systems, Properties of perfluorinated solvents, Triphasic systems; Supercritical Fluids: Physical properties of supercritical fluids, Chemical reactions in supercritical media; Catalytic Reactions in Alternative Reaction Systems: Hydrogenation, Hydroformylation, Diels-Alder, Oxidation, Carbon-carbon bond formation, Metathesis, Polymerization.

**KiM588                    Computational Chemistry Applications                    0+3    6.0**

ChemOffice: Use of Chem3D in molecule drawing, Preparing data file on Chem3D program for Mopac, Gaussian, etc.; Mopac: Calculations on Mopac; GaussView: Molecule drawing on GaussView program, Preparing the calculation file on GaussView program; Gaussian: Preparing the calculation file on Gaussian program, Keywords used in Gaussian, Calculation on Gaussian, Analysis of the calculated results, Investigation of calculations results; Other Calculation Software.

**KiM589                    Adsorption                    3+0    6.0**

Adsorption; Adsorption of Gases on Solids; Heat of Adsorption; Physical Adsorption; Chemical Adsorption; Monolayer Adsorption; Multilayer Adsorption; Adsorption Isotherms; Langmuir Adsorption Isotherm; The BET and Other Isotherms; Surface Area Determination; The Solid-Liquid Interface-Adsorption from Solution; Interactions at Solid-Solution Interface.

**KiM591                    Thermal and Surface Characterization Methods                    3+0    6.0**

Material: Classification of materials, Importance of material characterization; Surface Analysis by Gas Adsorption: Adsorption, Properties and types of adsorbents, Porosity, Surface area, Adsorption isotherms, BET theory, Surface characterization via BET instrument; Particle Size and Zeta Potential Measurements via Zetameter: Zeta potential, Isoelectric point, Measurements by zetameter; Thermal Characterization Methods: Analyses of thermogravimetry, Differential thermogravimetry and Differential scanning calorimetry, Dilatometry; Microscopic Methods: Optical, Scanning electron, Transmission, Scanning tunnelling and Atomic force microscopy; X-ray Methods: X-ray fluorescence spectroscopy, X-ray photoelectron spectroscopy, X-ray diffraction analysis; Some Spectroscopic Methods.

<b>KiM592</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>KiM593</b>	<b>Applications of Modern Analysis Methods I</b>	<b>0+3 6.0</b>
<p>Fluorescence and Phosphorescence Spectroscopy: Applications of fluorescence spectroscopy; Elemental Analyzer: Applications of elemental analyzer; Ion Exchange Chromatography: Applications of ion exchange chromatography; Atomic Absorption Spectroscopy (AAS): Applications of atomic absorption spectroscopy; Scanning Electron Microscope (SEM): Applications of scanning electron microscopy; Thermogravimetric Analysis (TGA): Applications of thermogravimetric analysis; Zeta Potential Device: Zeta potential field applications.</p>		
<b>KiM594</b>	<b>Applications of Modern Analysis Methods II</b>	<b>0+3 6.0</b>
<p>Refractometer: Finding refractive index of compounds; Polarimetry: Investigating the decomposition kinetics of sugar, Finding the rotating angle of maltose and lactose; UV- Visible Spectroscopy: Its use in qualitative and quantitative analysis; Infrared Spectroscopy: Determination of functional groups in organic compounds and structure of unknown substances; Nuclear Magnetic Resonance Spectroscopy (NMR): Illumination of structure of unknown organic compounds; High Pressure Liquid Chromatography (HPLC): Making quantitative analysis; Gas Chromatography (GC): Making quantitative analysis; Gas Chromatography-Mass Spectrometer (GC-MS): Analyzing the composition of known and unknown compounds.</p>		
<b>KiM595</b>	<b>Analytical Method Development Validation</b>	<b>3+0 6.0</b>
<p>Chemical Analysis Method and Its Steps; Steps of Quantitative Analysis; Method Calibration; Analytical Method Development and Validation; Validation Process; Qualification; Good Laboratory Practice (GLP); Current Good Manufacturing Practice (cGMP); ISO 9000 (TickIT); Method Development, Optimization and Validation Approaches; Method Validation; Organisations and Guides for Method Validation; Method Validation: Terminology and definitions: Accuracy, Precision, Error, Standard deviation; Confidence Ranges; Statistical Aids to Hypothesis Testing; Q Test; Method Validation Parameters (ICH/USP): Accuracy, Precision, Specificity, Limit of Detection, Limit of quantification, Linearity and range, Ruggedness, Robustness, Data elements required for assay validation; System Suitability (USP); Method Validation Protocol; Method Transfer and Revalidation.</p>		
<b>KiM596</b>	<b>Chemistry of Main Elements</b>	<b>3+0 6.0</b>
<p>General Properties of Main Elements: Classification, General physical and chemical properties; Periodicity: Atomic and ionic radii, Electronegativity, Ionization energy, Electron affinity; Chemistry of Hydrogen Atom; Chemistry of IA Group Elements: Reactivity, Compounds, Daily usage; Chemistry of IIIA Group Elements; Chemistry of IVA Group Elements; Chemistry of VA Group Elements; Chemistry of VIA Group Elements; Chemistry of VIIA Group Elements; Chemistry of VIIIA Group Elements.</p>		
<b>KiM598</b>	<b>Term Project</b>	<b>3+0 0.0</b>
<b>KiM601</b>	<b>Investigations of Mechanisms in Organic Chemistry I</b>	<b>3+0 7.5</b>
<p>Kinds of Organic Reactions; How Organic Reactions Occur; Aliphatic Nucleophilic Substitution: General features of Aliphatic Nucleophilic Substitution; Ion Pairs as Intermediate in Nucleophilic Substitution; Influence of Solvent; Nucleophile; Leaving Group; Intramolecular Cationic Rearrangements; 1,2-Shifts In Carbenium Ions; Carbonium Ions; Migrations to Carbonyl Group; Rearrangements to Electron-Deficient Nitrogen and Oxygen; Carbanion; Carbens and Electrophilic Aliphatic Substitution.</p>		
<b>KiM602</b>	<b>Investigations of Mechanisms in Organic Chemistry II</b>	<b>3+0 7.5</b>
<p>Addition and Elimination Reactions; Electrophilic Addition to Double and Triple Bonds; 1,2-Elimination Reactions; Nucleophilic Addition to Multiple Bonds; Electrophilic Aromatic Substitution; Nucleophilic Aromatic Substitution; Reactions of Carbonyl Compounds; Hydration and Acid-Base Catalysis; Other Simple Additions; Addition Followed By Elimination; Addition of Nitrogen Nucleophiles; Carboxylic Acid Derivatives; Enols; Enrolates, And Addition of Carbon Nucleophiles to C=O Bond; Cycloaddition Reactions; Electrocyclic Reactions; Sigmatropic Reactions.</p>		
<b>KiM603</b>	<b>Organic Synthesis</b>	<b>3+0 7.5</b>
<p>Designing Organic Syntheses and the Disconnection approach; The Order of Even Chemoselectivity; Stereoselectivity; Regioselectivity; Protecting Groups; One-Group C-C Disconnections and Carbonyl Compounds; Two-Group Disconnections; 1,2-; 1,3-; 1,4-; 1,5-; 1,6- Difunctionalised Compounds; Use of Acetylenes.</p>		
<b>KiM606</b>	<b>Molecular Symmetry and Spectroscopy</b>	<b>3+0 7.5</b>

Symmetry Elements; Symmetry Point Groups; Matrix Representations; Reducible and Irreducible Representations; Character Tables; Representations and Quantum Mechanics; Molecular Vibrations; Molecular Orbital Theory and Symmetry; Hybrid Orbitals; Transition Metal Complexes.

**KiM609                    Advanced Polymer Chemistry                    3+0   7.5**

Thermal, Mechanical, Chemical, Electrical and Optical Properties of Polymers; Polymer Mixtures; Solubility Parameters, Flory-Huggins theory; Polymer Characterization; Miscellaneous Polymerisations; Polymer Modification; Polymeric Reagents and Catalysts; Commercial Polymerisations.

**KiM612                    Pericyclic Chemistry                    3+0   7.5**

Fundamentals of Pericyclic Reactions; Electrocyclic Reactions; Cycloaddition Reactions; [2+2] Reactions; [4+2] Cycloaddition Reactions; Intra and Intermolecular Diels-Alder Reactions; 1,3-Dipolar Reactions; Chelotropic Reactions; Ene and Related Reactions.

**KiM614                    Conducting Polymers                    3+0   7.5**

Basics of Conducting Polymers; Doping and Conductivity Properties; Synthesis of Conducting Polymers; Semiconductor Models for Conducting Polymers; Electrochromic Properties; Electrochemistry of Conducting Polymers; Solubility and Processing of Conducting Polymers; Characterization Methods; Application Fields of Conducting Polymers.

**KiM615                    Chemistry of Drugs I                    3+0   7.5**

Mechanisms of Drugs Effect on Biological Systems; Relationships Between the Chemical Structures of Drugs and their Biological Effects; Receptor Concept and Structure Specific Drugs; Structure Non-Specific Drugs; Solubility-Ionization Property of Drugs in Biological Systems and Its Relationship With Biological Activity; Steric Properties of Drug Molecules and its Relationship With Biological Activity; Isosterism and its Application on Biological Systems.

**KiM616                    Chemistry of Drugs II                    3+0   7.5**

General Reactions Used in Drug Syntheses; Phenylalkylamines; Phenylethylamines; Phenylpropylamines; Allgesics; Arylalkanoic Acid Derivatives; Chemotherapeutics; Sulphonamides; Sulphonamide Diuretics; Pyrazole Analgesics; Azole Antifungals; Symptomimetics Containing Imidazoline Residue; Benzimidazoles; Pyridine Derivatives; Dihydropyridine Antihypertensives; Drugs Containing Quinoline Residue; Pyrimidine Anticancer Agents; Barbiturates; Quinolone Hypnotics; Antihistaminic and Neuroleptics Containing Phenothiazine; Dibenzazepine Antidepressants; Cyclopentanoperhydro-Phenanthrene Hormones.

**KiM617                    Statistical Thermodynamics                    3+0   3.0**

Permutations; Thermodynamic Probability; Distribution To Energy Levels of Molecules; Statistic Weight; Most Probable Distribution; Partition Functions; Statistical Correlation To Partition of Thermodynamic Functions; Work And Heat; Enthalpy And Heat Capacity; Entropy And Free Enthalpy; Mixing Entropy; Heat Capacity of Gases; Heat Capacity of Liquids; Statistical Interpretation of Equilibrium Constant; Statistical Approach For Transition State Theory.

**KiM618                    Molecular Imprinted Polymers and Applications                    3+0   7.5**

The Purpose And Basic Principles of Molecular Imprinting: Covalent bonding imprinting, Non-covalent bonding imprinting, Metal-coordination imprinting; Synthesis and Characterization of Molecular Imprinted Polymers; Application of Molecular Imprinted Polymers: Separation and preconcentration processes by solid-phase extraction, Application of molecular imprinted polymers on high performance liquid chromatography, Application of capillary electro chromatography, Application of biosensors, Application of Pharmacologic Technology: Separation and purification of chiral compounds, Improving of releasing systems; Bioimprinting: Separation and purification of bromolecules, Improving of mimic enzyme and catalytic applications; Environment Technology Applications; Recovering Valuable Chemicals

**KiM619                    Organic Electrochemistry                    3+0   7.5**

Principles and Methods of Organic Electrochemistry; Synthetic and Mechanistic Aspects of Cathode and Anode Reactions of Organic Compounds Classified by Electrophoreses; Electrochemical Classification of Heterocyclic Compounds; Natural Products; Pharmaceuticals and Coordination Compounds; Classification of Electrode Reactions by Reaction Type; Electro synthesis of Amalgams; Reagents; Acids and Bases by Indirect Methods, Present and Future of Electro synthetic Methods.

**KiM620                    Surface Chemistry                    3+0   3.0**

Colloidal Systems; Classification of Colloidal Systems; Preparation and Purification of Colloidal Systems; Kinetic Properties; The Motion of Particles in Liquid Media; Osmotic Pressure; Liquid-Gas and Liquid-Liquid Interfaces; Surface and Interfacial Tensions; Adsorption and Orientation at Interfaces; Association Colloids and Micelle Formation; The Solid-Gas Interface; Adsorption of Gases and Vapours on Solids; The Solid-Liquid Interface; Adsorption From Solution; Charged Interface; Colloid Stability; Emulsions and Foams.



Nanowires; Metal, Metal Oxide and Carbon Nanotubes; Inorganic-Organic and Inorganic-Polymer Nanocomposite Materials; Applications of Nanomaterials.

**KiM647 Molecular Structure Calculations and Theories 3+0 7.5**

Molecular mechanics, Hydrogen molecule ion, Potential energy surfaces, Born-Oppenheimer approximation, Linear combination of atomic orbitals, Hydrogen molecule, Valence bond theory, Electron density, Self consistent field theory, Koopman's theorem, Open shell calculations, Unrestricted Hartree-Fock theory, Differential overlap models, Atomic orbitals and choice of atomic orbitals, Ab-initio quantum mechanical calculations, Semi-empirical quantum mechanical calculations, Electron correlation, Application to real chemical problems.

**KiM648 Named Reactions in Organic Chemistry 3+0 7.5**

Named Reactions of Rearrangement: Chan, Demjanov, Ferrier, Payne, Ramberg-Backlund, Stevens, Tiffeneau-Demjanov; Named Reactions of Addition: Heck, Henry; Named Reactions of Coupling: McMurry, Roush, Sonogashira, Stille, Suzuki; Named Reactions of Olefination: Horner-Wadsworth-Emmons, Nysted, Pearlman, Peterson; Named Reactions of Aldehydes and Ketones: Barbier, Luche, Parkih-Doering, Garner, Seyferth-Gilbert; Named Reactions of Condensation, Stobbe, Ugi, Pechmann, Darzens; Named Reactions of Cyclization: Bergman, Birch, Danishefsky, Glase, Majetich, Paterno-Buchi, Nazarov, Pictet-Spengler; Named Reactions of Oxydation- Reduction: Swern, Julia, Jones, Fleming-tamao, Dess Martin; Named Reactions of Amines: Neber, Shapiro.

**KiM649 Organic Functional Group Preparations I 3+0 7.5**

Alkanes, Alkenes, Alkynes, Alcohols, Amines, Nitroso Compounds, Nitro Compounds, Nitriles, Isonitriles (Isocyanides), Cyanates, Isocyanates, Carbonyl Compounds, Thiocyanates, Isothiocyanates, Carbonyl Compounds.

**KiM650 Organic Functional Group Preparations II 3+0 7.5**

Azides, Azo Compounds; Boranes, Borates, Peroxides, Thiols, Sulfides, Disulfides, Sulfoxides, Sulfones, Sulfonik Acids, Sulfonates, Organophosphorus Compounds, Phosphonic Acids, Phosphinic Acids, Phosphines, Phosphates, Phosphites.

**KiM651 Biosensors 3+0 7.5**

Biosensors and Their Fundamental Properties: Ideal biosensor characteristics and measurement systems, enzyme kinetics; Basic Electrochemical Principles: Cells, electrodes, current-potential curves; Transducers: pH, O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>, ion measurements; Amperometric Biosensors: Mesarument systems and applications; Potentiometric Biosensors: Types of indicator electrodes and applications; Immunosensors: Basic principles and applications; Microbial Biosensors: BOD, gas, hybrid sensors and applications; Thermal Biosensors: Enzyme activity determination, environmental applications.

**KiM654 Proteomics and Genomics 3+0 7.5**

The Molecular Basis of Heredity: DNA; RNA; Gene; Chromosome; Protein and Heredity; Gene Cloning; Applications of Recombinant DNA Technology; Human Genome Project and Genetic Engineering; Protein Structure; Function and Purification; Affinity Chromatography and Application of Affinity Chromatography; Gel Based Proteomics; Electrophoresis and Principles and Applications of Proteomics; Molecular Analysis and Bioinformatics.

**KiM657 Asymmetric Organic Synthesis I 3+0 7.5**

Stereo chemical terms; P urpose and importance of asymmetric synthesis; Analytical methods; Resolution; Asymmetric synthesis and rules; General methods used in asymmetric synthesis; Use of natural chiral compounds in asymmetric synthesis; Asymmetric synthesis using chiral auxiliary component; Chiral catalysts and use of chiral catalysts in asymmetric synthesis; Chiral compounds; Bioorganic asymmetric synthesis and use of other methods in asymmetric synthesis.

**KiM658 Asymmetric Organic Synthesis II 3+0 7.5**

Overview of asymmetric organic reactions; Carbon-carbon bond formation; Asymmetric carbon-heteroatom bond formation; Addition reactions to multiple bonds; Hydrogenation; Cyclization reactions; Reduction and oxidation reactions; Rearrangement reactions; Isomerazation; Applications and industrial importance of asymmetric synthesis; Selected sample reactions in the literature for asymmetric synthesis.

**KiM659 Synthesis of Amino Acids and Peptides 3+0 7.5**

Sources and Roles of Amino Acids and Peptides; Nomenclature for ?The Protein Amino Acids?; Alias ?The Coded Amino Acids ; Abbreviations for Names of Amino Acids; Conformations of Amino Acids and Peptides; Physicochemical Properties of Amino Acids and Peptides; Examples of Assignments of Structures to Peptides from NMR Spectra and Other Data; Reactions and Analytical Methods for Amino Acids and Peptides; Determination of The Primary Structure of Peptides and Proteins; Synthesis of Amino Acids; Methods for The Synthesis of Peptides; Biological Roles of Amino Acids and Peptides; Some Aspects of Amino-Acid and Peptide Drug Design.

**KiM665 Bioorganometallic Chemistry 3+0 7.5**

Relationship Between Inorganic and Organic Chemistry; Metals and Chemistry of Metals in Biological Systems: Mn, Fe, Co and Cu, Ni metal identification techniques; Bonding Theories in Organometallic Chemistry: Valence bond, Molecular orbital and ligand field theory, Chemistry of M-C, M-N, M-S and M-O bonding; Supramolecular Ligands and Metal Complexes: Synthesis, Properties, Characterization; Biological Ligands: Metalloproteins, Carbohydrates, Sugars, Lipids; Biocatalysts and Biocatalytic Reactions; Chemistry of Enzyme: Catalase, Peroxidase, Nitrogenase enzymes; Metals in Medicine.

**KiM667 Metals in Catalytic Reactions I 3+0 7.5**

Concept of Catalysis: Catalysis, Catalyst, Selectivity, Activity; Catalytic Reaction Types: Homogeneous catalysis, Heterogeneous catalysis; Catalytic Reaction Mechanisms: Oxidative addition, Reductive elimination, Insertion, Elimination; Some Catalytic Reaction Types: Hydrogenation, Hydroformylation, Oxidation, Coupling; Catalytic Properties of Main Group Metals: Metal halides, Metal oxides, Phase transfer catalysts; Catalytic Properties of Transition Metals: Iron group metals, Copper group metals, Platinum group metals; Catalytic Applications of Transition Metals.

**KiM669 Analytical Method Development and Validation 3+0 7.5**

Statistical Evaluation of Analytical Data; Analytical Method Selection; Analytical Method Development and Validation: Introduction: Validation process, Qualification, Method development, Optimization and validation approaches: Method development, Optimization, Method validation approaches; Method Validation: Terminology and Definitions: Accuracy, Precision, Specificity, Limit of detection, Limit of quantification, Linearity and range, Ruggedness, Robustness, Data elements required for assay validation; System Suitability; Method Validation Protocol; Method Transfer and Revalidation.

**KiM675 Polymer-Clay Nanocomposites 3+0 7.5**

Polymers; Definition, Characteristics, Classification and synthesis methods of polymers; Clays: Definition, Structure, Characteristics and classification of clays, Cation exchange capacity, Organoclays; Nanocomposite Materials: Definition, Characteristics, Classification, Advantages and disadvantages of nanocomposite materials; Synthesis Methods and Characterization of Nanocomposite Materials; Rheological, Morphological, Thermal and mechanical properties of nanocomposite materials; Application Areas of Nanocomposite Materials; Nanocomposite Hydrogels.

**KiM676 Applications of HPLC and Other Chromatographic Methods in Food Analysis 3+0 7.5**

HPLC Method and Its Importance for Food Analysis; HPLC Analysis of Mycotoxins and Pesticides; HPLC Analysis of Vitamins and Phenolic Acids; HPLC Analysis of Carbohydrates and Lipids; HPLC Analysis of Protein, DNA, Peptide and Amino Acids; HPLC Analysis of Hormones, Drugs and Antibiotics; HPLC Analysis of Food Additives; Other Chromatographic Methods Used in Food Analysis: Gas chromatography, Capillary electrophoresis; Problems Encountered in HPLC Analyses, Possible Reasons and Troubleshooting; Sample Preparation Methods in Food Analysis: Liquid-liquid extraction, Solid phase extraction; HPLC Applications in Food Analysis.

**KiM692 Seminar 3+0 7.5**

**KiM701 Physical Chemistry of Foods 3+0 7.5**

**KiM790 Thesis 0+1 30.0**

**KiM890 Thesis 0+1 30.0**

**KiM890-0 Thesis (Thesis Proposal) 0+1 30.0**

**KMH501 Advanced Chemical Engineering Thermodynamics 3+0 7.5**

Basic Concepts of Thermodynamics; Properties of Pure Substances; The First Law of Thermodynamics; The Second Law of Thermodynamics; Entropy; Second-Law Analysis of Engineering Systems; Thermodynamics Relations; Gas Mixtures; Chemical Reactions; Chemical and Phase Equilibrium.

**KMH505 Advanced Mass Transfer 3+0 7.5**





**KMH519                      Advanced Fluid Mechanics                      3+0    7.5**

Viscosity and the Mechanism of Momentum Transport: Newton's law of viscosity, Pressure and temperature dependence of viscosity, Theory of viscosity of gases, Theory of viscosity of liquids; Velocity Distributions in Laminar Flow: Shell momentum balances, Flow of a falling film, Flow through a circular pipe, Flow through an annulus, Adjacent flow of two immiscible fluids; Transportation and Metering of fluids: Pipes, Fittings, Valves; Pumps: Positive-displacement pumps , Centrifugal pumps, Fans, Blowers, Compressors; Measurement of Flowing Fluids: Area meters, Turbine meters, Magnetic meters, Thermal meters, Elbow meters, Weirs.

**KMH520                      Chromatographic Separation Processes                      3+0    7.5**

Separation Principles; Dynamics of Zone Migration; Diffusion and Kinetics; Modern Analytical and Preparative Bio separation Techniques of Liquid Chromatography; Elution and Separation Techniques in Liquid Chromatography; Gradient Elution; Adsorption; Partition; Size Exclusion; Ion Chromatography and Ion Exchange; Detectors Used in Liquid Chromatography; UV-Vis; Fluorescent; Refractive Index; Conductivity and Mass Detectors; Column Packing Materials in Analytical and Preparative Scale Liquid Chromatography; Method Development and Validation in Liquid Chromatography; Applications to Food and Bioprocesses; Quantification.

**KMH521                      Mathematical Methods in Chemical Engineering I                      3+0    7.5**

Ordinary Differential Equations; Solutions by the Laplace Transform, Solutions by Series; Simultaneous Differential Equations; Functions and Definite Integrals; The Error Function; The Gamma Function; Other Tabulated Functions Defined by Integrals; Evaluation of Definite Integrals; Treatment of Experimental Results; Theoretical Properties; Curve Fitting; Propagation of Errors.

**KMH523                      Advanced Separations Processes                      3+0    7.5**

Thermodynamics of Separation Operations; Energy; Entropy; Phase Equilibria; Ideal Liquid Solution Model; Nonideal Thermodynamic Property Models; Derived Thermodynamic Properties From P-V-T Models; Liquid-Liquid; Liquid-Solid Equilibria; Solvent Extraction of Organic and Inorganic Solids; Principles; Equipment; Design Calculation Methods; Algebraic and Graphical Methods; Ideal Stage and Equilibrium; Fluid/Particle Separations; Theory and Practices; Motion of Particles in Fluids; Properties of Fine Particles; Interfacial Phenomena and Rate Equations; Membrane Processes; Supercritical Fluid Extraction; Supercritical Fluid; Principles; Phase Equilibrium; Operation; Effect of Co solvent; Applications.

**KMH524                      Materials' Synthesis, Characterization and Applications                      3+0    7.5**

Synthesis and Characterization Methods (Methods Such As XRD, AAS, SEM, AFM, EDS and XPS) and Applications of Micro-, Meso- and Macro-Porous Materials; Nano-Porous Materials and Their Industrial Applications.

**KMH525                      Supercritical Fluid Extraction                      3+0    7.5**

Fundamentals of Processing With Supercritical Fluids; Phase Equilibria; Thermodynamics; Equations of State; Critical Behavior; Crossover Effects; Properties of Supercritical Fluids; Viscosity; Thermal Conductivity; Diffusion Coefficient; Solubility in Supercritical Solvent; Extraction of Substances With Supercritical Fluids From Solid Substrates; Extraction Process; Extraction Rate; Influence of Process Parameters and the Conditions of the Solid Substrate on the Extracting Process; The Effect of Modifier on Solvent Power; Selectivity and their Pressure and Temperature Dependence; Supercritical CO<sub>2</sub>; Mass Transfer Phenomena in Supercritical CO<sub>2</sub> for Production of Natural Substances; Industrial Applications to Food; Pharmaceuticals; Natural Materials; Supercritical CO<sub>2</sub> Extraction of Vegetable Oils; Process Scale-Up and Economy.

**KMH526                      Membrane Separation Processes                      3+0    7.5**

Membrane Materials; Transport in Membrane: Liquid Diffusion, Gas Diffusion, Cascades; Dialysis and Electrodialysis; Membrane Structure: Reverse Osmosis Membranes, Microfiltration Membranes, Ultra Filtration Membranes; Pervaporation; Gas Permeation.

**KMH527                      Electrochemical Engineering                      3+0    7.5**

Vector Calculus; Dilute Solution Theory; Cell Potential; Effect of Convection in Mass Transfer; Estimation of Mass Transfer Rates from Nu Correlations; Potential and Current Distribution Problems; Secondary Distribution Problems; Numerical Calculation of Potential Distribution; Reactor Design in Electrochemistry; Differential Mass Balance; Convective Diffusion Problems; Concentrated Solution Theory; Electrode Kinetics: Measurement and Interpretation; Solid State Membrane Reactors; Measurement of Diffusion Coefficient; Impedance Modeling and Data Interpretation; Modeling and Design of Polymer Electrolyte Membrane Fuel Cell.

**KMH528                      Fuel Cells                      3+0    7.5**

Principles of Fuel Cells; Efficiency and Open Circuit Voltage; Operational Fuel Cell Voltages; Polymer Electrolyte Membrane Fuel Cells; Alkaline Electrolyte Fuel Cells; Medium and High Temperature Fuel Cells; Fuelling Fuel Cells; Auxiliary Units with Fuel Cells; Delivery of Fuel Cell Power.

**KMH529 Numerical Methods in Chemical Engineering I 3+0 7.5**

Thermodynamics; Establishment of Non-linear Equation and Equation Systems Frequently Encountered in Thermodynamics; Unit Operations and Chemical Kinetics; Numerical Methods for Solving These Equations; Numerical integration; Simpson Rule; Method of Successive Substitutions; Newton Method; Jacobi Method; Gauss-Jordan Method; Development of Computer Models.

**KMH530 Design of Experiments in Chemical Engineering 3+0 7.5**

Design of Experiments and the Taguchi Approach; Definition and Measurement of Quality; Common Experiments and Methods of Analysis; Experimental Design Using Orthogonal Arrays; Experimental Design with Two-Level Factors; Experimental Design with Three- and Four-Level Factors; Analysis of Variance; Experimental Design for Studying Factor Interaction; Experimental Design with Mixed-Level Factors; Combination Designs; Strategies for Robust Design; Analysis Using Signal-to-Noise Ratios; Result Comprising Multiple Criteria of Evaluations; Quantification of Variation Reduction and Performance Improvement; Effective Experiment Preparation and Planning.

**KMH531 Bioprocessing Engineering 3+0 7.5**

Introduction to Bioproducts: Primary and secondary metabolites; Proteins: Structure and stability; Biosystems: Eukaryotic and prokaryotic cell structure and cultivation; Cell Disruption Methods and Flocculation; Crystallization and Precipitation; Membrane Filtration; Extraction: Organic aqueous, Aqua two-phase, Reverse micelles, Supercritical fluids; Chromatography; Electrophoresis; Solvent Removal and Drying; Bioprocess Design.

**KMH532 Biochemical Engineering 3+0 7.5**

Bioprocessing; Enzyme Kinetics: Simple enzyme kinetics, Enzyme reactors, Enzyme inhibition; Cell Cultivations: Microbial, animal and plant cell cultivations; Cell Kinetics and Fermenter Design: Batch and continuous fermentation processes, Plug flow, Continuous stirred-tank fermenter, Multiple fermenters in series, Kinetic models; Sterilization; Agitation and Aeration: Basic mass transfer concepts; Measurements of Interfacial Area, Oxygen absorption rate, Scale-up; Downstream Processing: Solid-liquid separation, Recovery and purification processes.

**KMH533 Polymer Synthesis 3+0 7.5**

Concept of Polymer; Structure and Nomenclature of Polymers; Types of Molecular Weight in Polymers and Molecular Weight Determination Methods; Synthesis of Polymers: Step-growth polymerization, Condensation polymerization, Cationic polymerization, Anionic polymerization; Polymerization Techniques: Bulk polymerization, Solution polymerization, Suspension polymerization, Emulsion polymerization, Interfacial polymerization.

**KMH534 New Carbon Materials 3+0 7.5**

Carbon Materials: The element carbon, Carbon family, Characterization of carbon materials; Graphite: Natural graphite, Synthetic graphite; Isotropic Carbons: High density isotropic graphites, Glassy carbons; Carbon Fiber: Classification of carbon fibers, Production, Properties, Applications; Porous Carbons; Pore Formation and Characterization, Carbon foam, Activated carbon; Carbon Composites.

**KMH535 Porous Materials 3+0 7.5**

Definition and Classification of Porous Materials; Natural and synthetic porous materials, Synthesis methods for synthetic porous materials, Characterization methods; Using Porous Materials in Catalysis: As supporting materials and as catalysts; Determination of Internal and External Mass Transfer Mechanisms and Transport Parameters in Porous Materials; Internal and External Mass Transfer Effects on Selectivity in Reactions.

**KMH536 Advanced Concrete Admixtures 3+0 7.5**

Composition and Production of Cement; Properties of Concrete Making Materials; Properties of Fresh Concrete; Properties of Hardened Concrete; Mineral Admixtures; Classification of Chemical Admixtures Used in Concrete Production; Concrete Mixing Water; Compatibility of Cement and Chemical Admixtures; Plasticizing Admixtures; Set Retarding and Accelerating Admixtures; Air Entraining Admixtures; Water Proofing Admixtures; Anti-Corrosion Admixtures; Biological Admixtures

**KMH537 Hydrogen Production from Biomass 3+0 7.5**

Concepts of Biomass; Gasification: Thermal, Oxidation, Miscellaneous gasification processes; Biomass-Derived Synthesis Gas Conversion; Supercritical Conversion; Pyrolysis: Production of hydrogen, carbon and methanol; Biological Conversion of Biomass to Hydrogen; Production of Storable Intermediates from Biomass Partial Conversion: Hydrogen from biomass-derived pyrolysis oils, Hydrogen from biomass-derived methanol; Techno-economic and Life Cycle Analysis of the

Conversion of Biomass to Hydrogen: Techno-economic assessments, Life cycle analysis; Overview of Hydrogen Production Pathways.

**KMH538 Geopolymers 3+0 7.5**

Definition of Geopolymers; Geopolymerisation; Geopolymerisation Mechanism; Structures of Geopolymers; Raw Materials for Geopolymer Production; Parameters Affecting Geopolymerisation; Mechanical Properties of Geopolymers; Microstructural Properties of Geopolymers; Applications of Geopolymers: Geopolymer Cement, Geopolymer Concrete; Innovative Applications of Geopolymers.371

**KMH539 (Eng) Materials and Fire 3+0 7.5**

Fire hazards and safety; Thermal decomposition of polymeric materials; Thermal analysis; Polymer combustion; Mechanisms of flame retardancy; Flame retardant materials; Fire tests and parameters assessed; Heat release rate and calorimetry; Smoke, smoke measurement, smoke density; Multicomponent flame retardant systems and their applications; Intumescent flame retardant systems and their applications; Nanocomposite based flame retardant systems and their applications; Flame retardancy of textiles; Applications for flame retardants (building and construction, transportation etc)

**KMH540 Pharmaceutical Manufacturing Technologies 3+0 7.5**

**KMH592 Seminar 3+0 7.5**

**KMH601 Stage Separation Processes I 3+0 7.5**

The Staged Process; The Ideal stage; The Staged Separation; Batch and Continuous Processes; Steady-State and Unsteady-State Operation; Equilibrium and Non equilibrium Separations; Distillation; Liquid-Liquid Extraction; The Overall Material Balance; Flow Variables; Phase Flows, Recycle Matrices; Calculation of Flows; The Component Material Balance; Definitions of Phase Compositions; The Sum of Compositions Restrictions; Phase Equilibrium; The Equilibrium Ratio; Equilibrium Equations; Equilibrium Ratio Equations for Some Simple Cases; Computer Programs for Equilibrium Ratios.

**KMH602 Stage Separation Processes II 3+0 7.5**

Constant Equilibrium Ratio Extraction; The Equilibrium Ratio in Liquid Extraction; Equations for Constant Equilibrium Ratio Extractions; Basic Program for Constant Equilibrium Ratio Extractions; Iterative Methods for Simultaneous Vector Equations; Constant Flow Rate Distillation: a Fixed Flow Model; Distillation Terminology; Bubble and Dew Point Calculation; Bubble Point Correction Method for Constant Flow Distillation; Constant Flow Distillation With Nonideal Liquid Phases; The Fugacity Ratio; Isotropic and Extractive Distillation; Energy Balance Equations; Derivation of the Energy Balance Equations; Calculation of Enthalpy for Vapor and Liquid Mixtures; A Computer Program for Calculation of Enthalpy.

**KMH604 Petroleum Refinery Engineering 3+0 7.5**

History and Development of Refining; Composition of Petroleum; Refinery Products and Test Methods; Evaluation of Oil Stocks; Physical Properties of Petroleum Oil; Introduction to Processing; Refinery and Distillation Processes; Refinery Corrosion and Metals; Chemical Treatments; Solvent Treating or Extraction Processes; Fluid Mechanics; Vaporization and Condensation; Fractionation and Towers; Heat Transfer and Exchangers; Tubestill Heaters; Thermal Cracking and Decomposition Processes; Rebuilding Hydrocarbons; Catalytic Cracking and Reforming; Natural and Refinery Gases; Economics of Design; Typical Design Calculation.

**KMH605 Heterogeneous Reaction Kinetics and Reactor Design 3+0 7.5**

Global Rates of Reactions in Heterogeneous Processes; Fluid-Particle Reaction Kinetics; Fluid-Particle Reactor Design; Fluid-Fluid Reactions Kinetics; Fluid-Fluid Reactor Design; Solid Catalyzed Reactions; Rates of Adsorption; Desorption and Surface Reaction; Rate Equations in Terms of Fluid Phase Concentrations; Kinetics of Catalyst Deactivation.

**KMH606 Advanced Mathematical Modeling in Chemical Engineering 3+0 7.5**

Energy and Mass Balances in Steady-State Systems; Modeling in Unsteady-State Systems with a Single Variable; Modeling in Unsteady-State Systems with Multiple Variables; Modeling of Systems Involving Chemical Reactions; Solution of Finite Difference Equations.

**KMH609 Synthetic Fuel Production By Thermochemical Methods 3+0 7.5**

Fossil Fuels; Synthetic Fuels; Chemistry of Synthetic Fuels; Thermodynamics of Synthetic Fuels; Reaction Kinetics and Catalysis; Biomass; Biomass Sources, Thermochemical Methods; Pyrolysis: Mass and Energy Balances; Reactor Description; Effective Factors; Liquefaction: Indirect and Direct Liquefaction; Gasification; Oxygen Production; Hydrogen Production; Combustion.

<b>KMH611</b>	<b>Advanced Carbon Materials from Biomass</b>	<b>3+0 7.5</b>
Biomass Feedstocks: The main constituents of biomass, Characterization; Modelling the Thermochemical Conversion of Biomass: Heat and Mass transfer, Kinetics and thermodynamics; Thermochemical Conversion Technologies: Torrefaction, Pyrolysis, Gasification; Industrial Pyrolysis Technologies; Hydrothermal Carbonization and its Role in Catalysis; Green Carbons; Biocarbon as Adsorbents: Liquid and gas phase adsorption processes; Biocarbons for Gas Storage; Biocarbons for Energy Storage; Sustainability of Biocarbon Production and Application.		
<b>KMH613</b>	<b>Coal Technology</b>	<b>3+0 7.5</b>
Coal Beneficiation-History, Current Options And Effectiveness; Physical Coal Cleaning Systems; Coal Pre-Treatment-Size Reduction and Screening Techniques; Dry Mechanical Separation Processes; Wet Mechanical Separation Processes; Chemical Coal Cleaning; Coal Combustion; Fluidized Bed Combustion; Coal Briquette; Coal Pyrolysis; Coal Gasification; Coal Liquefaction.		
<b>KMH615</b>	<b>Principles and Applications of Biocatalysis</b>	<b>3+0 7.5</b>
<b>KMH617</b>	<b>Catalytic Conversion Technologies of Biomass</b>	<b>3+0 7.5</b>
Biomass content and types, Metal catalysts used in biomass conversion, Clay, zeolite, mesoporous catalysts used in biomass conversion, Carbon-based, metal-organic cage catalysts used in biomass conversion, Catalytic conversion of cellulose, Catalysts used for the production of 5-HMF from cellulosic carbohydrates, Furfural from biomass , Production of Levulinic Acid, and Formic Acid based fuel components, Production of Furfural, Levulinic Acid, and Formic Acid based fuel components from biomass, Catalytic lignin conversion.		
<b>KMH622</b>	<b>Mathematical Methods in Chemical Engineering II</b>	<b>3+0 7.5</b>
Partial Differential Equations; Boundary Conditions; Particular Solution of Partial Differential Equations; Method of Separation of Variables; One- and Two-Dimensional Heat Equations; Finite Differences; The Difference Operators $\Delta$ and $\nabla$ ; Linear Finite Difference Equations; Non-Linear Finite Difference Equations; Graphical Solutions.		
<b>KMH630</b>	<b>Numerical Methods in Chemical Engineering II</b>	<b>3+0 7.5</b>
Numerical Methods; Gauss Seidel Method; Solving Nonlinear Equations; Iterations of Newton-Raphson Model; Solving Ordinary Differential Equations; Euler's Method; Runge-Kutta Method; Solving These Equations With Computer Programs.		
<b>KMH692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>KMH790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>KMH890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>KMH890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>KOR504</b>	<b>Architectural History and Concepts</b>	<b>3+0 7.5</b>
Architecture and culture; Architecture and society; Architecture and city; Architecture and art; Architecture and form; Architecture and technology.		
<b>KOR506</b>	<b>Technics of Documentation</b>	<b>3+0 7.5</b>
Traditional Techniques of Architectural Documentation; Latest Techniques of Documentation; Use of Information Technology for Documentation; Formation of Archives.		
<b>KOR517</b>	<b>History of Modern Turkish Architecture</b>	<b>3+0 7.5</b>
Turkish Architecture in the Pre-Republic Period under the Effect of Western Architecture; the First Nationalistic Architecture Period; the First Period of Modern Architecture I; Period of Foreign Architects; the First Period of Modern Architecture II; Period of Turkish Architects; the Second Nationalistic Architecture Period; Architecture of Sedad Hakkı Eldem; The Period between 1950 and 1980 I; the Second Period of Modern Architecture; The Period between 1950 and		

1980 II; Importance of 1960s and its Reflections on Architecture; The Period between 1950 and 1980 III; Architecture of 1970s; Architecture after 1980 I; Architecture after 1980 II; Architecture of Today.

**KOR518 History of Anatolian Architecture 3+0 7.5**

Historical Continuity and Interaction in Anatolia; Anatolian Civilizations: Prehistoric Period; Anatolian Civilizations 1; Anatolian Civilizations 2; Greek Architecture in Anatolia; Roman Architecture in Anatolia; Byzantine Period and Architecture; Seljuk Period and Architecture; Architecture of Principalities Period; Early Ottoman Architecture, Classical Period Ottoman Architecture and Late Ottoman Architecture.

**KOR519 Construction Techniques and Conservation Problems of Ottoman Architecture 3+0 7.5**

Building Types in Ottoman Architecture; Architectural Development; Different Building Types and Typological Features: Regional characteristics, Construction techniques and materials; Analysis of Structure and Building Elements; Discussion and Evaluation of Additions from Different Periods and Restitution Problems: Methods and applications; Challenges Related to Preservation of Original Construction Techniques: Techniques, Applications, Issue of re-usage; Architectural and Typological Characteristics of Historical Buildings; Adaptation of Historical Buildings into Modern Life.

**KOR520 The Management of Cultural Heritage 3+0 7.5**

Definition of Cultural Heritage; Principles of International Conservation Laws; International Conservation Regulations and Their Reflections on the Conservation Principles of National Conservation Laws; The Organizations about Conservation in Turkey; The Legal Framework of Conservation in Turkey and the Latest Law of Conservation; Risk Factors in the Conservation Process, Organization and Principles of Conservation Site Management.

**KOR521 World Heritage Sites in Turkey 3+0 7.5**

Cultural Heritage and World Heritage; Management of World Heritage Sites; Archaeological and Historical Sites; Related Legislation, Protection Policies and Approaches; Protection of Cultural Heritage in International and National Law; International Organizations and Conventions; Sustainability of Cultural Heritage; Monitoring of World Heritage Sites; World Heritage Sites in Turkey: Cultural heritage management, Determining and analyzing the current status, Needs, and Related issues; Protection Techniques and Methods; Approaches Specific to Different Countries/Cultures; Examples of World Heritage Sites.

**KOR522 Housing During Republic Period 3+0 7.5**

Historical References of Traditional Turkish House; Space Organization and Regional Effects on Traditional Turkish House; Effects of Ottoman Westernization on Housing; Modernity in the Early Republic Period and its Effects on Housing; Housing during the World War II; Integration to International System and Housing; Mass Housing between 1923-1960; Housing in Pluralist Period; Searches for Solution to Housing Problem; Housing During Post-Modern Period; Reflection of Architectural Styles and Approaches on Housing Design; Student Presentations I; Student Presentations II.

**KOR523 Conservation Project I 2+2 7.5**

Determination of Historical, Architectural and Structural Properties of one or some of the Civil, Monumental and Concrete Examples of Cultural Architectural Legacy from Different Historical Periods; Determination of the Conservation Approach and Principles that Lead the Practice in the Same Building(s); Documentation and Historical Research; Formation of Conservation Decisions; Identification of Conservation Methods and Techniques; Proposal for the Conservation Practice.

**KOR524 Conservation Project II 2+2 7.5**

Documentation of the Current Situation of the Historical Settlements from Different Historical Periods, and Conducting Historical Research; Analysis of Historical, Architectural and Structural Properties of a Historical Settlement; Determination of the Conservation Approach and Principles that Lead the Practice in the Same Area; Formation of Conservation Decisions; Identification of Conservation Methods and Techniques; Proposal for the Conservation Practice.

**KOR525 Conservation History and Theories 3+0 7.5**

Historical Development of Conservation Problem; Conservation Approaches in the 19th Century; Relationship between Modernism and Conservation; Discussion on History, Memory and Identity, and Conservation Problem; Definition of Cultural Heritage; Conflict between Universality and Local Values; Concept and Approaches of Conservation in the Contemporary World; International Charters and Councils; National Conservation History and Theories, National Legislation for Conservation.

**KOR527 Research and Documentation Methods in Protection 3+0 7.5**

Introducing and Teaching the Researches, Resources and Methods to Identify Values and Phases of the Historical Structure and Environment in the Preparation Process of Restoration and Conservation Projects; Historical (Religious Courts and Kadi Registers, Charitable Foundation Documents, Decrees, Engravings, Miniatures, Historical Maps, Photographs, etc.), Written and Visual Sources and the Transmission of Usage Possibilities in this Area; Investigation of the Latest Techniques

Used in the Documentation of Cultural Assets; Examining the Possibilities of Using Communication Technologies in Documentation; Creation of Archive as a Permanent Information Bank.

**KOR528 Conservation of Modern Cultural Heritage 3+0 7.5**

History of Conservation of Modern Architectural Heritage; Conservation Problems; Typologies and Ideologies; Materiality and Authenticity; Interior Spaces, Furnishing and Color; Conservation of Industrial Heritage; Conservation of Modern Public Premises; Conservation of Public Buildings; Modern Residences; Stakeholders of Modern Cultural Heritage Conservation and Their Participation in Conservation Processes; Case Studies from Turkey and abroad.

**KOR530 Cultural Heritage Buildings and Their Adaptations to Contemporary Museum Function 3+0 7.5**

Conceptual Change of Museum and Its Definition in the Historical Process: Current Expansions of Museology Science; Design Input for the Museum Space; the Concept of Contemporary Museum and its Relations with Cultural Heritage: The Concepts of Tangible and Intangible Cultural Heritage and Their Effects to Museum Space Design; The Diversity of Interventions for Adaptations of Cultural Heritage Buildings to Contemporary Museum Function; Interventions for Functional Expansions and Changes; Analyses of National and International Samples.

**KOR531 Typological Readings in Conservation 3+0 4.5**

Terminological Approach to the Concept of Typology; Understanding the Place and Importance of Typology in Conservation; Determining Data Groups of Historical Structures by means of Various Data Sources; Analysis of the Collected Data with Various Data Evaluation Methods; Arranging the Typology Titles by Evaluating the Groups Formed through Analyses; Forming Typology; Matching the Concepts of Conservation and Restitution (Plan and Facade Setup, Materials, Bearing and Architectural Elements, and Urban Morphology) with Typological Readings; Sharing and Presentation of Readings about Typology.

**KOR534 Special Topics in Preservation 3+0 7.5**

Contemporary Approaches to Conservation; International Trends in Conservation; National Trends in Conservation; the World Heritage List and Its Criteria; Discussing the Reasons for Conservation of Cultural Heritage; Environmental Effects on Historic Buildings; Sustainable Conservation.

**KOR535 Special Topics in Conservation 3+0 7.5**

International Trends in Conservation; National Trends in Conservation; the World Heritage List and its Criteria; Discussing the Reasons for Conservation of Cultural Heritage; Effects of Environmental Problems on the Historical Buildings; Concept of Sustainable Conservation; Effects of Tourism on Cultural Heritage; Scope of Conservation in Contemporary World, Sustainable Cultural Tourism and Conservation; Conservation Area Management; the Concept of Protected Area, and Conservation.

**KOR536 Preservation Management 3+0 7.5**

National Regulations for Conservation; International and National Principles, Regulations and Directives; Conservation Organizations in Turkey; Legal Framework on Conservation in Turkey and the Latest Preservation Law; Risk Factors in the Conservation Process.

**KOR538 Memory - Space Relations in Conservation of Cultural Heritage 3+0 7.5**

Place and Space Concepts; Memory as an Interdisciplinary Concept; Memory and Space Relations: The effects of spatial transformation to the memory, The effects of changing memory to the spatial transformation; Scientific Methods in Revealing The Memory - Space Relations; Spatial Representation of Memory: Monuments, Museums, Commemoration spaces, Negative spaces, Memory spaces; Presentation of Spatial Memory; Temporary Approaches in Conservation of Cultural Heritage; Memory - Space Relations in Conservation of Cultural Heritage: Approaches, Principles, Projects, Memory mappings.

**KOR539 Construction Techniques and Conservation Problems of Ottoman Architecture 3+0 4.5**

Building Types in Ottoman Architecture; Periods and Regional Features; Different Building Types and Typological Features: Construction Techniques and Materials; The Analysis of Structure and Building Elements; The Discussion and Evaluation of Additions from Different Periods and Restitution Problems; The Problems About Conservation of Authentic Construction Techniques: Methods and Applications; Change of Function and Issues of Re-Usage; Examples of Adaptations of Historic Buildings for Modern Use.

**KOR541 History of Anatolian Architecture 3+0 4.5**

Historical Continuity and Interaction in Anatolia; Anatolian Civilizations: Prehistoric Period; Anatolian Civilizations: Hittite, Phrygian, Lydian, Urartian Civilisations; Anatolian Civilizations: Greek Architecture in Anatolia; Roman Architecture in Anatolia; Byzantine Period and Architecture; Seljuk Period and Architecture; Architecture of Principalities

Period; Early Ottoman Architecture; Classical Period Ottoman Architecture I; Classical Period Ottoman Architecture II; Late Ottoman Architecture.

**KOR543 World Heritage Sites in Turkey 3+0 4.5**

Cultural Heritage and World Heritage; Management of World Heritage Sites, Archaeological and historic sites; Legislation, Conservation policies, Approaches; International and National Law of Cultural Heritage; International Organizations and Conventions; Sustainability of Cultural Heritage; Monitoring World Heritage Sites; World Heritage Sites in Turkey: Site management, Current status, Conservation problems, Needs; Introduction of Various Techniques and Methods; Specific Approaches of Different Countries/Cultures; Examples of World Heritage Sites.

**KOR545 Cultural Heritage And Accessibility 3+0 7.5**

**KOR547 Modernization And Architecture in Eskişehir 3+0 7.5**

Introduction and Historical Background: Eskişehir's historical development and modernization process, the concept of modernization and its effects on architecture; Modernization and Social Change in Eskişehir: Modernization and changes in social structure in Eskişehir, The effects of economic, political and cultural factors on modernization in Eskişehir; Architectural Movements in Eskişehir: Changes in Turkish architecture in the Republican Era, National architecture and international influences; Modern Architecture and Urban Planning in Eskişehir: Effects of modern architecture on the urban fabric; Modern Architectural Buildings in Eskişehir; Modernization and Cultural Heritage: Preservation and transformation of cultural heritage in the process of modernization.

**KOR549 Disaster Risks and Management In Cultural Heritage Areas 3+0 7.5**

Cultural heritage areas and their importance, Sustainability of cultural heritage, Types of disaster, Sensitivity of cultural heritage areas to disasters, Assessment and determination of disaster risks, Disaster risk analyzes in cultural heritage areas, Risk management and risk reduction strategies, Effects of disasters on cultural heritage areas, Disaster protection and post-disaster restoration strategies, Disaster management and planning processes, Disaster planning and practices in cultural heritage areas, Emergency response and rescue strategies, Case studies on disaster management and preservation of cultural heritage through case studies from around the world and from Türkiye.

**KOR551 Current Topics and Approaches in Conservation 3+0 7.5**

Changing Meaning and Scope of Cultural Heritage; Conservation Problem of the Heritage of Modern Architecture; Conservation of Industrial Heritage Sites; Landscape Sites in Conservation: Cultural landscape, Historic Urban Landscape; Conservation of Rural and Vernacular Architecture; UNESCO and World Heritage: Site Management Approach; Conservation of Tangible and Intangible Cultural Heritage; Cultural Tourism and Conservation; Sustainability and Conservation; Natural Disasters and Conservation of Cultural Heritage; Climate Change and Conservation; New Technologies in Conserving Cultural Heritage.

**KOR610 Conservation of Rural Architectural Heritage 3+0 7.5**

Rural Architecture; Rural Architecture in Anatolia; Formation of the Physical Texture: Rural Landscape, Settlement and plan features;, Building types and Production Relations; Techniques Related to Documenting the Features of Rural Architecture; Analysis of Deterioration at Rural Areas; Conservation and Regeneration of the Rural Areas: Conservation Approaches for Rural Architecture Samples; International Policies for Rural Legacy; Framework for National Solutions; Rural Settlements in the Urban Context; Rural Architecture in the 21st Century.

**KOR611 Accessibility of Historic Places and Buildings 3+0 7.5**

Historic Places and Buildings Principles: Principles of design, Principles of conservation, Responsibilities; Legislative Context; Improving the Accessibility: Developing an access strategy, Access audit, Access options, The access action plan; Accessibility of the External Environment: Accessible routes, Urban furniture and lighting, Landscape; In and Around Buildings Accessibility: Car parking, Building routes, Entry, Circulation, Emergency evacuation; Providing Accessible Information.

**KOR612 Cultural Landscapes 3+0 7.5**

Definition of Cultural Landscape Concept and Its History; Tangible and Intangible Qualities of Cultural Landscapes; Conservation Approaches for Cultural Landscapes; Management Problems; Cultural Landscapes and Site Management in the scope of UNESCO World Heritage; Natural Landscape; Artificial Landscape; Historical Urban Landscape; Conservation of Cultural Landscapes in International Legal Framework; Landscape Conservation in National Legal Framework; Methodology of Integrated Conservation of Natural and Cultural Heritage; Management, Interpretation and Presentation of Cultural Landscapes; Monitoring; Stakeholders and Participation; Case Studies from Turkey/abroad.

**KOR613 New Touches to The Historical Texture 3+0 7.5**

Defining Historical Texture and Protection of Cultural Assets Necessary the Concept in the Light of National and International Opinion; Evaluating the Meeting With the Historic Surroundings of the New Concept; Discussing New Interventions in Historic Surroundings; Discussing New Interventions in Historic Building; Investigating New Historic Texture Touches on Various Samples Examined.

**KOR614**                    **Typological Readings in the Historical Environment**                    **3+0 7.5**

Terminological Approach to the Concept of Typology; Understanding the Place and Importance of Typology in Conservation; Determining the Data Sets of Historical Structures by the Use of Different Data Sources; Analysis of the Collected Data with a Variety of Data Evaluation Methods; Arranging the Typology Titles by Evaluating the Groups that Emerged according to the Analyses; Forming Typology; Making the Typological Readings Compatible with the Concepts of Conservation and Restitution (Plans and Facade Arrangement, Materials, Transporter and architectural elements and urban morphology); Sharing and Presentation of Typology Based Reading.

**KOR615**                    **Tangible and Intangible Cultural Heritage**                    **3+0 7.5**

Definition of Tangible and Intangible Cultural Qualities; The Concepts of Tangible and Intangible Cultural Heritage; Tangible and Intangible Heritage in the Scope of Integrated Conservation Methodology; 'Spirit of Place' and Tangible and Intangible Heritage; Integrated Interpretation and Presentation of Tangible and Intangible Cultural Heritage in International Documents; UNESCO World Intangible Cultural Heritage Lists; World Heritage and its Tangible and Intangible Cultural Qualities; Intangible Cultural Heritage in Turkey; Cultural Significance; Values and Narratives, Integrated Interpretation and Presentation of Tangible and Intangible Heritage.

**KOR616**                    **Cultural Heritage and Tourism**                    **3+0 7.5**

**KOR617**                    **Cultural Heritage Consciousness, Awareness and Participatory Approaches**                    **3+0 7.5**

**KRY501**                    **Introduction to Urban Risk Management**                    **3+0 7.5**

Introduction to : Overview & Perspectives of Urban Risk Management;, Hazard, Vulnerability & risks: A Conceptual Approaches to Disaster Management: Definitions, Role and responsibilities; Identifying Risks & Vulnerabilities in the Urbanization; Urban Disaster Risks: Vulnerability Analyses in Urbanization, Risk assessment and mitigation strategies; Perspectives & Approaches & Types Urban disaster risks; Turkey's Urban Risks: Past and future impacts Impact for Present and Future, Lessons I Learned from past disasters; Environmental Impacts of Urban Risk sImpacts; Earthquake Risks: Managing structural and non-structural risks, Mitigation Framework for Structural Safety and Non-Structural Mitigation Measures, GIS and Remote Sensing forin Managing Urban Risks.; Action Planning & Strategies For Urban Disater Risk Reduction.

**KRY502**                    **Emergency and Disaster Regulations**                    **3+0 7.5**

An Overview of Emergency and Disaster Management An Overview of Legislation Regulations; Importance and Necessity of Knowing Legislation the Regulations; Act no 7269 "Some Important Laws and Implementing Regulations Related to Measures Could to BBe Taken in Case of Disasters Affecting General Public Life and Supports"; Act no 5902 "Some Important Laws and Implementing Regulations Related to Organization and Duties of Disaster and Emergency Management Presidency"; Act no 7126 "Some Important Laws and Implementing Regulations Related to Civil Defence Act"; Disaster and Emergency Councils; Duties and Responsibilities of the Provincial Disaster and Emergency Management.

**KRY503**                    **GIS and RS in Risk Management**                    **3+0 7.5**

Fundamentals of GIS and RS: Definition and components of; CBS and RS components; GIS Data Features; Satellite Image Characteristics; RS and GIS Integration: Information Extraction fFrom Satellite IImages; Managing Data wWith GIS; Relationship betweenWith the Risk Management and GIS and RS; Pre-Disaster Risk Analysis: Disaster hazard analysis; Elements of Risk and Vulnerability Analysis; Types and Methods of Risk Analysis; Risk Assessment; Cost-Benefit Analysis Methods; GIS and RS Application Examples at the Risk Management: Landslide risk analysis, Flood risk analysis, Earthquake risk analysis, Risk analysis of forest fire.

**KRY504**                    **Microzonation for Municipalities**                    **3+0 7.5**

Definitions and General Methodology; Seismic Microbzonation; Data Acquisition and Establishing a Database; Data Processing for Spatial Analysis; Geographic Information System: Creating infrastructure for seismic microzonation by via geographical information systems (GIS), Evaluation and completion of the data, Mapping of raw data; Derivation and Creation of Microzonation Maps; Land Use Management; Application of the Seismic Microzonation Maps to Urban Master Planning.



- KRY505 Map Information and GIS 3+0 7.5**  
Introduction to Map Information: Map and map types; Scale; Specifications in Maps; Utilization from Maps: Distance and area calculations; Slope and Profile Calculations; Map Projections and Coordinates Systems: Shape of earth; Datum and geoid; Projection Types and Specifications; Geographic and Cartesian Coordinate Systems; Sheet Segmentation; Fundamentals of Geographic Information Systems (GIS): Concepts of data, Geographic data, information and information systems; Definition of GIS; History of GIS; Components of GIS; GIS Data Types and Models: Attributes and spatial data; Raster and Vector Data Models; Topology Concepts and its Rules; Application Area of GIS.
- KRY506 Flood and Drought Hydrology 3+0 7.5**  
The Concept of Flood; Factors Affecting Flood; Precipitation and Flow Relations: Flow, Hydrograph analysis; Flood Estimation Techniques: Methods for small scale basins, Unit Hydrograph; Flood Management; The Concept of Drought: Analysis for Low flow conditions: Formation of low flow, Recession curve; Analysis of dry periods; Definition of drought, Causes of drought, Critical drought period, Local Drought Analysis; Drought Management: Methods for increasing water volume, Methods of decreasing water demand, Methods for decreasing the impact of the drought.
- KRY507 Risk Evaluation During Urban Renewal Process 3+0 7.5**  
Demolition Approaches: Evaluation of the approaches, Intervention principles, Demolition activities in structural renovation in the demolition activities; , Planning and managing projects: Key considerations when aspects on planning demolition projects, Planning and managing for site work, Management and planning tools, Structural hazards: Identification of structural form and features; Structural condition, Health and safety of persons on or off site: Risk assessment based approach, Site security, Noise and vibration, Falling and projected materials; Demolition techniques: Waste Control, Moving and Recycling Materials: Materials handling and processing: The removal of demolition debris, Recycling techniques and mobile systems for recycling Mobile power plants for recycling of materials.
- KRY508 Environmental Geology and Hydrogeology 3+0 7.5**  
Introduction; Earth Processes; Geologic Hazards; An overview of the damages within the scope of environmental geology; Earthquakes: Formation Processes of Earthquakes, Source of the force causing an earthquake; Volcanoes; Meteor Impacts; Floods; Coastal Processes; Slope Failures; Soils; Surface Water Hydrology; Groundwater Hydrology; Resources and Reserves; Mineral Resources; Energy Resources; Military Impacts of Wars on the Environment; Environmental Law and Environmental Impact.
- KRY509 Risk Determination of Underground Structures 3+0 7.5**  
Definitions of Concepts: Underground structures and engineering, Sustainability, Hazard and risk; Factors Affecting Underground Development: Engineering the underground Underground engineering for sustainable urban development; Health and Safety in Underground Structures: Human factor effects for health and safety, Managing safety through regulation; Lifecycle Sustainability, Costs, and benefits of underground infrastructure development: Lifecycle sustainability assessment, Lifecycle Economic benefits and costs of lifecycle; Innovative Underground Technology and Engineering for Sustainable Development: Evolution of technology, Technologies for underground site characterization.
- KRY510 Global Climate Change and Meteorological Disasters 3+0 7.5**  
Climate; Climate System; Global Climate Change; Observed and Expected Changes in Climate in the World and in Turkey of Climate Change; Natural Disasters; Meteorological Disasters; Causes and Types; Temporal and Spatial Distribution of Meteorological Disasters; Hot Air Waves; Drought and Desertification; Floods and Overflows; Hurricanes; Strong Winds and Storms; Forest Fires; Agricultural Bugs; Early Warning Systems.
- KRY511 GIS Use in Resource Inventory and Analyses 3+0 7.5**  
Definitions About Environment; Types and Elements Components of Environment: Physical environment, Natural environment, Cultural environment; Resource and Types of Resources; Resource Inventory; Resource Analyses; Efficient Management of Resources: Global environmental problems, Global climate change, Sustainable development; Resource Analysis; Use of Geomatic Technologies in Resource Inventory and Analyses: Remote sensing, Geodesy, Geographical information technologies.
- KRY512 Urban Transformation Law 3+0 7.5**  
An Outline of Urban Transformation: Historical development, Objectives, Definition, Models of urban transformation; Regulations: Legislation, Rationale, Concepts; Urban Transformation Aimed for Disasters: Topics, Authority, Land acquisition, Demolition, supports to rights holders, Appeals and litigation; Urban Transformation Aimed for Improvement of City: Related laws, Aim Objective, Subject, Scope, Authority, Process, History of the City; Urban Transformation Aimed for Protection of History of the Cultural and Natural Heritage of the City; Nature and Cultural Heritage: Related laws, Objectives, Subject, Scope, Authority, Construction process; General Evaluation.
- KRY513 Advanced Technologies in Disaster and Emergency Management 3+0 7.5**  
Natural and Technological Hazards and Risk Assessment; The Use of Informatic and Communication Technologies in Disasters; Introduction to Advanced Technologies in Emergency Management; Disaster Communications and

Connectivity Connection Networking; Disaster and Emergency Management and the Internet; Video Communications; Introduction to Geographical Information Systems (GIS): GIS Technology for disasters and emergency management; Operational Problems and Technology; Turkey's National Disaster Response Plan; The Disaster Management and Decision Support System.

**KRY514 Disaster Law 3+0 7.5**

An Outline of Disaster law: Law and its sources, Regulations, Rationale, Concepts; Scope of Disaster Law: Measures to be taken, Supports, Insurance; An Outline of Urban Transformation Law: Historical development, Objectives, Definition, Models of urban transformation, Urban transformation aimed for disasters, Legal matters; Disaster and Emergency Management Presidency: Organization, Duties; Civil Defense and Disaster Law;: International Disaster Response Law; Civil and Criminal Liability: Civil liability, Criminal liability.

**KRY515 Spatial Analysis in Urban Risk Management 3+0 7.5**

Basic Concepts: Urban risk management and location intelligence, Urban information systems, Spatial analysis, Vulnerability; Geographical Information Systems in Urban Risk Management: Geospatial data, Spatial information, Spatial data creation stages; Remote Sensing in Urban Risk Management: Remote sensing data sources, Using remote sensing in post-disaster impact and damage detection; Geographical Information Systems in Disaster Studies: Geographic data collection, hazard and risk mapping, Spatial analysis with case scenarios.

**KRY516 Earthquake Risk Determination in Reinforced-Concrete Buildings 3+0 7.5**

Definitions aAbout Earthquake; Location of the Earthquake, Magnitude of the earthquake, Intensity of the earthquake; Structural Irregularities in RC Buildings: Irregularities in plan, Irregularities in vertical direction; Structural Defects in RC Buildings: Strong beam-weak column problem, Short column problem, Corner column problem, Clerestory problem, Discontinuous frame problem, Lack of stir-up problem, Yetersiz deprem derziLack of expansion joints, Workmanship defects, Low quality concrete, Defects caused by users; Earthquake Damages in RC Buildings: Damages in structural carrier system elements, Damages in non-structural carrier elements.

**KRY520 Disaster Hazard and Risk Factors of Turkey 3+0 7.5**

Definition and types of disaster: Factors affecting the magnitude of disaster, Disaster statistics; Hazard and Risk: Determination of hazard and risk, Maps of hazard and risk; Earthquake: Internal structure of the earth and plate tectonics, Fault and fault types, Earthquake, Earthquake waves, Earthquake parameters, Factors affecting earthquake, Seismicity of Türkiye, Earthquake regions/hazard maps of Türkiye; Flood: What is flooding, how it occurs?, Types of flood; Landslide: What is landslide, how it occurs?; Avalanche: What is avalanche, how it occurs?; Meteorological disaster; Technological disasters.

**KRY522 Disaster Regulation for Local Governments 3+0 7.5**

Disaster management system of Türkiye: Disaster and emergency management centers, Important institutions and organizations in terms of disaster management; 5216 numbered metropolitan municipality Law, 5393 numbered municipality law and Law no 5302 on provincial special administration duties; 7269 numbered disaster law, Civil defense law number 7126 and 3194 numbered development law duties; Tasks assigned to local governments under the Türkiye disaster response plan; Law No. 6306 on the transformation of areas at risk of disaster; Building earthquake regulation and ground and basic study application principles.

**KRY523 Disaster Logistics 3+0 7.5**

Content: Components of disaster, Disaster management; Cities Disaster Resilient: The concept of vulnerability and its applications, The vulnerability of cities, Disaster and resilience, Risk, Natural and technological hazards, Natech Risk Assessment and Management, Na-tech, supply chain, Emergency operations, Transportation, Geographic information systems and spatial analysis, Network analysis, Social/institutional network analysis.

**KRY524 Sustainable Urban Resilience 3+0 7.5**

**KRY525 Urban Planning and Geology 3+0 7.5**

Urban Planning Definition in Geology and Its Importance; Population and Urban Migration; Urban Planning Structures in Rapid Population Growth: Problems Experienced in the Fields of Economy, Education, Health and Engineering; Growth of Rapidly Migrating Cities Without Engineering Services and Geological Evaluation of Earthquake Risk of These Areas; Urban Phenomenon and Building Quality Question in Our Country After 1999 Marmara Earthquake; Local Geological Characteristics of Cities Where Zoning Plans Are Made / Will Be Planned and Geological Features of the Ground Where Building Foundations will be established; Developments in Urban Planning after TBDY 2019.

**KRY526 Rapid Seismic Performance Assessment Methods and Building Inventory Studies 3+0 7.5**

<b>KRY527</b>	<b>Combating and Adapting to Global Climate Change</b>	<b>3+0 7.5</b>
<b>KRY528</b>	<b>Combating and Adapting to Climate Change in Cities</b>	<b>3+0 7.5</b>
<b>KRY529</b>	<b>Building Inspection Practices in Disaster Risk Areas</b>	<b>3+0 7.5</b>
	Disaster Risky Areas and Their Historical Processes; Urbanization and Risk; Building Inspection Law No. 4708, Implementation Regulation; Structure of Cities in Turkey; Establishing the Urban Resilience Index and Interpreting the Index Values; Urban Transformation Practices in Our Country; Disaster Risk Area and Reserve Structure Area; Transformation Practices in the Scope of Transformation of Areas Under Disaster Risk No. 6306 in Building Inspection; Implementation Process in the Transformation to be Made pursuant to the Law No. 5393 in Building Inspection; Zoning Peace-Building Registration Document Arrangement.	
<b>KRY530</b>	<b>Artificial Intelligence Applications in Urban Risk Management</b>	<b>3+0 7.5</b>
	Introduction to artificial intelligence; Heuristic problem solving; Learning models; Learning in artificial neural networks; Fuzzy logic; Fuzzy set theory; Fuzzy logic-based systems Adaptive Neuro-Fuzzy Inference Systems (ANFIS); Genetic algorithms; Computer applications; Artificial neural network applications with MATLAB; Fuzzy based system applications with MATLAB; Genetic algorithm applications with MATLAB; Sample analysis on urban risk management.	
<b>KRY531</b>	<b>Geophysical Methods in Determining Earthquake Hazards</b>	<b>3+0 7.5</b>
	General Geophysics, Earthquakes: magnitude, intensity, structural and non-structural hazards, Detection of faults with seismic methods, Detection of faults using gravity and magnetic method, Solutions for shallow faults with ground penetrating radar, Seismology and fault solutions with seismological methods, Detection of faults with the electricity-resistivity method, Other geophysical methods and their areas of use, Active Fault and Türkiye Earthquake Hazard Map, Ground parameters in the Türkiye Earthquake Regulation, Estimation of ground parameters using geophysical methods, Statistical calculation of earthquake recurrence periods.	
<b>KRY599</b>	<b>Semester Project</b>	<b>3+0 0.0</b>
<b>LOJ511</b>	<b>Carriage of Dangerous Goods</b>	<b>3+0 7.5</b>
	The place and importance of carriage of dangerous goods in our country and in the world; ADR document, its definition, importance and purpose; regulations and standards in Turkey; Definition of dangerous goods; The importance of ADR Table A; Classification of dangerous goods and their characteristics; Basic packaging for transporting ADR dangerous goods; Transport documents; Accident written instructions; Liable for the transport of dangerous goods. Marking and labeling; Fire extinguishers; Things to be found in vehicles carrying dangerous material; Basic principles in the loading and unloading of dangerous material. National and international regulation of carriage of dangerous goods by railway. General structure of RID	
<b>LOJ512</b>	<b>Supply Chain Design</b>	<b>3+0 7.5</b>
	Supply Chain Concept and Scope: Definition of Supply Chain and Supply Chain Management, Decision Phases in a Supply Chain, Process View of a Supply Chain; Supply Chain Drivers and Performance Metrics: Drivers of Supply Chain Performance (Facilities, Inventory, Transportation, Information, Sourcing, Pricing), Supply Chain Drivers Related- Metrics, Financial Measures; Network Design in the Supply Chain: Factors Influencing Network Design Decisions, Capacitated Plant Location Models, Gravity Location Models; Aggregate Planning in a Supply Chain: Definition of the Problem, Aggregate Planning Using Linear Programming; Planning Supply and Demand in a Supply Chain: Predictable variability in the Supply Chain, Managing Supply, Managing Demand; Transportation in a Supply Chain: Modes of Transportation and their Performance Characteristics, Design Options for a Transportation Network; Sourcing Decisions in a Supply Chain: The Role of Sourcing, Outsourcing, Third- and Fourth-Party Logistics Providers, Supplier Selection.	
<b>LOJ513</b>	<b>Logistics Principles</b>	<b>3+0 7.5</b>
	Definition and development of Logistics: Historical Development and Influencing Factors, Logistics Activities: Transportation, Warehouse Management, Stock Management, Customer Service, Demand Forecasting, Handling, Packaging, Marketing Distribution Channels and Logistics: Logistics and Supply Chain Management: Logistics and Information Technologies: Reverse Logistics: Outsourcing in Logistics: Modern Logistics Applications.	
<b>LOJ514</b>	<b>Logistics Planning and Modelling</b>	<b>3+0 7.5</b>

Logistics planning and its importance; Operations Research methodology, Modeling with linear programming; Transportation problems and modeling techniques; Finding the basic basic solution to transportation problems; Simplex Method specific to transportation problems; Transportation Simplex Algorithm. Optimization test and finding entering and leaving variables; Transportation Modes and Selection; Facility Location Selection; Determination of fleet types and size; Cargo consolidation and shipping; Basic concepts related to network models; The shortest path problem and the Dijkstra Algorithm; Minimum spanning tree problem; The maximum flow problem; Route determination and models.

**LOJ515                      Transportation Economics                      3+0   7.5**

Fundamental Economic Concepts: Necessities, Goods & Services, Production Costs; Introduction to Transportation Economics: Effect of Transportation on Economic Growth; Features of Transportation Industry; Sub-Systems of Transportation; Economic, Social and Political Functions of Transportation; Microeconomic and Macroeconomic Approaches to Transportation Economics; Supply, Demand and Equilibrium in Transportation; Factors Affecting Transportation Demand; Methods of Transportation Demand Forecasting; Internal and External Costs in Transportation Industry; Pricing in Transportation Industry; Transportation Industry and Policies in Developed Countries; Transportation Policies in European Union; Criteria in the Selection Process of Transportation Systems and Analysis of Utility & Cost; Transactions of Transportation Systems with the Environment; Economic Analysis of Transportation Industry in Turkey, Current Conjuncture & Problems.

**LOJ516                      Corporate Communication In Logistics Businesses                      3+0   7.5**

The concept, functions and characteristics of cooperation; corporate communication and basic concepts; aim of corporate communication; management of corporate communication: business communication, public relations, organisational communication, management communication; Corporate identity, corporate brand, corporate reputation, corporate image; corporate culture: strategic management in corporate communication; public relations and advertising in corporate communication; social responsibility in corporate communication, sponsorship.

**LOJ517                      Human Resources Strategies on Logistics Sector                      3+0   7.5**

Human Resources Management Concept; Transformation from personnel management to human resources management: causes, differences, and strategic evaluation; Systematic and strategic thinking on human resources management; Selection, education, career planning, and performance management of human resources for achieving sustainable success; Strategies for gaining benefit from creative and innovative ideas of human resources, competition conditions and flexible working conditions on the motivation and performance of human resources; Strategies for prevent mobbing and cyberslacking; Future of human resources in the logistics sector; Guided readings on logistics sector's human resources management.

**LOJ518                      Transportation Systems                      3+0   7.5**

Basic definitions of transportation systems: Importance of Transportation, Types of Transportation; Transportation with Railway Systems: Components of Railway Systems, Importance of Railway Systems in Logistics; Highway Transport: Basic Concepts, The Importance of Highway for Logistics; Airline Transportation: Major Concepts in Airline Transportation, The Place and Importance of Airway in Freight Transportation; Seaway Transportation: Types of Seaway Transportation, Its Importance in Freight Transportation; Pipeline Transportation; Integration of Transport Types: Current Situation of Transportation Modes in Turkey, Required Steps and Measures for the Integration of the Modes.

**LOJ519                      Warehouse And Inventory Management                      3+0   7.5**

Forecasting: Subjective forecasting methods, Objective forecasting methods; Fundamentals of Warehousing; Warehouse Activities; Warehouse Types; Warehouse Equipment and Tools; Warehouse Operations; Performance Measurement in Warehouse; Warehouse Management Software; Inventory Types and Inventory Causes; Inventory Costs; Inventory Counting and Classification Systems; Inventory Models: Basic economic order quantity model, Economic production quantity model; Discount Models: Incremental discount, All unit discount.

**LOJ520                      Logistics Practices                      3+0   7.5**

Retail Logistics: Concept, Function And Characteristics; Food Logistics: Concept, Function And Characteristics; Textile And Clothing Logistics: Concept, Function And Properties; Electronic Product Logistics: Concept, Function And Properties; Automotive Logistics: Concept, Function And Characteristics; Project And Construction Logistics: Concept, Operation And Characteristics; Tourism Logistics: Concept, Function And Characteristics; Fair And Event Logistics: Concept, Function And Features; Medicine And Hospital Logistics: Concept, Function And Characteristics; Logistics Of Waste And Recycling: Concept, Function And Properties; Animal Logistics: Concept, Function And Characteristics; Rescue And Disaster Logistics: Concept, Function And Characteristics; Knowledge Logistics: Concept, Function And Features; Military Logistics: Concept, Operation And Characteristics.

**LOJ521                      Digital Marketing                      3+0   7.5**

Basic Concepts; What is marketing, Old vs new marketing rules, the five Ps of internet marketing, Digital Marketing Strategy; Digital marketing, Digital marketing Strategy, Web development and Design; Web design, Step-by-step guide to building a website, Customer Relationship Management; Key terms and concepts, A CRM model, Understanding customer, CRM and data, Benefit of CRM, Online Advertising; Key terms and concepts, Online advertising objectives, Types of

display adverts, Mobil marketing; The role of mobile personal communication, Mobile messaging channels, Mobile commerce, Integrating mobile into online marketing, Augmented reality.

**LOJ522 Coaching and Leadership Skills for Managers 3+0 7.5**

**LOJ523 Total Quality Management in Logistics Businesses 3+0 7.5**

The concept of quality and the basic features of quality; The historical development of quality over time and the pioneers of quality; Quality culture, quality philosophy and Kaizen; Total quality management and its basic elements; Total quality management philosophy and basic principles; The concept of standardization; ISO quality management system; Total quality management in improving service quality; Total quality management tools and techniques I; Total quality management tools and techniques II; Examination of total quality management practices in logistics enterprises I; Examination of total quality management practices in logistics enterprises II.

**LOJ524 Logistics Costs Analysis 3+0 7.5**

Cost Concepts and Behavior; Traditional Costing Methods; Logistics Cost Elements; Activity Based Costing; Time-Driven Activity Based Costing; Using Reverse Logistics and Outsourcing as a Cost Management Tool; Financial Reporting in Logistics Businesses; Logistics Performance Valuation and Its Impact on Share Value; Cost-Volume-Profit Analysis of Logistics Costs; Using the Customer Profitability Matrix in Logistics Decisions.

**LOJ525 Logistics Law 3+0 7.5**

Structure of Law and Legal System; Law Types and Sources; Types and Hierarchy of Legally Accepted Documents; Differences in 'Logistics' and 'Transportation' Concepts; Logistics Law and Its Relationship to Other Legislation; Fundamental Logistics Law Concepts; Legislation of Transportation Subtypes and Mixed (Multi Model) Logistics; Logistics Documents; Carriage Contracts; International Sale Contracts; International Commercial Terms (Incoterms).

**LOJ527 Research Methods in the Field of Logistics 3+0 7.5**

**LOJ599 Term Project 3+0 0.0**

**LOJ601 Logistics Planning and Modelling 3+0 7.5**

**MAT502 Analysis 3+0 7.5**

Tensor Algebra; Differential Forms; Exterior Derivative and Its Properties; Fields; Orientation; Volume Element; Poincare Lemma; Singular Cubes; Stokes Theorems on Open Sets; Manifolds; Manifolds With Boundary; Differentiable Mappings; Tangent and Cotangent Spaces; Differential Forms and Fields on Manifolds; Stokes Theorem on Manifolds; Classical Theorems of Green; Gauss and Stokes.

**MAT503 Topology 3+0 7.5**

Topological Spaces; Basic Concepts; Neighborhoods; Base and Sub base; Continuous Functions; Product Spaces; Quotient Spaces; Convergence; Nets and Filters; Separation and Countability; Separation Axioms; Countability Properties; Compact Spaces; Local Compact Spaces and Compactness; Metrizable; Complete Metric Spaces and Baire's Theorems; Connected Spaces; Local-Connectedness and Path-Connectedness.

**MAT504 Differential Equations 3+0 7.5**

Differential Equation; Classical Solution and Solution Concepts; Isoclines; Phase Space; System of the Linear Differential Equations; Wronskian, Gronwall Inequality; Nonlinear Differential Equations; Existence; Uniqueness and Extendibility of Cauchy Problem Solution; Dependence of Solutions on Initial Condition and Parameters; Numerical Solution Methods; Stability of Solutions; Lyapunov Theorems; Linear First Order Partial Differential Equations; Existence and Uniqueness of Cauchy Problem Solution; Characteristics Method.

**MAT506 Reel Analysis 3+0 7.5**

Measure Theory; Measure in the Plane; Lebesgue Measure and Its Properties; Measurable Functions; Convergence; Lebesgue Integral and Its properties; Lebesgue; Fatou and Levi Theorems; Differentiation of an Lebesgue Integral With Respect to its Upper Limit; Monotone Functions; Differentiation of Monotone Functions; Differentiation of An Integral With Respect to Its Upper Limit; Functions of Bounded Variation; Differentiation of the Indefinite Lebesgue Integral; Absolutely Continuous Functions; L Spaces.

**MAT507 Applied Mathematics I 3+0 7.5**  
Rectangular Coordinates; Coordinate Transformations: Polar, Cylindrical and Spherical Coordinates; Scalar and Vector Fields; Gradient, Divergence and Curl; Volume Integrals; Line Integrals and Surface Integrals; Gauss's Theorem; Stoke's Theorem; Linear Spaces; Subspaces. Linear Combinations and Linear Dependence; Hilbert Space; Orthogonal Complements; The Gram-Schmidt Procedure; Complete Orthonormal Sequences; Fourier Series; Fourier Series of a Periodic Functions; Approximations.

**MAT507 (Eng) Applied Mathematics I 3+0 7.5**  
Rectangular Coordinates; Coordinate Transformations: Polar, Cylindrical and Spherical Coordinates; Scalar and Vector Fields; Gradient, Divergence and Curl; Volume Integrals; Line Integrals and Surface Integrals; Gauss's Theorem; Stoke's Theorem; Linear Spaces; Subspaces. Linear Combinations and Linear Dependence; Hilbert Space; Orthogonal Complements; The Gram-Schmidt Procedure; Complete Orthonormal Sequences; Fourier Series; Fourier Series of a Periodic Functions; Approximations.

**MAT508 Applied Mathematics II 3+0 7.5**  
Linear Transformations; Inverse Transformation; Laplace transformation; Laplace Transformation and Differential Equations; Fourier Transformation; Partial Differential Equations; The Classical Partial Differential Equations; The One-Dimensional and Two-Dimensional Wave Equations; The One-Dimensional and Two-Dimensional Heat Equations; Separation of Variables; Laplace's Equation in a Circular Region; Laplace's Equation in a Sphere; Laplace Transformation and Fourier Transformation Applied to Partial Differential Equations.

**MAT508 (Eng) Applied Mathematics II 3+0 7.5**  
Linear Transformations; Inverse Transformation; Laplace transformation; Laplace Transformation and Differential Equations; Fourier Transformation; Partial Differential Equations; The Classical Partial Differential Equations; The One-Dimensional and Two-Dimensional Wave Equations; The One-Dimensional and Two-Dimensional Heat Equations; Separation of Variables; Laplace's Equation in a Circular Region; Laplace's Equation in a Sphere; Laplace Transformation and Fourier Transformation Applied to Partial Differential Equations.

**MAT509 Algebraic Topology I 3+0 7.5**  
Categories; Functors; Homotopy Category; Fundamental Group; Simply Connected Spaces; Contractible Spaces; Covering Projections; Deck-Transformations; Classification of Covering Spaces; Topological Groups; Group Actions; Computation Methods for the Fundamental Group; Higher Homotopy Groups; Wedge and Suspension; Fiber Bundles; Exact Sequences; Exact Homotopy Sequence of Fiber Bundles.

**MAT510 Algebraic Topology II 3+0 7.5**  
Axiomatic Homology and Cohomology Theories; Eilenberg-Steenrod Axioms; Elementary Homological Algebra; Singular Homology and Cohomology Theory as Model of Eilenberg-Steenrod Axioms; Method of Acyclic Models; Computation of Homology and Cohomology Groups of Spheres; Brouwer Fixed-Point Theorem and Other Geometric Applications; Products in Cohomology and Cohomology Ring; Eilenberg-Zilber Theorem.

**MAT511 Dynamical Systems I 3+0 7.5**  
Linear Systems; Diagonalization; Exponentials of Operators; The Fundamental Theorem for Linear Systems; Linear Systems in  $\mathbb{R}^2$ ; Complex Eigenvalues; Multiple Eigenvalues; Jordan Forms; Stability Theory; Non homogeneous Linear Systems; Nonlinear Systems; Local Theory; The Fundamental Existence-Uniqueness Theorem; Dependence on Initial Conditions and Parameters; Maximal Interval of Existence.

**MAT512 Dynamical Systems II 3+0 7.5**  
The Flow Defined by a Differential Equation; Linearization; The Stable Manifold Theorem; Hartman-Grobman Theorem; Stability and Liapunov Functions. Nonlinear Systems; Global Theory; Dynamical Systems and Global Existence Theorems; Limit Sets and Attractors; Periodic Orbits; Poincare Map; Stable Manifold Theorem for Periodic Orbits; Poincare-Bendixson Theory in  $\mathbb{R}^2$ .

**MAT513 Axiomatic Sets Theory 3+0 7.5**  
Mathematical logic; Formal systems; Basic proof methods; The work of Cantor; Paradoxes; Discussions about the basic of mathematics; Ways of solution; ZF and ZFC axioms; NGB set theory; Ordinal numbers; Transitive models; Consistency discussions.

**MAT515 Engineering Mathematics 3+0 9.0**  
Approximation Theory: Discrete least squares approximation, Orthogonal polynomials and least square approximations, Chebyshev polynomials and economization of power series, Rational function approximation, Pade rational approximation, Chebyshev rational approximation, Trigonometric polynomial approximation; Gamma and Beta Functions: Taylor series

expansion of Gamma function, Stirling's approximation for  $n!$  for large  $n$ ; Error Functions; Finite Differences; Linear Difference Equations: First degree difference equations, Second degree difference equations, High degree difference equations, Difference equations systems.

**MAT517 Applied Mathematics 3+0 7.5**

Vector Spaces; Subspaces; Linear Dependence And Linear Independence; Basis; Linear Mappings; Matrices; Matrix Representation of A Linear Mappings; System of Linear Equations; Eigenvalues And Eigenvectors; Inner Product Spaces; Differential Equations And Their Solutions; First Order Ordinary Differential Equations And Their Applications; Higher Order Linear Differential Equations And Their Applications; Systems of Linear Differential Equations.

**MAT519 Algebra 3+0 7.5**

Rings; Ideals; Quotient Rings; Integral Domains; Principal Ideal Rings; Euclidean Rings; Polynomial Rings; Vector Spaces; Linear Transformations; Matrix Representation of Linear Transformations; Dual Spaces; Modules; Algebra of Linear Transformations; Eigenvalues; Eigenvectors; Minimal Polynomials; Canonical Forms; Triangular Forms; Jordan Forms; Rational Canonical Forms; Hermitian, Unitary and Normal Transformations; Real Quadratic Forms.

**MAT520 Lie Algebras 3+0 7.5**

Simple and Semi Simple Algebras; Killing Form; Cartan's Criteria; Structure Theorems; Representations; Relations with Lie Groups; Cartan Sub-Algebras; Root Systems; Coxeter-Dynkin Diagrams; Classification of Complex Semi Simple Lie Algebras.

**MAT521 Geometric Topology 3+0 7.5**

Surfaces and Cell-Decomposition; Surgery; Fundamental Groups and Methods of Calculation; Van Kampen's Theorem; Edge Group of a Complex and its Relation with the Fundamental Group.

**MAT523 Introduction to Riemann Geometry 3+0 7.5**

Differentiable Manifolds; Tangent Spaces; Tangent Bundles; Riemannian Manifolds; Levi-Civita Connections; Geodesics; Curvature Tensors; Curvature and Local Geometry.

**MAT524 Geometry of Differential Forms 3+0 7.5**

Manifolds, Lie groups, Vector fields, Differential forms, Exterior algebra, Lie derivative, Frobenius theorem, Vector-valued differential forms, Maurer-Cartan form, Homology of manifolds, Stokes theorem, de Rham theorem, Hopf invariant, Massey product, Cohomology of compact Lie groups, Mapping degree.

**MAT525 Equations of Mathematical Physics I 3+0 7.5**

Boundary-Value Problems of Mathematical Physics: Some concepts from the theory of functions and operator theory, Fundamental equations of mathematical physics, Classification of quasi-linear differential equations of the second order, Setting basic boundary-value problems for second-order linear differential equations; Generalized Functions: Basic and generalized functions, Differentiation of generalized functions, Convolution of generalized functions, Generalized functions of slow increase, Fourier transform of the generalized functions of slow increase; Fundamental Solutions and The Cauchy Problem: Fundamental solutions of linear differential operators, Wave potential, Cauchy problem for wave equation, Propagation of waves, Cauchy problem for the equation of thermal conductivity.

**MAT526 Equations of Mathematical Physics II 3+0 7.5**

Integral Equations: Method of sequential approximations, Fredholm's theorems, Integral equations with the Hermitian kernel, Hilbert-Schmidt theorem and its consequences; Boundary-Value Problems for the Equations of Elliptical Type: Eigenvalue problems, Sturm-Liouville problem, Harmonic functions, Fourier's method for eigenvalue problems, Newton potential, Boundary-value problems for the equations of Laplace and Poisson in the space, Green's function, Dirichlet problem, Boundary-value problems from Laplace's equation on the plane; The Mixed Problem: Fourier's method, Mixed problem for the hyperbolic equation, Mixed problem for the parabolic equation.

**MAT527 Numerical Solutions of Partial Differential Equations 3+0 7.5**

Basic Concepts of Finite Difference Method; Finite Difference Methods for Parabolic Partial Differential Equations; Convergence, Stability and Consistency; Finite Difference Methods for Elliptic Partial Differential Equations; Finite Difference Methods for Hyperbolic Partial Differential Equations.

**MAT528 Optimization Methods I 3+0 7.5**

Unconstrained Optimization: Functions of One Variable, Functions of Several Variables, Positive and Negative Definite Matrices and Optimization, Coercive Functions and Global Minimizers, Eigenvalues and Positive Definite Matrices; Convex Sets and Convex Functions: Convex Sets, Convex Functions, Convexity and the Arithmetic-Geometric Mean Inequality, Unconstrained Geometric Programming, Convexity and Other Inequalities; Iterative Methods for Unconstrained Optimization: Newton's Method, Gradient Method, Broyden's Method, Secant Methods for Minimization; Convex

Programming and the Karush-Kuhn-Tucker Conditions: Separation and Support Theorems for Convex Sets, Convex Programming and the Karush-Kuhn-Tucker Theorem, Karush-Kuhn-Tucker Theorem and Constrained Geometric Programming, Dual Convex Programming.

**MAT529 Optimization Methods II 3+0 7.5**

Convex Programming and the Karush-Kuhn-Tucker Conditions; Separation and Support Theorems for Convex Sets, Convex Programming; Karush-Kuhn-Tucker Theorem, Karush-Kuhn-Tucker Theorem and Constrained Geometric Programming, Dual Convex Programming, Lagrangian Duality and Saddle Point Optimality Conditions; The Lagrangian Dual Problem, Duality Theorems and Saddle Point optimality Conditions, Properties of the Dual Functions, Formulating and the Solving of the Dual Problem, Getting the Primal Solution, Linear and Quadratic Programs, Least Squares Optimization; Least Squares Fit, Subspaces and Projections, Minimum Norm Solutions of Undetermined Linear Systems; Generalized Inner Products and Norms: The Portfolio Problem, Penalty Methods; Penalty Functions, The Penalty Method, Applications of the Penalty Function Method to Convex Programs.

**MAT530 Introduction to the Theory of Nonlinear Optimization 3+0 7.5**

Existence Theorems for Minimal Points; Problem Formulation, Existence Theorems, Set of Minimal Points, Generalized Derivatives; Directional Derivative, Gateaux and Frechet Derivatives, Subdifferential, Quasidifferential, Clarke Derivative, Tangent Cones; Definition and Properties, Optimality Conditions, A Lyusternik Theorem, Generalized Lagrange Multiplier Rule; Problem Formulation, Necessary Optimality Conditions, Sufficient Optimality Conditions.

**MAT531 Tensor Analysis 3+0 7.5**

Tensor fields, tensor product, some specific tensor fields, Tensor at a point, Components of tensor, Contraction, Tensor derivation, Metric tensor, Levi-Civita connection, Curvature tensor, Ricci curvature, Bianchi identities, Some basic differential operators.

**MAT532 Functional Analysis 3+0 7.5**

Normed Vector Spaces; Examples of Normed Spaces; Product of Normed Spaces; Continuous Functions Between Normed Spaces; Sequences and Completeness; Finite Dimensional Vector Spaces; Banach Spaces; Contraction Mapping Theorem; Integral and Differential Equations; Linear Mappings; Bounded Operators; The Space of Bounded Linear Transformations; Open Mapping Theorem; Closed Graph Theorem; Hahn-Banach Theorem; Inner Product Spaces; Hilbert Spaces; Self-Adjoint Bounded Linear Operators; Compact Operators; Self-Adjoint Compact Operators; Orthonormal Sets; Gram-Schmidt Orthogonalization Process.

**MAT533 Differentiable Manifolds 3+0 7.5**

Definition of Manifolds and Examples: Atlas; Smooth Structure; Manifolds As Subsets of  $\mathbb{R}^n$ ; Grassmannian Manifolds and Projective Spaces; Topological Properties of Manifolds. Smooth Mappings: Smooth Mapping between Manifolds; Diffeomorphisms; Partition of Unity. Tangent Vectors: Tangent Vectors on a Manifold; Differential of Maps between Manifolds; Expressing Tangent Vectors in Local Coordinates; Tangent Vectors of Curves. Vector Fields: Vector Bundles; Vector Fields. 1-Forms: Cotangent Bundles; 1-Forms; Push-Forward and Pull-Back of Vector Fields and 1-Forms.

**MAT534 Selected Topics in Algebra 3+0 7.5**

The Algebra Concept: Definitions and Examples; Structure Constants; Division Algebras; Normed Algebras: Cayley-Dickson Process; Associator; Alternativity; Hurwitz Theorem; Artin Theorem; Quaternion: Geometric interpretations and applications; Octonions: Moufang identities; Double; Triple and Quadruple Vector Cross Products; Characterization of Double Vector Cross Products and Determination of the Dimension in Which They Exist.

**MAT535 Hyperbolic Geometry 3+0 7.5**

Axioms of Hyperbolic Geometry; Upper Half Plane Model for Hyperbolic Plane; General Möbius Group: Cross Ratio; Classifications of Möbius Transformations; Reflections; Length and Distance in Upper Half Plane Model: Arc-Length Element; Hyperbolic Metric and Isometries; Other Models for Hyperbolic Plane: Poincaré Disk Model; Projective Disk Model; Hyperbolic Area and Gauss-Bonnet Formula Hyperbolic Trigonometry; Higher Dimensional Hyperbolic Spaces.

**MAT539 Fractal Geometry 3+0 7.5**

Fractal Examples: Contour Set; Koch Curve; Sierpinski Triangle; Menger Spongene; Examples From Nature; Iterated Function Systems: Metric spaces and Banach fixed point theorem; Hausdorff Metric; Iterated Function Systems; Collage Theorem; Dimension: Space-Filling Curves; Topology Dimension; Hausdorff Dimension; Fractal Dimension and Application; Iteration of Complex Functions: Julia sets; Mandelbrot set.

**MAT542 Game Theory 3+0 7.5**

Two-Person Zero-Sum Game; Maxmin Criterion; Von Neumann Theorem; Solution Concept; Domination; Worthwhile Strategies; Methods of Solution to the Matrix Game; Two-Person Non-Zero-Sum Finite Game; Maxmin Strategies And Equilibrium Pairs; Nash's Theorem; Swastika Method; Cooperative Games; Jointly Randomized Strategies; Bargaining Set



and Bargaining Procedure; Two-Person Zero-Sum Non-Matrix Game; Existence of The Solution; Ky Fan Inequality; Two-Person Non-Zero-Sum and Non-Matrix Game; Existence of The Equilibrium Pairs; Nikaido-Isoda Theorem; Differential Game; Positional Strategy; Existence of Value; Approach-Evasion Problem; Extremal Aiming Method; Existence of Alternative.

**MAT545 Integral Equations I 3+0 7.5**

Introduction and Basic Concepts: Classification of integral equations, Problems reduced integral equations; Fredholm Theory: Fredholm's formulas, Integral equations with degenerate kernels, Fredholm's theorems; The Contraction Operator Principle: The contraction operator principle, Applications of contraction operator to integral equations; Linear Integral Equations: Application of linear operator to integral equations, The Fredholm theorems for general Fredholm integral equation, Kernels with weak singularities, Character of solution of integral equation; Integral Transforms: Fourier transform, Laplace transform, Mellin transform, Wiener-Hopf's method.

**MAT546 Integral Equations II 3+0 7.5**

Symmetric integral equations, Symmetric operators, Hilbert-Schmidt theorem, Solutions of operator equations, Integral equations with symmetric kernels, Hilbert-Schmidt theorem for integral equations, Characteristic values and extremal properties of characteristic functions, Equations that can be reduced to symmetric equations, Classification of symmetric kernels, Green's function, Reduction of boundary value problems to integral equations; Integral Equations of the First Kind, Volterra equations of the first kind, Fredholm equations of the first kind, Operator equation of the first kind; Singular Integral Equations, Non-Fredholm integral equations, Hilbert transform.

**MAT547 Asymptotic Methods in Analysis 3+0 7.5**

Introduction: Order symbols; Asymptotic equivalence; Asymptotic series; Operations on asymptotic series; Implicit Functions: Lagrange inversion formula; Applications; Iteration methods; Roots of equations; Asymptotic iteration; Sum: Euler-Maclaurin summation formula; Stirling formula for the Gamma function; Alternating sums; Poisson summation formula; Laplace Method for Integrals: General case; Asymptotic expansion; asymptotic behavior of the Gamma; Multiple integrals; Saddle Point Method: Steepest descent method; Small perturbations; Applications of saddle point method; Indirect Asymptotics; Iterated Functions.

**MAT548 Numerical Solutions of Ordinary Differential Equations 3+0 7.5**

Basic Concepts: Definition of ordinary differential equations, Definition and basic concepts of initial value problems of ordinary differential equations, Difference equations; Single-step Methods: Taylor series method, Euler method, Runge Kutta methods, Convergence analysis, Stability analysis, Implicit Runge Kutta methods, Obrechhoff methods; Multistep Methods: Explicit multistep methods, Implicit multistep methods, General linear multistep methods, Stability analysis, Convergence analysis.

**MAT549 Introduction to Graph Theory 3+0 7.5**

Definitions and Examples: Graph, Vertex, Edge, Degree; Paths and Cycles: Connectivity, Eulerian graphs, Hamiltonian graphs; Trees: Properties of trees, Counting trees, Applications; Planarity: Planar graphs, Kuratowski's theorem, Euler's formula, Dual graphs; Colouring Graphs: Colouring vertices, Colouring maps, The four-color theorem, Colouring edges; Matching: Halls marriage theorem.

**MAT551 Ring and Module Theory 3+0 7.5**

Modules: Submodules, Ideals, Intersection and sum of submodules; Factor Modules; Module and Ring Homomorphisms; The Jordan-Hölder-Schreier Theorem; Endomorphism Ring of a Module; Exact Sequences; Direct Product and Direct Sum of Modules; Free Modules; Large and Small Modules; Injective Modules: Injective Hulls; Projective Modules: Projective covers; Baer's Criteria; Artinian Modules (Rings); Noetherian Modules (Rings).

**MAT552 Introduction to Mathematical Elasticity 3+0 7.5**

Introduction: Mathematical Preliminaries, Cartesian tensors, Operational tensors; Stress and Equilibrium: State of Stress, Equations of equilibrium, Principal stress, Properties and special states of stress; Deformations: Strain, Physical interpretation of strain tensor, Principal strains, Volume and shape changes, Compatibility; Material Behaviour; Formulation, Uniqueness, Solution strategies; Extension, Bending, Torsion; Two-dimensional Elasticity: Plane Stress Equations, Plain strain equations.

**MAT553 Fuzzy Set Theory 3+0 7.5**

Fuzzy Sets: The concept of fuzzy set; Operations of Fuzzy Set: Complement, Inclusion, Intersection, Union and other operations in a fuzzy set; Fuzzy Relation: Relation, Properties of relation, Definition of fuzzy relation and extension of fuzzy sets; Fuzzy Numbers: Definition of fuzzy numbers, Characterization theorems for fuzzy numbers, L-R fuzzy numbers, Fuzzy Algebraic Operations: Zadeh's extension principle, The sum and scalar multiplication, multiplying two fuzzy numbers, Difference of fuzzy numbers; Fuzzy Inference: Linguistic variables, The interpolation feature of fuzzy inference systems.

- MAT554 Integral Transforms and Their Application 3+0 7.5**  
 Basic Concepts and Definitions; Fourier Transforms: Definition basic properties of the transform, Applications of transform, Fourier cosine and sine transforms with examples, Multiple Fourier transform; Laplace Transforms: Definition basic properties of the transform, Applications of the transform, Finite Laplace transforms; Hankel Transforms; Definition basic properties of transform, Applications of transforms; Melin Transforms: Definition of the transform and examples, Basic properties of transform, Applications of transforms; Hilbert and Stieltjes Transforms, Definition basic properties of transforms, Their applications.
- MAT555 Introduction to Chaotic Dynamical Systems 3+0 7.5**  
 The Definition and Examples of Dynamical System; Iteration of Functions: Types of orbits; Fixed points, Periodic points, Contraction mapping and the contraction mapping theorem; Period-3 Theorem; Sharkovsky Theorem; Attracting and Repulsive Periodic Points; The Tent Map; The Doubling Map; The Logistic Map; Families of Functions; Bifurcations; Cantor Set; Symbolic Dynamics: The sequence space, The shift map; Chaos: Sensitive dependence on initial conditions, Transitivity, Topological conjugacy; Two Dimensional Chaos: The Henon map, The horseshoe map.
- MAT556 Linear Programming 3+0 7.5**  
 Standard Form of Linear Programming Problem; Karush-Kuhn-Tucker Optimality Conditions; Geometry of an Linear Programming Problem: Convex hull, Polytopes and its facets, Edges and vertices, Feasible descent directions, Finding a vertex; Vertex Minimizers: Finding a vertex minimizer, Uniqueness; Simplex Method: Basic and nonbasic variables, Simplex algorithm; Primal and Dual Solutions; Introduction to Interior Point Methods.
- MAT558 Vector Analysis 3+0 7.5**  
 Curves; Multi-Variable Functions: The derivative and Jacobian matrix; Multiple Integration; Surfaces: Parametric surfaces, Curves on surface and surface area, Orientation; Vector Fields: Integral curve, Gradient, Divergence, Rotational; Line Integrals of Scalar Valued Functions; Line Integrals of Vector Fields; Green's Theorem; Surface Integrals: Surface integral of scalar valued functions, Integral of vector fields on surfaces; Stokes' Theorem and Divergence Theorem; Differential Forms on  $R^n$  : Basic properties of the forms, Exterior derivative, Basic properties of the induced mappings; Integrals of Differential Forms: Stokes' Theorem.
- MAT592 Seminar 3+0 7.5**
- MAT601 Stability of Linear Systems 3+0 7.5**  
 Linear Systems; Stability of Matrices and Polynomials; Uncertain Systems; Robust Stability; The Value Set Approach; Zero Exclusion Principle; Kharitonov's Theory; Stability Bounds; Stability of Polytopes of Polynomials; Polytopes of Polynomials; Stability of Convex Combinations; Edge Theorems; Convex Directions: Definitions; Rantzer's Growth Condition; Schur Stability; Schur Stability of Interval Polynomials and Matrices; Weak and Strong Kharitonov Regions; Multi linear Structures and Mapping Theorem; Spherical Polynomial Families.
- MAT602 Stability of Nonlinear Dynamical Systems 3+0 7.5**  
 Nonlinear Differential Equations; Definitions; Existence and Uniqueness; Geometric Interpretation; Stability: Critical Points and Attractors; Stability and Asymptotic Stability; Linearization and Lyapunov Theory; Stability of Periodic Solutions; Stability of Two-Dimensional Autonomous Systems; Applications; Stability Analysis by the Direct Methods; Lyapunov Functions; Rantzer's Theorem; Bifurcation and Chaos; Hopf Bifurcation; Lorentz Equation; Chaos and Chaotic Maps.
- MAT603 Convex Analysis 3+0 7.5**  
 Lower and Upper Semi Continuous Functions; Ekeland's Variational Principle; Convex Sets and Functions; Continuity of Convex Functions; Yosida-Moreau's Approximation; Separation Theorems; Conjugate of the Convex Functions; Properties; Young-Fenchel's Inequality; Dual Problem; Fenchel's Theorem. Directional Derivability of Convex Functions; The Sub differential Concept; Subdifferentiability of Convex Functions; Sub differential Calculus; Tangent and Normal Cones of Convex Sets; Minimization of Convex Functions; Properties of Convex Set-Valued Maps.
- MAT604 Topological Vector Spaces 3+0 7.5**  
 Topological Vector Spaces; Convex; Balanced; Absorbing Sets; Neighborhoods of the Zero Vector; Subspaces; Quotient Spaces; Continuous Linear Mappings; Finite Dimensional Topological Vector Spaces; Normability of a Topological Vector Spaces; Locally Convex Topological Vector Spaces; Semi Norms; Locally Convex Topological Vector Spaces Generated by Semi Norms; Barrel Spaces; Convex; Compact Spaces.
- MAT605 Differential Inclusions Theory 3+0 7.5**  
 Set-Valued Maps; Differential Inclusion Concept; Existence of Cauchy Problem Solutions of Differential Inclusion With Convex Valued Right Hand Side Set-Valued Map; Closedness and Initial Condition Dependence of Solutions Set; Local Properties of Solutions; Reachable Sets and Integral Funnel of Differential Inclusions; Filippov's Theorem. Existence of

Cauchy Problem Solutions of Differential Inclusion With Nonconvex Valued Right Hand Side Set-Valued Map, Relaxation Theorem; R-Solution Concept; Approximate Computation of Reachable Sets; Weakly and Strongly Invariant Sets With Respect to Differential Inclusions.

**MAT606                      Riemannian Geometry                      3+0    7.5**

Differentiable manifolds: Differentiable manifold, Differentiable functions, Tangent space, Immersions and Imbeddings, Vector fields, Brackets, Tensors, Orientation; Riemannian Manifolds: Riemannian metric, Riemannian manifold, Affine connection, Riemannian connection, Geodesics, Convex neighborhoods; Curvature: Curvature, Sectional curvature, Ricci curvature, Scalar curvature, Tensors on Riemannian manifolds, Jacobi fields, Hopf-Rinow Theorem; Spaces of constant curvature.

**MAT607                      Topological Groups                      3+0    7.5**

Topological Groups; Neighborhoods Systems of a Point in a Topological Groups; Isomorphism and Local Isomorphism; Subgroups; Quotient Groups; Products of Topological Groups; Continuous Homeomorphisms; Direct Product of Topological Groups; Connected and Disconnected Groups; Uniform Structures on Topological Groups; Complete Groups; Completions of a Topological Group; Compactness in Topological Groups; Locally Compact Groups; Topological Transformations Groups.

**MAT608                      Analysis on Fractals                      3+0    7.5**

Geometry of Self-Similar Sets; Constructions of Self-Similar Sets; Shift Space and Self-Similar Sets; Self-Similar Structure; Self-Similar Measure; Dimension of Self-Similar Sets; Laplacians on Fractal Sets; Dirichlet Forms and Laplacians on a Finite Sets; Sequence of Discrete Laplacians; Constructions of Laplacians on P.C.F. Self-Similar Structures; Harmonic Structures; Harmonic Functions; Dirichlet Forms on P.C.F. Self-Similar Sets; Green's Function; Green's Operator.

**MAT609                      Knot Theory                      3+0    7.5**

Basic Definitions and Notations; Knot in the Plane; Jordan Curve Theorem and Chord Theorem; Torus Knots; Solid Torus; Connected Sums and the Knot Group; Seifert Surfaces; Cyclic Coverings and Torsion Invariants; Knots and Surgery in  $S^3$ ; Infinite Cyclic Coverings and the Alexander Invariants; Automorphisms of Sets and Quandle, Invariants Obtained From Quandle; Conway and Jones Polynomials; Knots With 2-Bridges and Insufficiency of Jones Polynomials; Mutants; Generalized Polynomials; Coefficients of Conway Polynomials and Its Relation With Alexander Polynomial.

**MAT610                      Basic Topics of the Set Valued Analysis                      3+0    7.5**

Set-Valued Map Concept; Upper and Lower Semi continuity of Set-Valued Maps; Selectors of Set-Valued Maps; Michael's Theorem; Steiner Point; Lipschitz Selectors; Marginal Functions and Properties; Parameterization of Set-Valued Maps; Carathéodory Parameterization; Contingent Cones; Derivative Sets of Set-Valued Maps; Fixed and Equilibrium Points of Set-Valued Maps; Kakutani Theorem; Integral of Set-Valued Maps; Bang-Bang Principle.

**MAT611                      Introduction to Gauge Theory                      3+0    3.0**

Principal Bundles; Transition Functions; Bundle Maps and Equivalence; Principal G-Bundles Over Spheres; Hopf Bundle; Vector Valued 1-Forms; Connections Over Vector Bundle; Connections Over Principal Bundles and Equivalence; Curvature and Gauge Fields; The Yang-Mills Functional; Hodge Dual For 2-Forms In Dimension Four; The Modular Space; Matter Fields; Associated Fiber Bundles; Matter Fields and their Covariant Derivatives; Seiberg-Witten Equations.

**MAT612                      Fractals and Chaos                      3+0    7.5**

Iterated Function Systems; Fractal Dimension; Hausdorff Dimension; The Notion of Chaos; Chaos on Fractals; Symbolic Dynamics; Logistic Chaos And Bifurcation; Henon - Lorenz Examples; Lyapunov Exponents.

**MAT613                      Clifford Algebras                      3+0    7.5**

Symmetric Bi-Linear Forms; Quadratic Forms; Tensor Product of Vector Spaces; Tensor Algebra; Tensor Product of Algebras; Definitions of The Clifford Algebra And Its Universal Property; Other Properties of Clifford Algebras; The Involution And The Anti-Involution of Clifford Algebra; Odd And Even Parts of Clifford Algebra; Non-Degenerate Real Clifford Algebras And Their Classifications; Degenerate Real Clifford Algebras; Representations of Real Clifford Algebras; Complex Clifford Algebras And Their Representations; Pin And Spin Groups; Spinors; Triality.

**MAT614                      Continuous Modules                      3+0    7.5**

Injectivity and Related Concepts: A-injective Modules; Quasi-injective Modules, Exchange and Cancellation Properties, Decomposition Theorems, Quasi-Continuous Modules: Basic Properties, Direct Sums of Quasi-Continuous Modules, Decompositions of Quasi-Continuous Modules; Internal Cancellation Property, Quasi-Continuity Versus Quasi-injectivity; Continuous Modules: Endomorphism Modules; Endomorphism Rings, Continuous Modules, The Exchange Property.

**MAT615                      Compact Operators                      3+0    7.5**

Compact Operators and their General Properties; The Theory of Riesz-Schauder for Compact Operators; Spectral Properties of Compact Operators; Compact Self-Adjoin Operators; Fredholm Andvolterna Integral Equations; Differential Equations; Eigen Value Problems and Green?s Functions.

**MAT616 Fiber Bundles 3+0 7.5**  
Manifolds; Local Triviality; Vector Bundles; Transition Maps; Operations On Vector Bundles; Sub Bundles; Sections of Vector Bundles; Maps Between Vector Bundles; Metric Structures on Vector Bundles; Frame Bundles; Normal Bundles; Covariant Derivative; Curvature Tensor; Lie Groups; Principal Fiber Bundles; Structure Groups; Grassman Bundles; Universal Bundle; Associated Vector Bundles; Vector Valued Forms; Connection; Connection Forms on a Principal Bundle; Curvature Form; Spinor Bundles.

**MAT619 Vector Optimization I 3+0 7.5**  
Convex Analysis: Linear spaces, partially order linear spaces, topological linear spaces and convex sets, Convex maps and differentiability, Some fundamental theorems: Zorn?s Lemma, Hahn Banach theorem, separation theorems, Contingent cones and Lyusternik theorem; Theory of Vector Optimization: Optimality notions, Scalarization, Existence theorems, Generalized Lagrange multiplier rule.

**MAT620 Vector Optimization II 3+0 7.5**  
Duality: A general duality principle, Duality theorems for abstract optimization problems, Specialization to abstract linear optimization problems; Vector Approximation: Simultaneous approximation, Generalized Kolmogorov condition, Nonlinear Chebyshev vector approximation, Linear Chebyshev vector approximation, Duality results; Cotingent Epiderivatives: Cotingent derivatives and cotingent epiderivatives, Properties of cotingent epiderivatives, Cotingent epiderivatives of real valued functions, Generalized cotingent epiderivatives; Subdifferentials: Concept of subdifferentials, Properties of subdifferentials, Weak subdifferentials; Optimality Conditions: Optimality conditions with cotingent epiderivatives, Optimality conditions with subgradients, Generalized Lagrange multiplier rule.

**MAT621 Metric Geometry 3+0 7.5**  
Metric Spaces, Length Spaces, Spaces of Bounded Curvature, Smooth Length Structures, Curvature of Riemannian Metrics, Spaces of Metric Spaces.

**MAT622 Characteristic Classes 3+0 7.5**  
Vector Bundles; Stiefel-Whitney Classes; Stiefel-Whitney Numbers; Grassman Manifolds and Universal Bundles; Cohomology Ring of Grassman Manifolds; Construction of Stiefel-Whitney Classes; Oriented Bundles and the Guler Class; Thom Isomorphism Theorem; Complex Vector Buudles; Chern Classes; Pontrjagin Classes; Chern Numbers; Pontrjagin Numbers.

**MAT623 Bochner Technique on Riemannian Manifolds 3+0 7.5**  
Gradient of a Function; Divergence of a Vector Field and of a (1,s)- Tensor Field; Hessian and Laplacian Operators; Killing Vector Fields; Conformal Killing Vector Fields; Harmonic Vector Fields; Bochner Formula for Any Vector Field; Weitzenböck Formula for Amy Function and its Applications to Eigenfunctions of Laplace Operator.

**MAT624 Stability of Switched Linear Systems 3+0 7.5**  
Switched Dynamical Systems: Switching signals, Switching sequences, Solutions of switched linear systems; Stability, Asymptotic stability, Exponential stability, Lyapunov theorems; Common Lyapunov Functions: Common quadratic lyapunov functions, Switched quadratic lyapunov functions, Piecewise quadratic lyapunov functions, Multiple lyapunov functions; Stabilization of Switched Systems: Quadratic stabilization of switched systems, Piecewise quadratic stabilization of switched systems.

**MAT625 Generalized Functions 3+0 7.5**  
Test and Generalized Functions : Introduction; Space of test functions; Space of generalized functions; Support of generalized functions; Regular and singular generalized functions; Sohotskii formula; Change of variables; Product of generalized functions; Derivative of Generalized Functions: Properties of generalized derivatives; The antiderivative of generalized functions; Convolution of Generalized Functions : Direct product of generalized functions; Definition of convolution; Regularization of generalized functions; Newton potential and examples of convolution; Slows Growing Generalized Functions: Space of functions S; Space S? Examples of slowly growing generalized functions; Fourier Transform : Fourier transform of functions from S; Fourier transform of functions from S? Properties of the Fourier transform of generalized functions; Examples; Fundamental Solutions : Fundamental solutions of linear differential operators; Notion of fundamental solution; Fundamental solutions of heat operator; Wave operator; Laplace operator and Helmholtz operator; Wave potential; Propagation of waves; Cauchy problem for the heat equation.

**MAT626 Boundary Value Problems 3+0 7.5**

Boundary Value Problems for Elliptic Equations: Eigenvalue problems; Sturm-Liouville problem; Harmonic functions and their properties; Fourier's method for eigenvalue problems; Newtonian potential; Boundary value problems for Laplace and Poisson equations in space; Green's function for Dirichlet problem; Boundary value problem for Laplace equation in the plane; Mixed problems: Fourier's method; Mixed problems for hyperbolic equations; Mixed problems for hyperbolic equations; Mixed problems for parabolic equations.

**MAT627 Antagonistic Differential Games 3+0 7.5**

Minimax Control Problems; Positional Strategy; Motion of the system; Quality criterion; Two person differential game; Game problem of Approach and Evasion; Local Estimation; Extremal positional strategy; Existence of the alternative; Existence of the value of the positional differential games; Bellman-Isaacs equation; Viscosity solution of the Hamilton-Jacobi equation and value function of the differential game; Unification of differential.

**MAT628 Rings and Radicals 3+0 7.5**

General Theory of Radicals; Rings with Descending Chain Condition: Nil and nilpotent; Descending chain condition; Ideals in nil semi-simple rings with D.C.C.; Central idempotent elements; First structure theorem; Second structure theorem; Simple rings; Radical properties; Rings with the Ascending Chain Condition: Relationship between A.C.C. and D.C.C.; Nil and nilpotent; Baer lower radical; Prime rings; Zorn's lemma; Prime ideals; Subdirect sums; Semi-prime rings; Semi-prime rings with A.C.C.; The Jacobson Radical: Quasi-regularity; Semi-simple rings; Right primitive rings; Jacobson radical and general radical theory; Brown-McCoy Radical: G-regularity; G-semi-simple rings; Brown-McCoy radical and the general theory; Levitzki Radical: Local nilpotent; Eight radicals and results.

**MAT629 Complex Analysis 3+0 7.5**

Review of Cauchy Formula and Some Results; Entire Functions: Zeros of Entire Functions; Infinite Products; Weierstrass Formula; Order of an Entire Function; Analytic Continuation: Notion of Analytic Continuation; Analytic Continuation on a Chain of Domains; Analytic Continuation on a Curve Segment; Continuation of Functional Equations; Weierstrass Method; Riemann Method and Schwarz Reflection Principle; Singular Points; Functions Defined in Terms of a Cauchy Kernel: Hölder Condition.

**MAT630 Hardy-Hilbert Space and its Operators 3+0 7.5**

Hardy-Hilbert space; Shift operator, invariant subspaces, Beurling's theorem, Inner and outer functions, Blaschke products, Singular inner functions, Structure of outer functions; Toeplitz operators, Basic properties of Toeplitz operators, Spectral structure of Toeplitz operators; Hankel operators, Bounded Hankel operators, Compact Hankel operators, Relation between Hankel and Toeplitz operators; Composition operators, Littlewood subordination theorem, Eigenvalues and eigenvectors of composition operators, Compact composition operators .

**MAT631 Mathematics for Operations Research 3+0 7.5**

Introduction to Convex Analysis; Vector Spaces; Basis, Matrices; Linear Transformations; Systems of Linear Equation; Eigenvalue and Eigenvectors; Positive Certainty; Convex Sets and Their Topological Characteristics; Hyper Planes; Polyhedron Sets; Cones; Separating and Supportive Hyperplanes; Extreme Points and Directions; Convex Functions; Continuity and Differentiability of Convex Functions.

**MAT632 Complex Geometry 3+0 7.5**

Complex Structures and Holomorphic Maps; Almost Complex Manifolds: Integrability, Nijenhuis tensor field; Complex Manifolds: Complex vector fields, Differential forms; Connection in Almost Complex Manifolds; Hermitian Manifolds; Hermitian metrics, Kaehler Manifolds; Kaehler metrics, Kaehler form, Curvature tensor, Ricci tensor, Ricci form, Kaehler Metrics in Local Coordinate Systems; Examples of Kaehler Manifolds.

**MAT633 Measure Theory and Integral 3+0 7.5**

Measurable Space and Measure Space; Borel Measurable Sets; Regular and Radon Measure; The Jordan and Hahn Decompositions of Measure; The Saks, Alexandrov and Carathéodory Theorems; Measurable Functions; Egorov and Luzin Theorems; Integral of Simple Functions and Integral of Measurable Non-Negative Valued Functions; Bochner Integral; The Lebesgue and Radon-Nikodym Theorems; The Banach space  $L^1$ ; Riesz representation of continuous functionals defined on the space of continuous functions; Topological conjugate of the space of continuous functions.

**MAT634 Compactness Theorems on Riemannian Manifolds 3+0 7.5**

Metric Structure on Riemannian Manifolds; Riemannian Metric Tensor; Length of a Curve; Distance between Two Points; Geodesics; Completeness of a Riemannian Manifold with Respect to a Metric; Definition of the Segment Between Two Points; Calculus of Variations and Compactness Theorems on Riemannian Manifolds; Laplace Comparison Theorems and Compactness Theorems on Riemannian Manifolds.

**MAT635 Graph Theory 3+0 7.5**

Graphs: Basic definitions, Trees, Counting trees and Cayley's Theorem; Planarity: Planar graphs, Euler Formula, Kuratowski Theorem, Graphs and planarity; Colouring Graphs: Colour-ing vertices, Brooks Theorem, Chromatic polynomials, The four-colour theorem, Colouring edges; Digraphs: Orientations, Directed Euler trails; Ramsey Theory: The graphical case of Ramsey's Theorem, Bounds on Classical Ramsey numbers, The general case of Ramsey's Theorem; Flows in Networks: Transportation networks and flows, Maximal flows, The max flow min cut theorem and algorithm, Supply and demand problems; Some Graph Algorithms: Data structures, Some graph algorithms.

**MAT636 Asymptotic Solutions of Differential Equations 3+0 7.5**

Matched Asymptotic Expansions: Outer solution, Boundary layer, Matching, Composite solution, Transcendentally small terms, Interior layers, Corner layers; Multiple Scales Expansions: Regular Expansion, Multiple-scale expansion, Forced motion near resonance, Weakly coupled oscillators, Slowly varying coefficients, Boundary layers; WKB and Related Methods: Turning points, Wave propagation and energy methods, Wave propagation and slender-body approximations, Ray methods.

**MAT637 Fuchsian Groups 3+0 7.5**

Hyperbolic Geometry: Hyperbolic metric, Geodesics, Isometries, Hyperbolic area and The Gauss-Bonnet Formula; Fuchsian Groups: The  $PSL(2, \mathbb{R})$  group, Discrete groups, Algebraic properties of Fuchsian groups; Fundamental Regions: The Dirichlet region, Isometric circles and Ford fundamental region; Geometry of Fuchsian Groups: Geometrically finite Fuchsian groups, Co-compact Fuchsian groups.

**MAT639 Differential Topology 3+0 7.5**

Topological Manifolds, Differentiable Manifolds, Manifolds with boundary, Vector bundles, Fibre bundles, Sard's Theorem, Imbedding theorems, Homotopy and Stability, Dynamical systems, Isotopies, Transversality, Tubular Neighborhoods, Degree of a map, Euler Character-istic, Intersection number, Winding number, Lefschetz fixed point theorem, Poincare-hopf Theorem, Morse functions, Regular levels, Connected sum of manifolds, Classification of surfaces.

**MAT641 Asymptotic Approximation of Integrals 3+0 7.5**

Properties of Mellin Transforms: Works of Handelsman and Lew, Explicit error terms, A double integral; Distributional Approach: The Stieltjes transform, An oscillatory case, Hilbert transform, Laplace and Fourier transforms near the origin, Fractional integrals, Method of regularization; Uniform Asymptotic Expansions: Saddle point near a pole, Saddle point near an endpoint, Coalescing saddle point, Laguerre polynomials, Legendre function.

**MAT643 Introduction to the Theory of Elastic Waves 3+0 7.5**

Fundamental Waves of Elastodynamics and Their Representations: Fundamental body waves, Time harmonic body waves, Solution of boundary-initial value problems, Cauchy problems; Reflection and Refraction of Time Harmonic Waves at an Interface: Reflection of P and SV waves, Reflection of SH waves; Time Harmonic Waves in Elastic Waveguides: Waves in infinite plate in plane strain, Mixed conditions on plate faces, Love waves; Transient Waves in an Elastic Half Space: Plane strain problems, Lamb's problem, Axially symmetric problems.

**MAT645 Fractional Differential Equations I 3+0 7.5**

Special Functions of the Fractional Calculus: Definition of Gamma, Beta, Mittag-Leffler and Wright functions and some properties; Fractional Derivatives Operator: Grünwald-Letnikov, Riemann-Liouville, Caputo and Riesz fractional derivative operators and some properties; Solutions of Fractional Differential Equations: Laplace, Fourier and Mellin transform methods for the solutions of fractional differential equations.

**MAT646 Fractional Differential Equations II 3+0 7.5**

Existence and Uniqueness Theorems of the Linear Fractional Differential Equations: Linear fractional differential equations, Existence and uniqueness theorem; Fractional Green Functions: Definition and some properties; Power Series Method For the Fractional Differential Equations: One-term equation, Equation with non-constant coefficients, Two-term non-linear equation; Numerical Solutions of the Fractional Differential Equations: Initial conditions, Examples of numerical solutions; Fractional Differential Equations Systems and Solutions: Fractional-order systems, Examples.

**MAT647 Algorithmic Graph Theory 3+0 7.5**

**MAT649 Near-Rings 3+0 7.5**

The Elementary Theory of Near-Rings: Fundamental definitions and properties, Constructions, Embeddings; Ideal Theory: Sums, Chain conditions, Decomposition Theorems, Prime ideals, Nil and nilpotent; Structure Theory: Types of n-groups, Change of the near-ring, Quasiregularity; Primitive Near-Rings: 0-primitive near-rings, 1-primitive near-rings, 2-primitive near-rings; Radical Theory: Jacobson-type radicals; Distributively Generated Near-Rings.

<b>MAT651</b>	<b>Chotic Dynamical systems in Higher Dimensions</b>	<b>3+0 7.5</b>
<b>MAT653</b>	<b>Z-Numbers Theory</b>	<b>3+0 7.5</b>
<p>Z-Numbers: Definitions and Main Properties of Z-Numbers; Operations on Continuous Z-Numbers: Addition, Subtraction, Multiplication and Division on Continuous Z-Numbers, Operations on Discrete Z-Numbers: Addition, Subtraction, Multiplication and Division on Discrete Z-Numbers; Z-Number Based Operation Research Problems: Z-Number Valued Linear Programming, Z-Restriction Based Multicriteria Choice, Decision Making Under Z-Information, Computing with Words and Z-Numbers, Application of Z-Numbers: Business Behavioral Decision Under Z-Information, Marketing Decision Making Process Under Z-Information, Optimal Planning of Company Production by Z-Linear Programming, Z-Number Modeling in Psychological Research.</p>		
<b>MAT692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>MAT790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>MAT890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>MAT890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>MEK501</b>	<b>Advanced Soil Mechanics</b>	<b>3+0 7.5</b>
<p>Soil Structure; Hydraulic Conductivity: Permeability and seepage; Stresses in Soil Mass: Two-dimensional problems and three-dimensional problems; Consolidation Theory: Settlement analysis; Theory of Shear Strength; Bearing Capacity of Shallow Foundations; Stability of Slopes; Theory of Lateral Earth Pressure; Soil Improvement: Grouting, Jet grouting.</p>		
<b>MİM501</b>	<b>Analysis in Architecture</b>	<b>3+0 7.5</b>
<p>The Concept of Place and Space in Architectural Design; The Special Form of House; Perception; Definition of the Visual and Special Elements; In Connection With Cultural and Environmental Characteristics; Meaningful in the Architecture; Agenda of the Concept Studies; Scientific Researches and Reflection to Architectural Design; The Scaling Problem in Architecture; Components of Space and Place; Conceptual, Graphical, Typological and Algorithmic Techniques.</p>		
<b>MİM502</b>	<b>Criticism in Architecture</b>	<b>3+0 7.5</b>
<p>Criticism in Architectural Design; Descriptions and Methods; Relationships of the Criticism/ Evaluation; Architectural Design; Criticism and Structure of the Criticism; The Criteria Developing in Architectural Design; Selection and Hierarchy of Criteria; Formation of Conceptual and Instructive Criteria and Criticism in Architectural Education.</p>		
<b>MİM503</b>	<b>Housing Problems and Policies</b>	<b>3+0 7.5</b>
<p>Historical Development of Housing Problem; Housing Problem of Developed Countries; Housing Problem of Developing Countries; Housing Problem of Turkey; Housing Demand and Factors Affecting the Demand; Housing Policies of Developed and Developing Countries; Basic Principles of Housing Policy in Turkey and Results of Implementation of Them.</p>		
<b>MİM504</b>	<b>Qualitative Values of Housing Areas</b>	<b>3+0 7.5</b>
<p>Concept of Quality in Housing Areas; Basic Determinants of Forming a Dynamic Environment in Mass Housing Areas by Considering Social Aspects; Comfort Conditions Depending on Variables of Physical Environment; Physical; Aesthetics; Visual and Social Parameters Which Form Quality Concept; Analysis of Housing Environment in Terms of Social and Technical Infrastructure; User Demands; Problems Related to Quality of Housing Environment.</p>		
<b>MİM505</b>	<b>Ecological Planning and Design</b>	<b>3+0 7.5</b>
<p>Fundamental Ecologic Principles and Terms; Hybrid and Active Energy Design; Production and Protection of the Energy Planning of the Electric Production; Manipulation and Protection for the Sun; Heat and Wind; Protection for the Water Resources; Ecological Infrastructure of Some Countries; Pollution and Environmental Health; Protection of Fauna and Flora; The Difference Between Natural and Artificial Planning; Plants for Determining Environmental Quality; The Methods for Plants Protection.</p>		





Structural Steel in Architecture; Steel Production and Steel Products; Development in Steel Structures; High-Rise Steel Structures; Design and Application Criteria for Steel Structures; Basic Planning Problems; Columns; Wind Bracings; Flooring Structures and Applications; Constructional Elements; External Walls; Roofs; Fire Prevention; Corrosion and Prevention.

**MiM521 Environmental Design 3+0 7.5**

Environmental Design; Perceiving and Environmental Perception; Theories and Researches; Environmental Cognition and Perception; Theories; Researches; Design and Cognitive Studies; Environmental Behavior; Behavioral Settings; Patterns of Act; Fit and Fitness; Researches; Behavior and Design; Space; Personal Space; Proximity Theory; Researches; Space and Design; Proximity; Intimate; Theories; Territoriality; Defensible Space; Intimate and Design; Environmental Stress; Theoretical Approach; Ecological Fitness.

**MiM523 Contemporary Interpretation of Traditional Turkish Houses 3+0 7.5**

Primitive Living Spaces, Sheltering Conception of Turkish Society, Differences Between Nomad Period and Settled Period, Rural and Urban Houses, Turkish House Space Configuration, Turkish House and Regional Diversity, Plan, Function, Elevation Formations, Material, and Decorate about Turkish House; Analysing a Turkish House in Contemporary Life.

**MiM525 Culture, House and Identity 3+0 7.5**

Sheltering; Housing and Mass Housing Concept; Shaping Development from Utopia to Present; The Relationship between Culture; Identity Concept and Housing Space; Approaches for Environmental Behavior on House Based Studies; Cultural Factors Affecting the Process of Shaping Housing Environment in Different Levels; Culture; House and Identity Components in the Settlements in different Cultures.

**MiM526 Computer Aided Architectural Analyses Techniques 3+0 7.5**

Information Systems; Spatial Information Techniques; Computer Aided Design Applications; 3D Modeling; Computer Aided Architectural Analyses Techniques; Preparation Base Maps with High Resolution Satellite Images; Visualization Techniques; Topographical Analyses; Overlay; Interpretation Techniques.

**MiM528 Using of Space around House and House Environment 3+0 7.5**

The Relationship between Environment, House and Mass Housing; Shaping Housing Area; Design of Housing Indoor and Outdoor Space: Micro climatic components, Physiological Environment components, Indoor and Outdoor Landscape, Livable Housing Environment, User needs; Quality in Housing Environment, Usability of Housing Environment; Post Occupancy Evaluation; Studying and Evaluation of the Alternative Housing Layout according to Environment; House and User.

**MiM529 Urban Space and Handicapped People 3+0 7.5**

Planning Approaches for Healthy Cities; Features of the City; Urban Rights and Dependency; Handicapped People in the City; Urban Environment and Handicapped People; Accessibility in Urban Space; Urban Design for Everyone; Applications, Problems and Solutions; Handicapped Persons and Laws.

**MiM530 National and International Aspects of Urban Conservation and Renewal 3+0 7.5**

The Reasons for Conservation of Historical Environment and Renewal; Historical Development of Conservation and Renewal Awareness in National and International Levels; Context and Concept of Conservation of Historical Environment and Renewal in National and International Level; Actions and Fundamentals of Conservation of Historical Environment and Renewal; Legislative Aspects of Conservation of Historical Environment and Renewal; The Tasks and Authorizations of the Conservation and Renewal Agencies.

**MiM531 Architectural Design Methods 3+0 7.5**

Architectural Design and Process: Creativity, Analysis, Concept, Definition of the problem; Logic of Design and Methods: The role of perception, The originality of design and expression; The Approaches in Architectural Design; Participatory and Sustainability Design: The problem of place in architectural design, Contemporary Concepts and Evaluation of Environmental Problems: Cultural and historical design.

**MiM532 Urban Regeneration 3+0 7.5**

National and International Scope of Urban Regeneration; Urban Development Processes and Regeneration Practices; Historical Formation and Structure of Urban Space; Social and Demographic Development Processes in Urban Spaces; Economic Development Processes; Physical Development Processes in Urban Spaces; Formation of the Urban Culture and Its Effect on Urban Space

**MiM533 Methodologies in Architectural Design Research 3+0 7.5**



- MiM547 Architecture Communication 3+0 7.5**  
 Architectural and Interior Design in Organization of Enterprises; Thinking on Architecture, Communication and Organizations and Conceptual Frameworks; Power of Spatial Relationships; Decision Making by Administrators and Architects in Consideration of Strategic Spatial Planning and Business Needs; Field Studies and Examples; Message Given by Successful Spatial Design to Clients and Business Partners; Impact of Communication and Spatial Design on Business Efficiency and Effectiveness.
- MiM549 Accessibility 3+0 7.5**  
 Built-up Environment and Users, Mobility and Accessibility: Accessibility of travelling, Pedestrian spaces, Transportation space and vehicles, Accessibility as a Right: International legislation, National legislation, Accessibility of the Built-up Environment: Architectural space, Urban space, Urban landscape, Design and accessibility for everyone, National and international norms and standards, Accessibility practices and problems, Accessibility and legal conditions.
- MiM553 Auditorium Acoustics 3+0 7.5**  
 Basic Information of Room Acoustics; Sound Level in Enclosed Spaces; Direct and Reverberant Sound Levels; Early Reflections and Their Effects; Parameters of Room Acoustics; Requirements Related to Parameters; Measurements Related to Parameters; Acoustical Design of Rooms; Determining Dimensions of the Room; Acoustic Defaults and Precautions in Rooms; Designing Interior Surfaces of Rooms and Selection of Materials; Practices of Architectural Acoustics in Sample Projects.
- MiM554 Digital Design and Production in Architecture 3+0 7.5**  
 Digital Design Concept: The history and use of computers in architecture, Virtual-Real Real-Virtual Digital Fabrication: The history of digital manufacturing, Additive, Subtractive, Forming; Prototypes: Alpha and beta, Prototypes in architecture; Material: Geometry and dimension of materials, The relation of materials and fabrication; Digital Tectonics in Architecture: Sectioning, Tessellation, Folding, Contouring, Forming, Assembly; Digital Design in Architecture: Parametric, Performative, Interactive; Digital Design and Form: Blob, Metamorphosis, Genetic; Strategies and Tools: Software, Fabrication, Algorithmic design and coding; Rhinoceros and Grasshopper.
- MiM555 Immaterial Architecture and its Elements 3+0 7.5**  
 Basic Arguments and Discussions about the Concept of Material; Evolution of the Concepts of Material and Idea Throughout the History; Explanation of Arguments Related to Material and Memory from the Perspective of Bergson's Philosophy of; Arguments and Explanations Related to the Concepts of Material and Immateriality; Concept of Immateriality in Architecture; Immaterial Elements in Architecture; Immaterial Elements in Architecture and Contemporary Information Technology.
- MiM557 Design Principles of Room Acoustics 3+0 7.5**  
 Sound Field Differences Between Open and Enclosed Spaces; Sound Level in Enclosed Spaces; Frequency Response; Subjective and Objective Room Acoustics Parameters; Sound Reflective, Diffuser and Absorptive Surfaces; Combined Space; Presence Effect and Practices on Presence Effect; Acoustic Design Principles of Rooms for Speech; Acoustic Design Principles of Rooms for Music; Acoustic Design Principles of Multi-Purposed Rooms; Use of Computer Modeling in Room Acoustics.
- MiM558 Introduction to Artificial Intelligence Applications in Architecture 4+0 7.5**  
 Relationship Between Computers and Computer Programs; Basic Principles of Computers; Artificial Intelligence Concept and Application Areas; Artificial Intelligence and Architecture Relationship; Machine Learning Concept; Data Sets: A File Containing One or More Records; Machine Learning for Architectural Practices; Fuzzy Logic Concept and Architectural Applications; The Concept of Generative Adversarial Neural Networks and Architectural Applications.
- MiM559 Noise Control I 3+0 7.5**  
 Basic Principles of Sound; Noise and Noise Sources; Effects of Noise on Human and Community; Noise Control and Basic Principles; Regulations and Standards on Noise Control; Physical Events Related to Sound; Airborne Sound and Structure Borne Sound; Propagation of Sound; Environmental Factors on Propagation of Noise; Sound Reflection and Absorption; Importance of Sound Absorptive Materials on Noise Control; Basic Principles of Sound Transmission; Practices on Sound Transmission Loss Calculations; Sound Level and Sound Insulation Measurements.
- MiM560 Noise Control II 3+0 7.5**  
 Sound Transmission and Noise Control; Sound Reduction on Single, Double or Multiple Layered Building Components, Calculations and Applications; Airborne and Structure-Borne Noise Insulation for Building Components; Basics of Vibration Sources in Buildings and Related Precautions; Outdoor Sound Propagation; Noise Barriers and Calculation Techniques; Computer Simulations and Applications Related to Urban and Building Acoustics.
- MiM561 Architectural Design Studio I 2+2 7.5**

Architectural Design Education: Architectural design processes, Architectural design methods; Current Aspects of Architectural Design: Studies on global architecture, Research on regional subjects, Data collection, Analysis, Developing projects/solutions; Responsibility in Architectural Design; Key Points in Architectural Design: Function, Firmness and Aesthetics; Use of Technology in Architectural Design Process.

**MiM562 Architectural Design Studio II 2+2 7.5**

Theory and Applications in Architectural Design; Architectural Examples from the Local to the Global; Approaches to Architectural Design: Scientific research, Design methods; Interpretation in Architectural Design; Methods of Using Architectural Technologies; Current Architectural Issues Related to Economic and Environmental Responsibilities in Design.

**MiM565 21st Century Approaches in Architectural Design 3+0 7.5**

**MiM567 Architectural Design Process Approaches 3+0 7.5**

Architecture Profession and the Concept of Architectural Design; Interaction of Architecture Profession and Architectural Design Process; Stages of Architectural Design Process; The Current Tools of Architectural Design Process; The Revolutionary Approaches in Architectural Design Process; Current Approaches in Architectural Design Process; Design Process Models that efficient in Architectural Design Process; Architectural Design Process Analysis Through Sample Projects; Designing the Architecture Design Process.

**MiM569 Environment Factor on Architectural Design 3+0 7.5**

Basic Concepts: Environment, Physical environment, Natural environment, Built environment; Physical Environment Components: Soil, Air, Water; Biological Elements: Human, Animal, Plant, Microorganisms; Physical Elements Affecting Architectural Design: Topography, Climate, Vegetation, Water, Existing built environment; Physical Environmental Factors: Heat, Air movements, Humidity, Light, Sound, Noise; Environmental Comfort: Thermal comfort, Acoustic comfort, Visual comfort; Providing Environmental Comfort in Architectural Design: Providing thermal comfort, Providing acoustic comfort, Providing visual comfort; Natural disasters and architectural design.

**MiM571 Advanced Human Factors in Aviation 3+0 7.5**

**MiM573 Design Process Approaches in Intersection of Architecture and Architecture Education 3+0 7.5**

**MiM592 Seminar 3+0 7.5**

**MiM599 Term Project 3+0 0.0**

**MiM601 Architectural Studio Research I 3+0 7.5**

In architecture, to bring together different areas in the basic idea of the systematic design; To ensure the cooperation interdisciplinary with exchange and communication with other disciplines; To do research on and develop upon to produce and to win the community the best qualified information that can be transferred to practice.

**MiM602 Architectural Studio Research II 3+0 7.5**

In the field of architecture to search configuration of to create of global warming, climatic changes, technology and scientific approaches; Depending on the research the future of an experimental project preparation, to work and development of innovative works in theoretical and practical architectural design fields by coming together in the interdisciplinary and the experimental environment.

**MiM603 Architectural Research Methods 3+0 7.5**

Domain of Architectural Research: Systems of Inquiry and Standards of Research Quality, Literature Review, Theory in Relation To Method, Design in Relation To Research; Seven Research Strategies: Interpretive-Historical Research, Qualitative Research, Correlational Research, Experimental and Quasi-Experimental Research, Simulation and Modelling Research, Logical Argumentation, Case Studies and Combined Strategies.

- MiM604 Architecture: Art, Science and Technology 3+0 7.5**  
 Architecture: Art, Science and Technology, Design; Interdisciplinarity, Design Process, Built-in Environment, Construction, Anesthesiology, Esthesiology, Live Art Performance, Benefits Of Society/User/Architect, Theory and Applications, Case Study.
- MiM605 Sustainable Architecture 3+0 7.5**  
 Principles of Sustainability, Strategic Design, Ecology, Recycled Building Materials, Eco Building Materials, Lowtech Housing, Hightech Housing, Passive and Active Sustainable Design.
- MiM606 Urban Space Design Quality 3+0 7.5**  
 The definition of urban space, the analysis of urban space form, the determination of user- urban space relationship, the user needs and requirements for urban space, the definition of quality, relationship between architecture an quality, urban space quality indicators, the analysis of well-done examples urban space.
- MiM607 The Tools and Quality Measurement Methods for Design 3+0 7.5**  
 Definition of design, architecture and design, architectural space, theories of perception, spatial perception and comprehension, spatial quality theory, space is associated with quality measurement methods, quantitative and qualitative measurement techniques in architectural design classification, use of quality indicators measurement method, weighting (multiple criteria method) method of valuation, integrated method, examples of quality measuring tools.
- MiM613 Civic Space and Buildings 3+0 7.5**  
 Study on the terminology of "Civic space" and "civic buildings"; Case studies on public and civic spaces such as agora, forum, square, place, piazza, public parks, hippodromes or stadiums, and public parks; significant examples of bureaucracy and cultural institutions such as the parliament, justice buildings, university, theatre, opera, concert hall, academies and art buildings; emphasizing on the twentieth century buildings and capitals.
- MiM614 Health Impact Assessment of Space 3+0 7.5**  
 The definition of health and well-being, Physical health, Mental health and well-being, Social health and well-being for open space; The typology of open spaces, according to their function and strategic importance; local and neighbourhood differences; parks: private gardens; natural and semi-natural greenspaces; green corridors; play space for children and teenagers; amenity greenspace; and, other functional greenspaces.
- MiM615 Spatial Relationships and Architecture 3+0 7.5**  
 Evaluation Physical Environment and Place: Interdisciplinary different approaches and different readings, Historical and cultural continuity concepts and contributions of historical process to spatial reading, Requirements of multi-aspect readings of spatial relationship; Spatial Relationships and Spatial Continuity: Different dimention of spatial relationships, Concepts of spatial continuity and interface on different scales, All interfaces from scale of the city to the interior spaces as a place; Importance of Spatial Continuity and Concept of Integrated Design: Use of visual meterials, Case studies with students.
- MiM616 Bounderies of the House and Modernity 3+0 7.5**  
 Home, House, Housing and Dwelling: Forces determining the house form: Physical Forces, Social Forces; House and its environment; Boundary and the House, Inside- Outside, Inside-inside relationships; Conditions of Modernity and the Change: House and its changing boundaries in first half of the 20th century, Analysis of the houses from Turkey and abroad.
- MiM617 Architecture and the Morphological Study 3+0 7.5**  
 The three existential world centers: SUB, OBJ, SEM, A model of fundamental triads, The fundamental triad of SUB, OBJ, SEM, Whitehead's view of the world as system of societies, The structural principle of the Gestalt method, Morphology: a cognitive approach to the general study of pattern, Goethe's morphology, The Kulturmorphologie movement, Cultural pattern stability, transmission, synchrony and diachrony
- MiM618 History and Criticism of Contemporary Architecture 3+0 7.5**  
 Modern Architecture I; Modern Architecture II; Modern City I; Modern City II; Postmodern Culture and Architecture I; Postmodern Culture and Architecture II; Trends in Contemporary Architecture I; Trends in Contemporary Architecture II; Trends in Contemporary Architecture III; Trends in Contemporary Architecture and Criticism IV; Effects of Contemporary Architecture on Turkish Architecture I; Effects of Contemporary Architecture on Turkish Architecture II.
- MiM619 Contemporary PProjects in Sustainable 3+0 7.5**  
 Analysis of Contemporary Projects on Sustainable Architecture; Definition and Ideas: Ecovillage, Architectural design approaches, Concept; Sustainable Development: Definition, Environmental issues and sustainability, Economic issues and sustainability, Social issues and sustainability; Technology, Project and Application; Research Fields: Sustainability,

Sustainable architecture, Logic of investment on sustainability; National and Global Design Policies; National and International Network for Sustainability.

**MiM620 Universal Design 3+0 7.5**

Introduction to Universal Design; Design and Users; Universal Design/Design for All; Users of Universal Design: People with disabilities, People without disabilities, Elderly; Barriers and Universal Design; Principles of Universal Design; Accessibility as a Right; Accessibility to Products and Services; Accessibility to Built Environment: Indoor public facilities, Outdoor public facilities; Best Practices and Universal Design Guide; Policies Supporting Universal Design.

**MiM621 Architecture and Housing 3+0 7.5**

Housing: Definition, Concept, Architectural design process, Role of the architect, Design methodology; Housing Typologies: Single family houses, Detached type, Semi-detached type, Row houses, Terrace houses, Apartments: definitions, node apartments, star apartments, block apartments; Mass Housing: Definition, Housing for the elderly and disabled, Lofts, Mobile homes, Youth hostels, Social housing: Definition and Projects; Research Fields: Building types, Housing, Mass-Housing, Affordable housing; Analyses of National Examples; Analyses of International Examples.

**MiM622 Urban Acoustic Comfort 3+0 7.5**

Basic Information on Sound and Noise; Propagation, Reflection and Absorption of the Sound Outdoors; Fundamental Factors in Noise Propagation; Ambient Noise and its Sources; Evaluation of Urban Acoustic Comfort (Objective and Subjective Evaluation Methods); Noise Measurements, Noise Maps and Simulations; Soundscape and Its Components; Design Principles for Urban Acoustic Comfort.

**MiM623 Integrated Design Studio in Architectural Education 3+0 7.5**

Architectural education; Teaching of architectural design; The views on architecture this teaching reflects; principles emerging through its implemented pedagogy; educational objectives; teaching strategies; methods and priorities; a specific framework of thinking: understanding and doing a digital design; a specific architectural paradigm. as lab or as studio: 'integrated' or 'vertical' of the teaching design; the decisive melting pot of architectural education; a framework of thinking, understanding and doing design.

**MiM624 Integrated Design Studio in Architectural Education II 3+0 7.5**

Architectural education; Teaching of architectural design; The views on architecture this teaching reflects; principles emerging through its implemented pedagogy; educational objectives; teaching strategies; methods and priorities; a specific framework of thinking: understanding and doing a digital design; a specific architectural paradigm. as lab or as studio: 'integrated' or 'vertical' of the teaching design; the decisive melting pot of architectural education; a framework of thinking, understanding and doing design; Conceptual: where the articulation and integration of architectural ideas take place, through experimentation, critique, confrontation, exchange, argumentation, debate or even imposition; the innovative, the experimental design techniques; the extended applications of digital technology.

**MiM625 Current Issues in Contemporary Architecture 3+0 7.5**

**MiM626 Contemporary Approaches in Architectural Design 3+0 7.5**

Relational dimension of Architecture; Interdisciplinary interaction in Architecture; Current research topics in Architectural Design; Comparative perspective on practical and objective, theoretical and literary productions in Contemporary Architectural Design; Case study analysis: conceptual and methodical evaluation of related practical and objective productions; Case study analysis: conceptual, methodical and scientific contribution evaluation of the related theoretical and literary productions; Comparative evaluation of Contemporary Architectural Design Approaches and development of a methodological proposal for improvements and adaptations.

**MiM627 Integrated Conservation of Tangible and Intangible Cultural Heritage 3+0 7.5**

Understanding the Intangible Cultural Heritage as an Interdisciplinary Concept; Acceptance of Intangible Values as Cultural Heritage: National and International Legal Frame; UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage; Intangible Cultural Heritage and Research Methods; Intangible Values and Intangible Cultural Heritage Aspects: Daily Life Culture, Cultural Practices, Cultural Narratives; The Relationship of Tangible and Intangible Cultural Heritage: Living Spaces, Economical-life Spaces, Building Culture; Integrated Conservation Approaches Based on the Relationship of Tangible and Intangible Values.

**MiM628 Architecture and Intertextuality 2+0 7.5**

<b>MiM692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>MiM790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>MiM890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>MiM890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>MKM501</b>	<b>Advanced Heat and Mass Transfer</b>	<b>3+0 7.5</b>
Introduction to Heat and Mass Transfer; Generalized Continuity Equations; One and Two-Dimensional Heat Conduction Mechanism and Formulations; Transient Heat Conduction; Introduction to Heat Convection, Non-dimensional similarities; Introduction to Boundary Layer and its Properties; Heat Convection Mechanism and Formulations; Heat Convection for Internal and External Flows; Natural Convection; Radiation Process; Mass Transfer and Diffusion; Similarities Between Heat and Mass Transfer.		
<b>MKM503</b>	<b>Academic Development</b>	<b>3+0 7.5</b>
History of Science; Ethics and Typical Application Mistakes; How to Choose a Scientific Topic; How to Reach Scientific Information: Web of science, Google academic; How to Write and Present a Scientific Article; How to Prepare a Project: Problem analysis, Objective analysis, Strategy analysis, Method analysis: Originality: Impact; Points to Consider when Preparing a Presentation; Effective Oratory Techniques; Relationship between the Student and the Advisor; Laboratory Safety; Evaluation and Assessment.		
<b>MKM509</b>	<b>Machining Dynamics</b>	<b>3+0 7.5</b>
Modelling Technics in Machining; Mechanistic and Analytical Cutting Models; Modal and Structural Dynamic Anaysis; Modal Anaysis in Machine Tools and Tools; Development of Chatter Model: Chatter models for milling, Chatter models for turning; Dynamic Simulations; Dynamic Simulation Method in Machining with Using Finite Element Methods.		
<b>MKM511</b>	<b>Advanced C++ Programming</b>	<b>3+0 7.5</b>
Introduction to Computer Programming; Program Development: Flow chart, Software, Compilation, Debugging; Data Types: Integer, Real numbers, Complex numbers, Characters; Operators and Expressions; Program Control Statements: If, Else, For, While; Arrays; Functions and Modeler Programming; Pointers; Class and Object Oriented Programming; Parallel Programming: OpenMP programming, MPI programming.		
<b>MKM513</b>	<b>Experimental Methods for Fluid Dynamics</b>	<b>3+0 7.5</b>
Introduction the Experimental Techniques for Fluid Dynamics and Fundamental Terms; Critical Topics in Measurement Techniques; Steady State and Time Dependent Measurements; Pressure Measurement Methods; Temperature Measurement Methods; Optical Measurement System; Velocity/Turbulence/Flow Rate Measurement Methods; Measurement of Flow Angle; Advance Measurement Methods; Statistical Analysis of Experimental Data; Post Processing Techniques and Understanding of Measurement Results; Fourier Transformation; Cross Correlation of Data; Uncertainty Analysis.		
<b>MKM514</b>	<b>Atomistic Simulation of Materials</b>	<b>3+0 7.5</b>
Introduction to Quantum Mechanics; Introduction to Quantum Mechanic Simulations: Hartree-Fock and density functional theory, Lattice constant of Si and C, Bulk modulus, Elastic constants and electronic band structure, Structural and electronic properties of C based nanomaterials; Introduction to Molecular Dynamics; Atomistic Potential Generation Techniques; Introduction to Molecular Dynamics Simulations: Lattice constant, High T properties.		
<b>MKM515</b>	<b>Renewable Energy Systems</b>	<b>3+0 7.5</b>
Description and Historical Development of Renewable Energy Technologies Energy Sources; Hydraulic Energy and its Usage Principles; Hydraulic Energy Systems; Wind Energy and its Usage Principles; Wind Energy Systems; Solar Energy and its Usage Principles; Solar Energy Systems; Geothermal Energy and its Usage Principles; Geothermal Energy Systems; Fuel Cells; Analysis of Renewable Energy System; Evaluation of Renewable Energy Systems in Economical Way; Renewable Energy and Environmental Laws.		
<b>MKM516</b>	<b>Additive Manufacturing Methods</b>	<b>3+0 7.5</b>

Additive Manufacturing: Basics of rapid prototyping, Reverse engineering and additive manufacturing; Methods and Materials in Additive Manufacturing: Additive manufacturing with fused deposition methods, Stereolithography (SLA) method, Additive manufacturing with laminated object manufacturing, Selective laser sintering, Selective laser melting, Laser deposition systems; Metallic Additive Manufacturing Systems; Composite Additive Manufacturing; Biological Printing; Industrial Applications of Additive Manufacturing.

**MKM517 Computer Aided Analysis 3+0 7.5**

Introduction to ANSYS Simulation Software; Direct and Solid Modeling; Solution of a Variety of Mechanical Engineering Problems using ANSYS; Static Analysis of Beams and Plates; Static Analysis of Planar and Space Trusses; Temperature Effects ve Non-linear Examples; ANSYS Applications in Structural Analysis; ANSYS Applications of Free and Forced Vibrations; Solution of Contact Problems using ANSYS.

**MKM518 Sustainable Manufacturing 3+0 7.5**

Introduction to Sustainable Manufacturing; Sustainable Business and Production Models; Product Life Cycle Transformation of Production Systems; Product Life Cycle in Manufacturing; Green Manufacturing; Environment and Health in Manufacturing; Green Design in Engineering; Absence of Products: Recycle and life cycle of product; Business Models in Sustainable Manufacturing; Energy Efficiency and Decreasing of Energy; Modelling of Carbon Foot Print in Manufacturing; Sustainability and Productivity; Effects of Social Factors in Manufacturing Systems; Operations in Sustainable Manufacturing, Tools and systems.

**MKM519 Exergy and Entropy Analysis 3+0 7.5**

Fundamental Thermodynamics Laws and Principles; Definition of Exergy and Energy; History of Exergy and Usable Energy; Exergy Balance and Exergy Losses; Exergy Efficiency of Thermal Systems; Thermodynamic Applications of Exergy Analysis; Exergy Calculations; Exergy Calculations in Open Systems; Physical and Chemical Exergy Calculations; Exergy Analysis of Typical Thermal Systems; Exergy Analysis of Combined Cycles; Exergy Analysis of Solar Collectors; Adiabatic Systems; Exergy of Steady State Flow Processes; Characteristics of Irreversible Systems and Processes.

**MKM520 Computer Aided Engineering 3+0 7.5**

Fundamentals of CAD/CAM/CAE and Introduction to Computer Aided Engineering Software; Introduction to CAD/CAM/CAE Systems; Engineering Processes in Design; Geometric Modeling in Engineering Applications; Numerical Methods in Engineering Design Systems; Solid Modeling; Numerical Methods in Structural Analysis; Introduction to Dynamic Analysis; Applications of Numerical Control Machining Systems; G-Codes; Applications of CAD/CAM/CAE Commercial Products in Engineering Projects.

**MKM522 Mechanical Behavior of Materials 3+0 7.5**

Classification of Materials and Properties; Elastic and Plastic Deformation; Stress and Strain Relationships; Hooke's Law; Von Mises Yield Criteria; Tresca Yield Criteria; Plastic Deformation; Factors Influencing Plastic Behavior; Strengthening Mechanisms; Ductile and Brittle Fracture; Yielding and Plastic Instability; Introduction to Linear Elastic Fracture Mechanics; Fatigue and Fracture; Influence of Environmental Parameters on Mechanical Properties; Fundamentals of Damage.

**MKM523 Vehicle Systems Design 3+0 7.5**

Introduction to vehicle dynamics, tires and their mechanics, drive-train model, braking stability, steering of vehicles, suspension kinematics and vehicle ride models. Design and specifications of brake systems, pneumatic and hydraulic brake systems, disc and drum brakes, elements of brake systems, auxiliary elements of brake systems, pneumatic tires and rims, design of suspension systems, springs and dampers, steering wheel mechanisms. Vehicle design in Matlab - Simulink environment.

**MKM524 Smart Materials and Applications 3+0 7.5**

Definition of Smart Materials; Sensors, Actuators and transducers; Introduction to Different Types of Smart Materials; History and Industrial Applications of Smart Materials; Piezoelectric Materials: Crystallography, Crystal structure, Mechanism of piezoelectricity; Common Piezoelectric Materials; Superelasticity; Superelastic Materials Phase Transformation; Martensitic Transformations, Shape memory effect and superelasticity; Mechanical Behavior and Shape Memory Characteristics of Different Shape Memory Alloy Systems; Ti-Ni Phase Diagrams; One Way, Two Way Shape Memory Effect and General Applications.

**MKM525 Superalloys 3+0 7.5**

Introduction: Definition of superalloys and general concepts; Classification of Superalloys: Superalloy strengthening mechanisms; Properties of Superalloys: Physical properties, Mechanical properties, Thermal properties; Processing of Superalloys: Physical metallurgy and initial processing, Forming and machining, Final processing; Selection of Superalloys: Selection criteria, Example application.



<b>MKM526</b>	<b>Advanced Powerplant System Technologies and Applications</b>	<b>3+0 7.5</b>
Introduction; Thermodynamic Laws; The Rankine Cycle; Fossil Fuel Steam Generators; Fuels and Combustion; Turbines; Condensators and Pumps; Gas Turbines; Combined-Cycle Systems (Cogeneration and Trigenation); Nuclear Energy and Nuclear Powerplant Systems; Geothermal Energy and Heat-Power Production Systems; Solar Energy and Heat-Power Production Systems; Wind Energy and Wind Turbines; Wave Energy; Power Production from Wave Energy, Energy Storage Systems.		
<b>MKM527</b>	<b>Design for Manufacturing and Assembly</b>	<b>3+0 7.5</b>
Introduction: Overview of engineering design, Engineering design flow, Concurrent engineering; Engineering Design Criteria: Functionality, Strength, Aesthetics, Cost, Time; Overview of Design for Manufacturing and Assembly; Design for Casting and Injection Processes; Design for Forming Processes; Design for Machining Processes; Design for Joining Processes; Design for Additive Manufacturing; Design for Assembly; Example Applications.		
<b>MKM528</b>	<b>Advanced Level Nondestructive Inspection Methodologies</b>	<b>3+0 7.5</b>
<b>MKM529</b>	<b>Selected Topics In Mechanics</b>	<b>3+0 7.5</b>
Stress; Plane stress, General state of stress, Transformation of general state of stress, State of nonhomogenous stress; Strain: Transformation of plane strain, Three dimensional analysis of strain, Compatibility equations, Transformation of three dimensional strain; Linear Elastic Materials-Hooke's Law; Generalized Hooke's law for linear isotropic elastic solids and anisotropic solids, Thermoelastic constitutive relations, Compatibility condition in a state of plane stress; Energy methods: External works, Elastic strain energy, Conservation of energy, Impact loading, Work and energy under several loads, Virtual work, Castigloano's theorems; Theories of Failure.		
<b>MKM530</b>	<b>Vehicle Control Systems</b>	<b>3+0 7.5</b>
<b>MKM532</b>	<b>Biomass and Bioenergy Systems</b>	<b>3+0 7.5</b>
<b>MKM533</b>	<b>Exergy Analysis in Mechanical Engineering</b>	<b>3+0 7.5</b>
First and second law of thermodynamics / Concept of Exergy Analysis, Physical and Chemical Exergy / Exergy Analysis Applications on Different Systems, Cooling Systems, Exergy Analysis, Exergy Analysis of Absorption Refrigeration Systems, Vehicle Emissions Exergy Analysis, II. Law of performance indicators, Exergy Analysis of Cooling Towers and Evaporative Coolers, Heating Systems, Exergy Analysis, Exergy Analysis of Thermal Power Plants, Cogeneration Systems, trigenation systems, Exergy Analysis of Geothermal Systems, Ecological Exergy Model / Exergy-Economic Relations and Analysis.		
<b>MKM534</b>	<b>Thermal System Design</b>	<b>3+0 7.5</b>
<b>MKM535</b>	<b>Advanced Fluid Mechanics in Mechanical Engineering</b>	<b>3+0 7.5</b>
Introduction to fluid mechanics; Fundamentals of fluid statics; Introduction to Fluid Dynamics, Streamlines, Streaklines, Pathlines, Flow rate, Mean velocity; Integral Form of Flow Equations: Conservation of mass, Conservation of momentum, 1st and 2nd law of thermodynamics; Bernoulli equation; Differential Formulation of Fluid Flow: Continuity equation, Euler's equation, Navier-Stokes equation, Energy equation, Boundary layer theory and dimensional analysis; Micro-nanoscale fluid mechanics applications.		
<b>MKM536</b>	<b>Engineering Failure Analysis</b>	<b>3+0 7.5</b>
Importance Of Failure Analysis; Preliminary Analysis Of A Mechanical Failure; Mechanism Of Failure And Failure Theories; Analysis Of Failure And Damage In Micro And Macro Scale; Methods Of Life Predicting In Structural Materials; Techniques And Tools Used In Failure Analysis; Damage Resistance Tests Of Materials; Fracture Mechanics And Crack Behaviours; Corrosion Related Failures; Manufacturing Related Failures; Wear Related Failures; Preventing Failure And Extending Service Life.		
<b>MKM537</b>	<b>Mechanics of Composite Materials</b>	<b>3+0 7.5</b>
Introduction to Composite Materials: Classification of composite materials, Reinforcement types, Matrix types; Elastic Behaviour of Composite Lamina in Micro Scale; Elastic Behaviour of Composite Lamina in Macro Scale; Strength of Unidirectional Lamina-Micromechanics; Strength of Unidirectional Lamina-Macromechanics; Elastic Behaviour of		

Multidirectional Laminates; Stress and Failure Analysis of Multidirectional Laminates; Mechanical Characterization of Composite Materials.

**MKM539 Analytical Methods in Engineering 3+0 7.5**

Ordinary Differential Equations; Power Series Solutions; Bessel, Modified Bessel Gamma, Legendre, Functions, Boundary and Initial Value Problems (The Sturm-Liouville Eigenvalue Problem); Laplace and Fourier Transforms; Fourier Integrals; Introduction to Integral Equations; Partial Differential Equations (Heat Conduction Equation, Wave Equation, Laplace Equation); Separation of Variables; Transformations.

**MKM592 Seminar 3+0 7.5**

**MKM599 Term Project 3+0 0.0**

**MKM611 Artificial Intelligence in Mechanical Engineering Applications 3+0 7.5**

Artificial intelligence definition, basic concepts and techniques; Expert systems and engineering applications; Fuzzy logic and engineering applications; Decision support systems and applications; Genetic algorithms and application examples; Artificial neural networks: structure and basic elements of artificial neural networks; The first artificial neural networks, artificial neural network models, back propagation networks; Mechanical Engineering applications of artificial neural networks.

**MKM612 Micro-Nanoscale Heat Transfer 3+0 7.5**

Introduction to nanotechnology; Micro-nanoscale heat transfer concepts, Deviation from the macroscopic theory; Phonons, photons and electrons as energy carriers; Energy quantization; Energy states in solids; Statistical thermodynamics; Energy transfer by waves; Size effects on heat transfer mechanisms (conduction, convection and radiation); Near-field radiative transfer; Special topics.

**MKM613 Advanced Exergy Analysis of Energy Systems 3+0 7.5**

First And Second Law of Thermodynamics / Concept of Exergy Analysis, Physical and Chemical Exergy / Exergy Analysis Applications on Different Systems, Endogenous Exergy Destruction; Exogenous Exergy Destruction; Avoidable Exergy Destruction; Inevitable Exergy Destruction; Advanced Exergy Analysis in Cooling Systems, Advanced Exergy Analysis in Heating Systems, Advanced Exergy Analysis in Thermal Power Plants, Cogeneration Systems, Trigenation Systems, Advanced Exergy Analysis in Geothermal Systems.

**MKM614 Automotive Control Systems 3+0 7.5**

Introduction to Automobile modeling and testing; Automobile Tire modeling; TCS, ABS and ESP control systems; Automotive suspension modeling; Automatic control systems of vehicle longitudinal dynamics; Automatic control systems of vehicle lateral dynamics; Road and driver models; Active and Semi-Active Suspensions of automobiles; Control algorithms of automobiles; Powertrain control of automobiles; Active rear-wheel steering of automobiles; Cruise control; Adaptive cruise control. Modeling and Simulation of Automobiles via Matlab/Simulink and IPG-CarMaker.

**MKM615 Optimization Methods and Applications 3+0 7.5**

(Eng)

Problem formulation; Linear programming type optimization problems and various techniques; the simplex method, artificial variable technique, and dual simplex method; Single variable nonlinear problems; various bracketing, region elimination, point estimation, and gradient methods; Multivariable unconstrained nonlinear optimization problems; Multivariable constrained nonlinear optimization problems; Geometric programming; Dynamic programming; Integer programming; Multiobjective optimization; Meta-heuristic optimization methods.

**MKM616 Advanced Thermodynamics in Mechanical Engineering 3+0 7.5**

Thermodynamics I. and II. Basic Concepts of Laws and Their Applications / Entropy Production / Exergy Analysis Concept, Systems with Chemical Reactions / Irreversible Thermodynamics / Exergy Analysis Applications on Different Systems; Cooling Systems, Heating Systems, Thermal Power Plants, Cogeneration Systems, Trigenation Systems, Geothermal Systems.

**MKM618 Design for Additive Manufacturing 3+0 7.5**

Examination of Additive Manufacturing technologies; Design Considerations for Additive Manufacturing; Design Optimization Techniques; Material selection for Additive Manufacturing; Software tools for design in Additive Manufacturing; Introduction of additive manufacturing CAD software; hands-on training with design software, designing

for specific additive manufacturing processes; Practical Design Exercises; Designing components for additive manufacturing, Iterative design process, Design review and feedback studies, Project studies.

**MKM692 Seminar 3+0 7.5**

**MKM790 Thesis 0+1 30.0**

**MKM890 Thesis 0+1 30.0**

**MKM890-0 Thesis Proposal 0+1 30.0**

**MLZ501 The Structure-Property Relationships in Materials 3+0 7.5**

The Structure of Materials; Levels of Materials Structure; Introduction to Structure-Property Relationships in Materials; Pauling Principles in Ionically Bonded Systems; Crystal Chemistry; Symmetry Operations; Symmetry Components; Point Groups and Their Stereograms; Space Groups; Transformation of Space Groups to Point Groups; Transformation Components for Symmetry Components; Neumann Principle; Analytical Form of Neumann Principle; Heckmann Diagram; Thermodynamic Relations; Specific Heat and Entropy; Pyro-electricity; Stress and Strain; Thermal Expansion; Piezoelectricity and Piezoresistance; Application Examples.

**MLZ502 Thermodynamic Applications in Material Science 3+0 7.5**

The Zeroth, First, second, and Third Laws of Thermodynamics; Ellingham Diagrams; One-component Phase Diagrams; The Behaviour of Raoultian, Henrian and Regular Solutions; Gibbs Free Energy-Composition and Phase Diagrams of Binary Systems; Statistical Interpretation of Entropy; Reactions Involving Gases: the effect of temperature and pressure on the equilibrium constant, reaction equilibrium as a compromise between enthalpy and entropy; Reaction Equilibria in Systems Containing Components in Condensed Solution: criteria for reaction equilibrium, alternative standard states, binary systems containing compounds, graphical representation of phase equilibria, the solubility of gases in metals, solutions containing several dilute solutes; Electrochemistry: the relationship between chemical and electrical driving forces, the effect of concentration on EMF, formation cells, concentration cells, Pourbaix diagrams.

**MLZ503 Electrical Properties of Materials 3+0 7.5**

Electrons in Crystal; Electrical Conduction in Metals and Alloys; Superconductivity; Thermoelectric Phenomena; Semiconductors and Semiconductor Devices; Electrical Properties of Polymers, Ceramics, Dielectrics, and Amorphous Materials; Optical Properties of Materials; Applications (Electro-Optical Waveguides, Optical Storage, Complementary Metal-Oxide-Semiconductors (CMOSs), Charge-Coupled Devices (CCDs), LEDs, LCDs, LASERS); Magnetic Properties of Materials; Applications (Permanent Magnets; Magnetic Memory and Recording, Magnetic Detection and Sensors); Thermal Properties of Materials; Thermal Conduction and Expansion in Metals and Alloys; Applications (Thermocouples, Thermal Camera and Detectors).

**MLZ504 Fracture Mechanics of Materials 3+0 7.5**

Introduction; Fundamentals of Fracture Mechanics; Dislocations, Plastic Flow and Stresses; The Fracture Strength; The Factors Affecting Elastic Modulus in Ceramics; Impact Resistance and Toughness of Ceramics; Critical Crack Size; Fracture Surface Energy; Work of Fracture; The Effects of Coefficients of Thermal Expansion Difference on Mechanical Properties; Thermal Stresses and Fracture; The Determination of Thermal Shock Parameters for the Industrial Applications; Thermal Shock Behaviour; Engineering Design Data.

**MLZ505 Thermal Analysis of Polymeric Materials 3+0 7.5**

Properties of Thermoplastics, Thermosets and Elastomers, Introduction to Polymer Thermal Analysis, Polymer Physics, Definition of Glass Transition, Melting and Crystallization for Different Polymer Types. Differential Scanning Calorimetry (DSC) and Its Working Principles, Real Life Examples to DSC Applications with Hands on Experiments, Thermogravimetry (TG) Analysis and Its Working Principles, Real Life Examples to TGA Applications with Hands on Experiments, Thermo Mechanical Analysis (TMA) and Its Working Principles, Real Life Examples to TMA Applications with Hands on Experiments, Introduction to Dynamic Mechanical Analysis (DMA), DMA Applications with Hands on Experiments. Introduction Micro-Thermal Analysis.

**MLZ506 Mathematical Methods in Polymer Science and Technology 3+0 7.5**

Molecular Weights and Numerical Average of Polydispersity Indices and Calculations of Weight Averages; Stoichiometry of Polymerization Reactions, Their Kinetics and Transformations; Crystallization, Polymer Solutions, Polymer Mixtures and Calculations of Miscibility Parameters; Calculations Based on Viscoelasticity; The Use of WLF Equation; Heat Transfer Calculations; Stress-Strain Calculations in Fiber Containing Composites; Calculations in Molding Presses; Extrusion Calculations; Heat Treatment Calculations; Other Calculations in Polymer Production.

**MLZ507                      Fundamentals of Polymer Engineering                      3+0    7.5**

Introduction to Polymer Engineering, Engineering Plastics, Polymerization, Copolymers and Cross-Linked Polymers, Physical and Chemical Properties of Solid Polymers, Crystalline and Glassy Polymers, Creep and Stress Relaxation in Polymers, Time Dependent Analysis of Viscoelastic Polymers, Fracture Mechanics of Polymers, Extrusion, Injection Molding, Thermoforming, Blow Molding, Compression and Transfer Molding.

**MLZ508                      Mechanics of Polymer-Based Laminated Composites                      3+0    7.5**

Introduction to Polymer Composites, Overview of Constituents Material Forms, Processing and Applications, Macro-mechanical Behavior of A Lamina, Orthotropic Material Properties, Transformation of Coordinates, Lamina Strength Criteria, Micromechanical Behavior of Lamina, Classical Laminate Theory, Thermal Effects, Laminate strength, Delamination, Matrix Cracking, and Durability, Inter-laminar Stresses, Edge Effects, Fatigue and Fracture, Analysis of Laminated Beams, Composite I Beams, Shear in Composite Beams Design Examples.

**MLZ509                      Advanced Composite Materials                      3+0    7.5**

Introduction; Classification of Composites; Ceramic Matrix Composites; Nano-composites; Laminate Composites; Metal Matrix Composites; The Properties and Conditions Required for Matrix and Reinforcement Phases in Composite Materials; The Effects of Thermal Expansion Mismatch in Composite Materials; Fracture Strength of Composites; Mechanical Properties of Composites; Fracture Mechanisms of Composites; Toughening Mechanisms; Properties of Interfaces and Thermal Stresses; Thermal Shock Parameters; Stress-Strain Behaviour of Ceramics with the Addition of Reinforcement Phase.

**MLZ510                      Thin Film Production and Vacuum Technologies                      3+0    7.5**

Review of Materials Science; Vacuum Science and Technology; Principles of High Vacuum; Thin Film Evaporation Process; Discharge, Plasmas, and Ion-Surface Interactions; Plasma and Ion Beam Processing of Thin Films; Chemical Vapor Deposition; Film Deposition; Substrate Surfaces and Thin Film Nucleation; Physical Vapor Deposition; Plasma Etching; Sputtering; Electron Beam Evaporation; Epitaxy; Film Structure; Electrical Properties; Characterization Techniques.

**MLZ511                      Dielectric Materials and Devices                      3+0    7.5**

Transformations and Tensors; Crystals and Texture Symmetry; Curie Principle and Neumann's Law; Polar Tensors; Pyroelectricity; Permittivity; Piezoelectricity; Elasticity; Thermodynamics; Equilibrium Properties; Axial Tensors; Piezomagnetism; Magnetoelectricity; Pyromagnetism; Magnetic Symmetry-Time Reversal, Hysteretic Properties-Domains; Transport Properties; Thermal and Electrical Conductivity; Galvanomagnetic Phenomena; Thermoelectric Phenomena; Thermomagnetic Phenomena; Waves Acoustics and Optics; Optical Activity.

**MLZ512                      Applications of Crystallography                      3+0    7.5**

Summary of Crystallography; Stereographic Projections and Their Applications; Slip in Single Crystals and Diehl's Rule, Diffraction, Reciprocal Space, Ewald Sphere, Polymorphism and Polytypes, Rutile and Anatase Crystal Structures and their Applications, Zinc Sulfide Crystal Structures and Piezo and Pyroelectricity, Relationship between Optical Anisotropy?Crystal Structure; Interaction Colours and Photoelasticity, Olivin-Spinel Phase Transitions, Perovskite Structure, Superconductivity, Phase Transformations, ccp/hcp Phase Transformations and Shape Memory Alloys, Silicon Dioxide, Zirconia, Silicon Nitride and Silicon Carbide Phase Transformations.

**MLZ513                      Raw Materials and Mineral Processing                      3+0    7.5**

Introduction; Ceramic Raw Materials; Clays, Quartz, Feldspars, Limestone, Marble and Other Raw Materials; Mineral Processing: Crushing, Grinding, Screening, Classification; Sizing Classification and Handpicking Enrichment; Gravity Separation; Magnetic Separation; Electrostatic Separation; Flotation; Chemical Enrichment

**MLZ514                      The use of Glass Materials in Industry                      3+0    7.5**

Introduction; Importance of Glass and Glassy Materials in Industry; Introduction to Glaze Science; Certain Raw Materials Used in Glaze Production; Frit Production; Glaze Preparation and Application; Glaze-Body Interactions; Characterisation of Glazed Products; Technologically Important Glazes; Enamel Production; Technologically Important Enamels; Enamel Defects and Their Corrections.

**MLZ515                      Refractory Technology                      3+0    7.5**

Classification and Properties of Refractories; Production Process and Test Methods; Industrial Applications; Properties and Application of Basic Refractories; Properties and Application of Acidic Refractories, and Corrosion Resistance;

Fundamentals of Fracture Mechanics; Determination of Mechanical Properties; The Effects of Coefficients of Thermal Expansion Difference on Mechanical Properties of Refractories; The Determination of Thermal Stress and Shock Parameters for the Industrial Applications; Thermal Shock Behaviour of Refractories; Preparation of Refractory Samples; Mechanical Testing; Microstructural Examinations in Scanning Electron Microscopy.

**MLZ516 Coating Techniques 3+0 7.5**

An Introduction to Thin Coating; Coating Types and Process Steps; Evaluation of the Parameters for the Best Coating for a Given Application; Thermal Spraying Methods (Plasma Spraying, Low Pressure Plasma Spraying; Flame Spraying, HVOF Spraying; Their Applications and Coating Properties; TBC Coatings; Chemical Vapour Deposition (CVD); Metal Organic Chemical Vapour Deposition (MOCVD); Plasma CVD; Process Parameters, Application Areas; Physical Vapour Deposition, Process Parameters and Application Areas; Coating Properties; Ion Implantation ; Hardness, Friction and Wear Principles and Mechanisms

**MLZ517 X-Ray Diffraction Techniques in Materials Characterisation 3+0 7.5**

Importance of materials Characterization; Importance of XRD Techniques in Materials Characterization; Techniques Used in Materials Characterisation and their Difference; Electromagnetic Radiation; The Continuous Spectrum; The Characteristic Spectrum; Absorption; Filters; Production of X-rays; Detection of X-rays; Introduction of the XRD Device; Specimen Preparation Methods; Interpretation of XRD Spectra; Lattices; Crystal Systems; Symmetry; Primitive and Non-primitive Cells; The Stereographic Projection; The Stereographic Projection; Diffraction Theory I: Directions of Diffracted Beams; Diffraction; Bragg Law; X-ray Spectroscopy; Diffraction Directions; Diffraction Methods; Diffraction Under Non-ideal Conditions Diffraction Theory-II: Intensities of Diffracted Beams: Scattering by an Electron; Scattering by an Atom; Scattering by a Unit Cell; Structure Factor Calculations: Multiplicity Factor, Lorentz Factor; Absorption Factor; Temperature Factor; Intensities of Powder Pattern Lines; Application; Determination of Particle Size; Determination of X-ray Density; Depth of X-Ray Penetration; Determination of Crystal Structure; Indexing Patterns of Cubic Crystals; Indexing Patterns of Noncubic Crystals; Determination of the Number of Atoms in a Unit Cell; Determination of Atom Positions, Quantitative XRD; X-Ray Fluorescence (XRF); XRF Applications.

**MLZ518 Strengthening Mechanisms in Materials 3+0 7.5**

Classification of Materials; In Materials: Mechanical Properties; Mechanical Behaviours; Thermal Properties and Behaviours; Imperfections in Solids; Dislocations and Plastic Deformation; Mechanisms of Strengthening in Metals; Recovery, Recrystallization and grain growth; Imperfections in Ceramics and Mechanisms of Plastic Deformation; Defects in Polymers; Mechanisms of Deformation and for Strengthening of Polymers; Strengthening Mechanisms in Composites.

**MLZ519 Atomic Force Microscopy and Applications 3+0 7.5**

Basics of Atomic Force Microscopy; Historical Background; Components of Microscope, scanning Modes, Calibration; Tip-Sample Interaction; Imaging and Compositional Analysis; Mechanical Property Analysis; Nano-Indentation and Scratch Resistance Measurements; Elec-trical Property Analysis; Magnetic Property Analysis; Nano-Production Techniques with AFM.

**MLZ521 Fracture Mechanics of Materials 3+0 7.5**

Definition, Importance and History of Fracture Mechanics: Historical perspective, Fracture mechanics for design, Effect of materials' properties on fracture; Linear Elastic Fracture Me-chanics: An atomic view of fracture, Effect of stress concentration on flaws: Griffith energy balance, Energy release rate, Instability and the R curve; Crack Tip Plasticity Zone; Plastic zone shape; Elastic Plastic Fracture Mechanics: Crack-tip opening displacement, The J integral, Relationships between J and CTOD; Fatigue Fracture Formation: Fatigue diagram, Fatigue plastic zone; Materials Behavior: Fracture mechanism in metals, Facture mechanism in non-metals, Theoretical and practical research and discussion.

**MLZ522 Application of Electrochromic and Photochromic Polymers 3+0 7.5**

Fundamental principles of photochemistry and electrochemistry; Modern techniques of electrochemical characterisation; Chromism, Electrochromism, Polyelectrochromism; Electrochromic systems; kinetics and mechanism; Construction of electrochromic device; Organic monomeric chromes, Inorganic chromic systems; Electroactive conductive polymers; Photochromic viologen-based systems; Photochromic liquid crystal polymers; Photoelectrochromism; Matrix polymers; Photostimulated conformation changes of polymers in solution and gel phase; Last developments.

**MLZ523 Polymer Chemistry and Physics 3+0 7.5**

Basic Concepts of Polymer Science; Microstructure and Molecular Weight; Chemical Bonding and Polymer Structure; Step-growth and Addition Polymerization; Polymerization Kinetics; Probability and Statistics of Polymerizations; Stereochemistry of Polymerization; Reactions of Polymers; Ideal and Real Chains; Thermodynamics of Polymer Solutions and Blends; Flory-Huggins Equation and Cohesive energy Density; Random Branching and Gelation; Predicting Polymer Properties by Computational Methods.

**MLZ524 Electrochemical Characterization of Conducting Polymer 3+0 7.5**



**MLZ603 Special X-Ray Techniques and Their Applications 3+0 7.5**  
Reflectivity of X-Rays from Soft Matter Surfaces and Multiple Interfaces; Roughness and Density Profiles; Reflectivity Experiments and Experimental Consideration; High Resolution Diffractometers and Reflectometers; Grazing Incidence and Exidence Diffraction and in-Plane Diffraction Techniques; Reciprocal-Space Map and Q-Scan Techniques; Limits on the Use of Powder Diffractometer; High Temperature Powder Diffractometer Techniques.

**MLZ604 Inorganic Powder Synthesis Technologies 3+0 7.5**  
Introduction to Ceramic and Metal Powder Synthesis Methods; Powder Synthesis by Atomization; Powder Synthesis via Precipitation from Homogeneous Solutions; Powder Synthesis in Molten Salt; Powder Synthesis by Sol-Gel Technique; Interpretation of Solubility-pH Diagrams; Nucleation and Growth Kinetics; Size and Shape Control in Powder Synthesis; Composite and Multi-Functional Powder Preparation Techniques.

**MLZ605 Sintering of Particulate Materials 3+0 7.5**  
Introduction to Sintering Terms; Processing of Ceramic and Metal Powders; Microstructure-Sintering Relations; Sintering Analysis Techniques; Solid State Sintering; Liquid Phase Sintering; Viscous Sintering; Herring's Scaling Law; Sintering Maps; Deformations Occurring during Sintering and Approaches to Prevent Them; Pressure Assisted Sintering Techniques (Sinter Forging; Hot Pressing etc.); Other Sintering Techniques (Transient Liquid Phase Sintering, Reactive Sintering; Microwave Sintering, etc.); Examples of Sintering Methods Applied to Ceramic and Metal Particulate Systems; Grain Growth (Normal Grain Growth; Exaggerated Grain Growth; Anisotropic Grain Growth, etc.)

**MLZ606 Phase Transformation Reactions of Metals 3+0 7.5**  
Free energy, interface energy and activation energy terms; Structure of liquids; Liquid-solid interface; Solidification models; Solidification microstructures; Solidification kinetics and industrial control; Chemical partitioning and diffusion direction; Interaction of free energy and phase diagrams; Examples of chemical partitioning reactions of alloy systems; Classification of solid-solid transformation reactions and interface types; Diffusional transformation reaction mechanisms, kinetics, crystallography and morphologies; Industrial examples of diffusional transformation reactions through alloy systems; Mechanism of martensitic transformation, kinetics, crystallography and morphology; Industrial examples of martensitic transformation through alloy systems; Mechanism of spinodal decomposition, kinetics, crystallography and morphology; Industrial examples of spinodal transformation reactions through alloy systems.

**MLZ607 Alloy Development-Principles, New Horizons and Extreme Applications 3+0 7.5**  
Alloy development principles; trends, causes and products at existing alloy systems for conventional applications; Alloy selection examinations at applications that need tough property combinations; Alloy development attempts and products for cutting-edge applications; Alloy theory and microstructures of alloys; Steel types: Complication and expansions at classification; New trends, causes and products at steels; High temperature alloys (superalloys): new trends, causes and products; Aluminium alloys: new trends, causes and products; Titanium alloys: new trends, causes and products; Magnesium alloys: new trends, causes and products; Magnetism and magnetic alloys: new trends, causes and products; Alloys selection examples for extreme applications; Trends and products at alloy development for extreme applications.

**MLZ608 Polymer Rheology 3+0 7.5**  
Rheology in Engineering Applications, Rheology of Polymers, Review of Vector and Tensor Analysis Flow, Newtonian Fluid Mechanics, Isothermal Flow Problems for Generalized Newtonian Fluids, Non-isothermal Flow Problems for Generalized Newtonian Fluids, Shear and Shear-Free Flows, Steady Shear Flow Material Functions, Unsteady Shear Flow Material Functions, Shear Free Flow Material Functions, Linear Viscoelastic Measurements, Parallel-Disk Viscometer, Cone-And-Plate Parallel-Disk Capillary Rheometer Slit Rheometer Newtonian Fluid and Hookean Solid, Linear Viscoelastic Fluids, Linear Viscoelastic Rheological Properties, Experimental Rheological Characterization of Different Types of Polymers with Hands on Experiments.

**MLZ609 Modeling of Polymer Composites Manufacturing Processes 3+0 7.5**  
Introduction to Polymer Composites, Polymer Composite Fabrication Processes, Mass, Heat And Momentum Transfer Equations for Polymer Composite Manufacturing, Introduction to Polymer Composites Process Modeling, Introduction to MATLAB Programming Assisted Numerical Calculations, General Aspects of Advanced Thermoplastic and Thermoset-Matrix Fiber-Reinforced Composites, Introduction to Liquid Composite Molding Processes (Resin Transfer Molding and Vacuum Assisted Resin Transfer Molding), LIMS (Liquid Injection Molding Simulation) Coupled with Hands-on Manufacturing of Composite Parts.

**MLZ610 Kinetics 3+0 7.5**  
Kinetics of Diffusion: Ficks First Law and applications, Ficks Second Law and Semi-Infinite System Applications, Ficks Second Law and Finite System Applications, Ficks Second Law and Laplace Transformations, Multi ? Phase Diffusion; Chemical Diffusion: Boltzman-Matano Analysis, Atomistic Theory of Diffusion, Fast Diffusion Regions, Ionic Diffusion; Kinetics of Chemical Reactions: Introduction, Determination of Reaction Orders and Rate Constants, Reaction Mechanisms

and Corresponding Rate Laws, Solid ? Gas Reactions in Materials Science: Kinetics of Metal Oxidation, Kinetics of PVD Process, Kinetics of CVD Process

**MLZ611 Diffusion in Solids 3+0 7.5**  
Introduction; Diffusion Equations; Diffusion in Alloys; The Effect of Concentration Gradient on Diffusion; Diffusion in Non-Metallic Materials; Suitable Environments for Diffusion and Diffusion Methods; Heat Diffusion in Solids and Electrolyze.

**MLZ612 Ferroelectric Materials and Devices 3+0 7.5**  
Crystal Structure and Ferroelectricity; Origin of Spontaneous Polarization; Origin of Field Induced Strain; Electrooptic Effect; Applications of Ferroelectrics; High Permittivity Dielectric; Pyroelectric Devices; Piezoelectric Materials; Piezoelectric Resonance; Piezoelectric Transformers; Ultrasonic Transducers; Surface Acoustic Wave Devices; Piezoelectric Actuators; Ultrasonic Motors; Electrooptic Devices; Wave Guide Modulators; PTC Materials; PTC Phenomenon; PTC Thermistors; Grain Boundary Layer Capacitors; Composite Materials.

**MLZ613 Crystal Anisotropy 3+0 7.5**  
Introduction and Overview; Permittivity; Polarization Mechanism; Dispersion and equivalent circuits; High Voltage Insulators; Electric Breakdown Mechanisms; Substrates and Packaging; Thick and Thin Film Processing; Resistance; Electronic Conduction; Fixed Resistors, PTC and NTC Thermistors, Varistors and Barrier Layer Capacitors, Humidity and Chemical Sensors; Ceramic Electrodes and Superconductors; Ionic Conduction and Batteries; Capacitors; Disk, tubular, Multilayer; Low k Ceramics: Temperature coefficient, Microwave dielectric resonators.

**MLZ614 Spintronic and Applications 3+0 7.5**  
Introduction to Magnetism; Spin Dependent Transport; Magnetoresistive (MR) Effects (X-MR Effects: Anisotropy-MR; Giant-MR; Tunnel-MR and Clossal-MR Effects); Electrical Transport in Nonmagnetic and Magnetic Metals; Spin Dependent Tunneling; Ferromagnetic-Isolator and Superconductor-Isolator Tunnel Contacts; Spin-Valves; XMR-Effects and Their Applications.

**MLZ615 Material and Energy Balance in Production 3+0 7.5**  
Fundamentals of energy balances, material balances for processes without reaction; recyle, bypass and industrial application; gaseous and liquid fuels, calculations of enthalpy changes; application of Energy balances to open and closed systems; Applications of energy balances in processes that include chemical reactions; Energy balances in lime and cement industries; Formulations of ceramic mixes; Phase diagrams in ceramics; The equilibrium relations between liquid and solid phases; Design of a kiln in ceramic industry.

**MLZ616 Colloid Chemistry and Rheological Behaviour 3+0 7.5**  
Introduction to Colloid Chemistry and Classification; Colloidal Systems and Importance of Interface; Kinetic Properties; Surface Tension and Surface Energy; Gibbs Adsorption Equation; Adhesion, Cohesion, and Diffusion; Physical Adsorption by Solids; Physical Adsorption by Solids; Langmuir Isotherms; Freundlich Adsorption Isotherm; BET Adsorption Theory; Electrical Phenomena at Interfaces; Electrical Double Layer and Zeta Potential, DLVO Theory; Colloid Stability; Flocculation; Surfactants; Wetting; Rheological Behaviour; Pseudoplasticity; Dilatant Flow Behaviour; Thixotropy, Effective Parameters on Viscosity; Rheological Applications; Stability of Clay Based Mud; Slip Casting; Ceramic Glazes.

**MLZ617 Inorganic Pigments and Pigments Interactions 3+0 7.5**  
Light and Colour; Colour Measurement Methods; Inorganic Pigments; Definitions; Classification and Crystal Structures; Pigment Production Process; Traditional Method; Sol-gel Method; Inorganic Pigments Used in Ceramics Industry; Pigments for Glazes; Pigments for Bodies; Inorganic Pigments Used in Plastics and Automotive Industry; Glaze-pigment and Body-pigment Interactions.

**MLZ618 The Relationship between Structure and Properties in Industrial Glazes 3+0 7.5**  
Introduction; The Importance of Glassy Coating Materials in 21st Century's Industry and Life; Certain Glaze Systems of Fast Firing Technologies; Utilization Possibility of Alternative Raw Materials in Glaze Production; Raw Material Based Cost Analysis and Adaptation to New Production Processes; Synthesis of Fast Firing Frits and Their Use in Glazes; Technological Improvements in Raw Glazes; New Detailed Characterization Techniques Applied to the Developed Products in order to Establish Structure-Property Relationships; The Interaction between Industry and Environment in Terms of the Technological Development; Adaptation of New Product Achieved as a Result of Micro-Structural Control to the Present Standards.

**MLZ619 Phase Transformation Mechanisms of Metals 3+0 7.5**  
Concepts of Free Energy, Interface Energy and Activation Energy; Relationship between Free Energy and Phase Diagrams; Diffusion Mechanisms, Industrial Examples for Diffusion Mechanisms; Diffusion Controlled Transformation Mechanisms; Kinetics, Crystallography and morphology, Industrial examples for diffusion controlled transformation mechanisms; Homo-



geneous and Heterogeneous Nucleation Mechanisms: Kinetics and control parameters; Precipitation Mechanisms: Kinetics, Crystallography, Interphase Analysis; Mechanism of Precipitate Coarsening; Spinodal Transformations; Martensitic Transformations, Industrial Examples for Martensitic Transformations.

**MLZ621 Electrical and Magnetic Characterization 3+0 7.5**

Electrical: Two point probe technique (TPP), Four point probe technique (FPP), Impedance spectroscopy (IS); Magnetic: Vibrating sample magnetometer (VSM): Magnetic hysteresis, Magnetic Susceptibility, Magnetic Anisotropy, Temperature and Angular Dependence of Magnetization, Zero-Field- and magnetic-field cooling; Spin Paramagnetic Resonance (SPR); Ferromagnetic Resonance (FMR); THz-Time Domain Spectroscopy (THz-TDS); Material and Device Examples: Phase transition materials; Smart Materials; Magnetics Ceramic Materials; Nanomagnetic Materials; Magneto-Resistive Sensors; Micro-Electro-Mechanical Systems (MEMS).

**MLZ622 Porous Materials 3+0 7.5**

Introduction: The importance of adsorption, Physisorption and chemisorption, Types of adsorption isotherms; Thermodynamics of Adsorption at the Gas-Solid Interface; Methodology of Gas Adsorption; Adsorption at the Liquid-Solid Interface; Classical Interpretation of Physisorption Isotherms at the Gas-Solid Interface; Modelling of Physisorption in Porous Solids; Assessment of Surface Area by Gas Adsorption; Assessment of Mesoporosity; Assessment of Microporosity; Adsorption by Active Carbons; Adsorption by Metal Oxides; Adsorption by Metal-Organic Frameworks.

**MLZ623 Structural and Optical Characterization 3+0 7.5**

Optical spectrum: Radiation sources, Material-radiation interactions; X-ray diffraction (XRD): Grazing Incidence X-Ray Diffraction (GI-XRD), In-Plane X-Ray Diffraction (IP-XRD); X-Ray Reflectivity (XRR); X-Ray Photoelectron Spectroscopy (XPS); Raman Spectroscopy; Fourier-Transform Infrared Spectroscopy (FTIR); Ultraviolet-Visible Spectroscopy (UV-Vis-NIR); Surface Plasmon Resonance (SPR) Spectroscopy; THz-Time Domain Spectroscopy (THz-TDS); Material Examples: Phase transition materials; Smart Materials; Surface-Plasmon-Supporting Materials; Optical Absorbance Materials.

**MLZ624 Advanced Manufacturing Techniques 3+0 7.5**

**MLZ626 Material Characterization and Inspection Techniques 3+0 7.5**

**MLZ628 Powder Metallurgy 3+0 7.5**

**MLZ630 Advanced Surface Engineering 3+0 7.5**

**MLZ632 Fracture Mechanics and Fatigue 3+0 7.5**

**MLZ651 Materials Science and Advanced Materials Technology 3+0 7.5**

Materials Science; Atomic structure; Bonding Between Atoms; Chemical Reactions and Reactivity; The Crystalline State; Elastic and Plastic Behavior; Constitution; Electrical and Magnetic Properties; Materials Technology; The Shaping of Materials; Metals; Ceramics; Thermoplastics; Thermosetting Materials; Composite Materials; The Behavior of Materials in Service; Testing of Materials; Metal-Joining Processes; Macroscopic and Microscopic Examination of Materials.

**MLZ652 Fatigue and Creep Behaviour of Aircraft Materials 3+0 7.5**

Fracture and Toughness in Aircraft Materials; Fatigue Failure; Mechanism of Fatigue; Fatigue Crack Growth Analysis; Load Interaction; Case Studies for Aircraft Fatigue Failure; Creep and Creep Related Failure in Aircraft Engine; Kinetic Theory of Diffusion; Mechanism of Creep and Creep-Resistant Materials; The Turbine Blade-a Case Study in Creep Failure.

**MLZ692 Seminar 3+0 7.5**

**MLZ790 Thesis 0+1 30.0**

<b>MLZ890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>MLZ890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>MOD501</b>	<b>Pattern Design in Textile</b>	<b>3+0 7.5</b>
Importance of Pattern in Fashion Textile; Designing Patterns in View of Current Fashion Trends; Development of Textile Patterns (Imprinted and Woven); Relationship Between Patterns and Motifs; Basic Principles in Pattern Design; Methods of Pattern Design and Multiplication; Industrial Applications.		
<b>MOD503</b>	<b>Fashion Theories and Trends</b>	<b>3+0 7.5</b>
Description of fashion concept, Theories of fashion: Bottom-down or class difference theory, Collective selection theory, Changing endogenous areas theory, Mass bazaar theory, Subculture influence theory; Definition of fashion trend and types of fashion trend: Long term fashion trends, Short term fashion trends; Factors influencing fashion trends: Political factors, Social factors, Economic factors, Technological factors; Current studies on fashion trend analysis, Cycle of fashion, Dissemination process of fashion.		
<b>MOD510</b>	<b>Fashion Concept in Design</b>	<b>3+0 7.5</b>
Definition and Development Process of Fashion Concept; Art and Fashion Relation; Development Process of Fashion Concept in Design; Accepting a New Design in Different Levels of Society; Interaction Between Society and Fashion; Applications of Creating a Style According to the Conceptual Recommendations.		
<b>MOD511</b>	<b>Intelligent Textiles and Clothing</b>	<b>3+0 7.5</b>
Basic Research and Design Procedure of Intelligent Textiles; Phase Change Materials: Phase change Technology, Thermo physiological comfort, Pems in textile and clothing; Shape Memory Materials: Principles of shape memory materials, Ssms for Textile Applications; Chromic and Conductive Materials: Photo chromic, Thermo chromic and Electrochromic materials, Conductive Fibers and Yarns, Polypro Applications; Solar Textiles: Solar Cells, Photovoltaic, Textile Applications; Electronic Textiles: Principles of Wearable Electronics and Computers, Medical and Monitoring Applications of Electronic Textiles; Nanotechnology for Intelligent Textile Clothing; Future Trends in Intelligent Textile and Garment Applications.		
<b>MOD512</b>	<b>Art and Design</b>	<b>2+2 7.5</b>
Creating and Improving Two and Three Dimensional Surface-Form Relations; Approaching Processes Like Subject, Object: Converting Concepts to Visual Language; Interpreted and Re-Commented; Improving Techniques and Abilities to Use Concepts Like Ratio-Proportion, Placement, Form and Volume by Using Study Methods Based on Observation; Forming Conceptual, Cultural and Functional Relations by the use of Separate Subjects Chosen by Individual Students.		
<b>MOD513</b>	<b>Advanced Projects in Fashion Design I</b>	<b>2+2 7.5</b>
Scale; Function; Aesthetic; General Design Methods; Project Planning; General Design Strategy of an Organization; Methods and Principles About Creation of a Collection; Project Applications; Analyze of the Design Language; Design Challenging Conditions; Interaction Analysis; Cultural Analysis.		
<b>MOD514</b>	<b>Advanced Projects in Fashion Design II</b>	<b>2+2 7.5</b>
Rapid Prototyping Methods and Applications; Formal and Functional Analysis of Potential Trends; Development of Alternative Solutions and Evaluation of Methods Used in Testing Steps; Using High Technology for Product Development and Sample Analysis; Examining Design and Cost Relation.		
<b>MOD515</b>	<b>Fashion Design Presentation and Graphic Design Relation</b>	<b>3+0 7.5</b>
Importance of Fashion Design Presentation: Scrutinizing the Tools and Techniques Used in Graphic Design Presentation; Crucial Factors Influencing Fashion Design Marketing: Graphic presentation techniques and graphic design within the changing fashion periods, Marketing and promotion of fashion design; A Semiotic Approach to the Relationship Between Fashion Design and Graphic Design.		
<b>MOD516</b>	<b>The Quest for a Form in Fashion Design</b>	<b>2+1 7.5</b>
The Quest for a Form in Fashion Design: Shape, Form, Dimension, Two Dimension, Three Dimension, Modelling, Application, Technical Research; Extraordinary Researches and Applications on Design; Design and Form; Body Art Studies; Formless Applications; Design Solutions; Functional Design; Form Research: Theories of Form Applications on Different Fabrics, Constructivism, Kubism, Analyzing the School of Bauhaus.		

- MOD517 Design, Art and Fashion Relationship 3+0 7.5**  
Introduction to Design, Art and Fashion relations: Non-verbal communication between art and fashion, Relationship between artistic creation and design; Assessment of selected subjects by students in terms of design; Intellectual and Functional Relations on Fashion Design and Fashion Fact: Assessment of selected subjects; Student designs and assessment of selected student designs.
- MOD518 Computer Based Technologies for Textile and Print Design Simulation 3+0 7.5**  
Introduction to Textile and Print Design: Background on fabric and print design; Fabric Types and Production Methods; Print Design and Printing Machines: Traditional methods and digital printing; Role of Computer Technology in Textile and Print Design; Main Computer Technologies and Software in Textile and Print Design; Benefits and Limitations of Computer Based Technologies for Textile and Print Design; Challenges and Future Trends.
- MOD519 New Approaches to Design of Fashion Accessories 3+0 7.5**  
Definition of Accessories Design: Place and importance of accessories in fashion design, Sources; Creating a Collection of Accessories; Preparing a Collection; Market analysis, Distribution research, Synthesis of trends, Main idea, Compliance with formal design in accessories, Knowledge of materials, Choosing the correct material for design, Design applications, Project implementation; Determination of Design Criteria; Criticism in a Studio Atmosphere; Seminars and Evaluation by Juries.
- MOD520 Experimental Draping 1+2 7.5**
- MOD521 Fiber Art I 3+0 7.5**  
Introduction to the History of Contemporary Textile Arts; Mini Textile Applications with Plant Fiber: Producing three-dimensional fiber art works in free and modular forms; Examination of Contemporary Fiber Arts Works; Contemporary Interpretation of Traditional Techniques in Textile Arts; Relationship Between Space and Fiber Art; New Creative Quests in Fiber Arts.
- MOD522 Fiber Art II 3+0 7.5**  
Yarn and Fabric Applications in Textile Arts: Examination of contemporary art works by yarn and fabric specimens; Modern Textile Art Applications in Line with Design Principles; Investigation and Discussion of Modern Textile Art Samples; Three-dimensional Surface and Space Practices with the Use of Yarn and Fabric.
- MOD523 Philosophy of Design 3+0 7.5**  
Concepts of Philosophy and Aesthetics; Use of Design Theories and Principles in Fashion and Textile Design; Relationship between Philosophy, and Industrial Textile Design and Fashion Design; Philosophical Analysis of the Reflection of Urban Culture in Public Sphere through Textile and Fashion Products; Critical Evaluation and Interpretation of Contemporary Design Products via Philosophical Methodology.
- MOD524 Applied Studies on Natural Dyeing 2+1 7.5**
- MOD525 Experimental Printing Design 3+0 7.5**  
Information about Printing Techniques: Analysis of textile literature, Block printing applications on fabric, Screen printing applications, Alternative new screen printing, Applications of transferred printing, Digital printing design, Mixed printing applications, Cross techniques applications, Different techniques applied by combined and diagonal methods, New experimental ideas, Preparing a presentation of prints produced, Alternative new prints on fabrics.
- MOD526 Cultural Approaches in Fashion and Textile Design 3+0 7.5**  
Textile as a Craft: The history of textile; The Industrial Revolution: Industrial revolution and the new world order, The industrial revolution, Science, art, Culture and social impacts, New requirement for textile- Training of Fashion Design, Debates on the original- local-conventional, Innovation in Art and Design, The technological developments and the concept of alienation in the 20th Century, Basis of the Development through of Women's Clothing Fashion, Quest for Authenticity and causes of Women's Clothing design in 20th Century of Design, Cultural Propositions in Women's Clothing, The variability of culture, The locality and modernity- Traditional - the original quest of the examination of Fashion's definition, 728
- MOD527 Wearable Art 1+2 7.5**  
Basic Concepts: Conceptual art, Art and design, Wearable art; Themes: Classical art, New constructivism, Modern art, Textile design, Place and importance of textile design in fashion, Performance arts, Avant-garde fashion, Traditional Japanese art, Sustainable fashion, Concepts of green textile and slow fashion; Research on Wearable Art Materials:

Identification of a theme, Methodology, Discussion of literature survey, Determination of techniques and materials, Application process, Report writing and presentation.

**MOD528 Youth Subcultures and Fashion 3+0 7.5**

The concept of culture and definitions: Judge (ruling) culture, Popular culture, Mass culture, Folk culture, High (elite) culture; Definitions of subculture, Sociology of subculture, Formation of subculture, Fashion from 1950 to 1980, Youth subcultures from 1950 to 1980: Reggae, Ted, Mod, Hipster, Beat, Skinheads, Hippie, Punk, Glam - Rock; Techniques of creating style of youth subcultures, The industrialization of fashion belonging to the youth subcultures, The influence of the clothing of youth subcultures on fashion designers and brands.

**MOD529 Cultural Approaches in Fashion Design 3+0 7.5**

Clothing History, semiotics, Iconic Community, clothing and aesthetic, Fashion and psychology, The industrial revolution, new world order, textile and fashion design education, the original- local-conventional, Innovation in Art and Design, Development of Textile Industry, Arts&Crafts movement, the aesthetic movement, wearable design suggestion, technological developments, Women's Clothing and Fashion, Cultural Propositions in Women's Clothing, The variability of culture, The definition of fashion as the phenomenon are discussed.

**MOD530 Creativity in Clothing Design 3+0 7.5**

Concepts of Design and Creativity; Creativity in Design Process: Preparation, Incubation, Illumination, Evaluation; Creative Thought Theories: Gestalt theory, Psychoanalytic theory, Perceptual theory, Factorialist theory, Humanistic theory, Cognitive development theory; Features of the Creative Designer; Criteria of Creative Design: Originality, Functionality, Aesthetics, Production quality, Suitability to target group, Flexibility, Fluency; Factors Affecting Creativity: Motivation, Medium, Environment and Society, Family, Attitudes, Doctrines.

**MOD531 Textile Surface Applications in Wearable Art 1+2 7.5**

Textile Surface Research: Application technique, Printing- Dyeing technique, Sewing- Embroidery technique, Weaving- Knitting technique, Folding- Crushing technique; Modern Art: New constructivism, 2000s, Performance arts, Body art; New Approaches on Design: Contemporary art and wearable art, An importance of textile design; Place of Wearable Art and Importance on Fashion Phenomena: Technical solutions of wearable art, Contemporary textile surfaces, Wearable art and sustainability, Wearable art avantgarde textile surfaces application; Ecological Textile Surface Applications: Green textile slow fashion, Eco- Design application.

**MOD532 Sustainability in Textile and Fashion Design 3+0 7.5**

The Concepts and Applications of Recycling, Upcycling, Product Life Cycle, Sustainability, Sustainable Design; Sustainability Practices and Environmental-Friendly Production Methods in Textile and Fashion Industry; New Trends in Sustainable Textile and Fashion Design; Evaluation of Recycling and Upcycling Opportunities for Textile Wastes Through Case Studies; Recycling and Upcycling of Textile Wastes; Reporting and Evaluation of Experimental Studies.

**MOD533 Garment Comfort 3+0 7.5**

Human-Garment-Environment Interactions; The Concepts of Textile and Garment Comfort; The Importance and Components of Garment Comfort; The Attitude and Expectations of Users Towards Garment Comfort; Classification of Comfort; Factors Affecting Garment Comfort; The Effect of Material, Manufacturing technology and material construction on comfort properties; Comfort Properties of Textile Materials in the Form of Fibre, Yarn and Fabric; Garment Comfort Test Methods.

**MOD534 Natural Printing Applications in Wearable Art 1+2 7.5**

Definition and History of Wearable Art; Methods and Techniques Used in Wearable Art; Examination of Textile Artists and Their Works in the Field of Natural Printing; Definition and History of Natural Printing Technique; Types of Natural Printing; Types of Plants, Mordants and Application Methods Used in Natural Printing; Natural Printing Applications on Cotton, Silk, Linen, Wool, Leather; Experimental Studies with Rust Printing; Spirit Cloth Design Applications; Evaluation of Applications.

**MOD535 Digital Technologies for Textile and Garment Design 3+0 7.5**

Introduction to Textile Design: Basics of woven and knitted fabric design; Fabric Types and Production Methods: woven fabrics, preparation processes, weaving process, knitted fabrics, knitting process; The Role of Computer Technologies in Textile and Garment Design; Computer Technologies and Software used in Textile Design: software used in woven fabric design, software used in knitted fabric design, software used in printing design; Software and Technologies Used in Garment Design: three dimensional dimensioning systems, pattern software, 2D garment simulation, 3D garment simulation, fit control; Benefits and Limitations of Digital Technologies Used in Textile and Garment Design; Challenges and Future Trends.719

**MOD536 Research Methods and Applications in Textile and Fashion Design 3+0 7.5**

Basic Concepts of Science; Scientific Paradigms; Quantitative Research Design: Descriptive and .... Models, Experimental Methods; Data Analysis in Quantitative Research: Descriptive Data Analysis, Parametric Data Analysis, Non-parametric data analysis; Qualitative Research Design: Ethnographic research, Phenomenological research, Case Study, Historical study, Action research, Narrative research, Grounded theory; Writing Scientific Research, Presenting Scientific Research.

**MOD537 Fiber Art 3+0 7.5**

Introduction to the history of contemporary textile arts; Mini Textile Applications with Vegetable Fibers: Production of superficial and three-dimensional free and modular forms using fiber-cored structures, Examination of contemporary fiber arts examples, Contemporary interpretations in textile arts, Space and fiber art relations, Yarn and fabric usage in fiber arts: Yarn and fabric usage examination of contemporary art application examples, contemporary textile art applications in accordance with design principles and principles are realized, surface and three dimensional applications obtained by using yarn and fabric are examined.

**MOD538 Fashion Sociology 3+0 7.5**

MOD 538 Fashion Sociology 3+0 7,5 Fashion and Dress: Etymology of fashion, early fashion research; Fashion and Social Change: The role of fashion in social change, Symbols of Status, Symbols of belonging; Fashion and Gender: Dress and fashion differentiation, Fashion and ambiguity; Fashion Industry: Historical development of fashion industry, Fashion industry as a cultural industry, Fashion cities and events; Fashion Media: Fashion journals, The myth of designer, Gatekeeping.

**MOD539 Fashion Design Presentation and Graphic Design Relation 1+2 7.5**

Presentation Fashion Design: Research keywords, Reading, Writing, Illustrative overview, Narrative technique graphic; Thematic Approach: Creating the story, Key words and the symbolic approach, Keywords, and surface design; Graphic Expression in Clothing Design: Fashion design and graphic perception; Presentation of Fashion Design and Illustration : The transfer graphic of the story; The Importance of Graphical Perspective: The methodological approach in the presentation of fashion design; Textile to the Surface of Transfer; Transfer Applications for Graphic; Perceptual Lecture.

**MOD541 Textile and Garment Comfort 3+0 7.5**

Human-Garment-Environment Interactions; The Concept of Textile and Garment Comfort; The Importance and Components of Textile and Garment Comfort; The Attitude and Expectations of Users Towards Textile and Garment Comfort; Classification of Comfort; Factors Affecting Textile and Garment Comfort; The Effect of Material, Manufacturing Technology and Material Construction on Comfort Properties; Comfort Properties of Textile Materials In the Form of Fibre, Yarn and Fabric; Garment Comfort Test Methods.

**MOD542 Fashion and Nature 3+0 7.5**

The Concept of Circularity: Biological cycle, Industrial cycle, Sustainability, Ethics, Value; Material Flows: Downcycling, Recycling, Upcycling, Waste, Discard; Circular Design: Design for circularity, Design for sustainability, Circular economy; Fashion and System: Fashion system, Fashion ecosystem, Transition design, Blockchain technology, Circular fashion system; Fashion and Nature: Biomaterials, Biomimicry, Biodegradability, Ecological design, Ecological fashion.

**MOD543 Applied Studies on Natural Dyeing 2+1 7.5**

Sustainability Practices in Textile Dyeing; Principles and Current Status of Natural Dyeing; Sources, Types and Extraction of Natural Dyes; Definition, Classification and Use of Mordants in Natural Dyeing, Determination of Suitable Dyes for Cellulose, Protein and Synthetic Fibers and Relevant Pre-treatments, Extraction of Dyes; Preparation and Dyeing of Different Textile Materials, Optimization of Pre-treatment, Extraction, Mordanting and Dyeing Processes; Measurement of Fastness Properties; Making Proposals to Improve Fastness Properties

**MOD544 Innovative Approaches in Textile Design 3+0 7.5**

Innovation Concept; Definitions, Methods, Application areas Innovative Design Approaches; Innovation and design relationship, Innovative design processes and application areas, Examination of innovative design approaches in the context of textile design and case studies Innovative Approaches in Textile Design; Production methods, Structure and form searches, Resources and materials; Applications and usage areas, Future scenarios etc.

**MOD545 Art and Fashion Concept in Design 3+0 7.5**

Art, Design and Fashion Throughout History; Art Movements: Modern art movements; Design Schools: Bauhaus, Arts and Crafts movement; The industrial Revolution and Development of Fashion Industry; Research on Fashion Movements and Fashion Styles: Anti-Fashion movements, The relationship of subculture fashion with art and design; Analysis of Interaction Between Art, Design and Fashion Throughout History; Evaluation of Research Results.

**MOD546 Biomimicry and Biodesign in Textiles 3+0 7.5**

Biomimicry and Biodesign Concepts; Definitions, Historical process and development, Case studies from past to present Design Approaches Related to Biomimicry and Biodesign; Examination of design approaches such as sustainable design,

circular design, material-oriented design, environment-oriented design, non-human-oriented design, etc. in the context of "Biomimicry and Biodesign" concepts Biomimicry and Biodesign Practices in Textile Design; Innovative material, form and function searches and examination of application cases.

**MOD547 Fashion and Memory 3+0 7.5**

Fashion Concept: Fashion, Textile, Material culture; Concept of Memory: Memory, Remembrance, Memoir, Recollection, Story, Record, History, Past, Present, Future, Individual memory, Cultural memory; Object Ontology: Object Theory, Object Oriented Ontology, Hyperobjects, Actor, Effect, Interaction, Communication, Image, Assemblage; The Relationship Between Fashion and Memory: Fashion studies and memory, Material culture studies and memory.

**MOD548 Draping Applications in Fashion and Art Relationship 2+1 7.5**

Basic Terms About Draping: Mannequin and body differences, Drape, Draping, Pattern, Proportion, Measurement; The Importance of Draping in Fashion and Art; Applying the Design on the Mannequin with Draping Method; Converting Three Dimensional Pattern to Two Dimensional Pattern; Draping Studies with Different Materials, Model Applications: Symmetrical model, Asymmetrical model; Fixing on the mannequin; Prototyping; Presenting the finished product; Criticizing the product.

**MOD549 Interior Textile Design 2+1 7.5**

The Use of Textiles in the Interior in the Historical Process; Properties of Interior Textile Products: Physical, Technical, Aesthetic; Textiles Used in Interiors: Upholstery, Window, Floor, Bedroom, Bathroom, Kitchen, Wall and Ceiling textiles; Aesthetic Criteria in Interior Textiles: Color, Pattern, Texture, Style, Period, Trend; Identity in Interior Design, Design and Presentation Board Preparation; Design Application Studies for Interior.

**MOD592 Seminar 3+0 7.5**

**MOD701 Research in Area of Specialization 3+0 4.5**

**MOD702 Research in Area of Specialization 3+0 4.5**

**MOD790 Thesis 0+1 30.0**

**PLT501 Aircraft Performance and Operation Analysis 3+0 7.5**

Basic Definitions: Standard atmosphere, General performance requirements, Forces acting on an aircraft and axis; Symmetrical Steady State Flight: Horizontal flight and cruise performance characteristics, Climb performance characteristics, Descend and glide performance; Take-off: Take-off distance and take-off performance characteristics; Landing: Landing distance and landing performance characteristics; Curvilinear Flight: Turn performance and characteristics, Climbing and descending turns, Helicoidal and spiral climb, Descend and spin, Spin recovery; Cruise Range and Endurance.

**PLT503 Aviation Research 3+0 7.5**

History of Aviation Research: American aviation research, NASA and FAA, European aviation research and space strategy, Turkish aviation research; Needs for Aviation Research; Aviation Research and Development Vision; R&D Politics and Strategy; R&D Methodology; R&D Resources: Human resources, Finance, Technical infrastructure; Know-How, Regulations, etc.; Innovation and Entrepreneurship; Intellectual and Industrial Property Rights; R&D Culture and Education; R&D Organization and Cooperation; R&D Software; R&D Strategic Management; Relationship Between R&D and Economic Development; Innovations in Aviation Industry; Sample Research Studies.

**PLT504 Aviation Safety Cases 3+0 7.5**

Classification of Factors Affecting Aviation Safety; Flight Operation-oriented Accidents: Flight crew, Communication and procedural errors; Aircraft-oriented Accidents: Design and material failures; Maintenance-oriented Accidents: Personnel and procedural errors; Airport/Air Traffic Control-oriented Accidents: Midair and runway collisions; Accidents due to Meteorological and Geographical Conditions; Security-oriented Accidents: Terrorist attacks and security errors.

**PLT505 Statistical Methods in Aviation 3+0 7.5**

Using Statistical Analysis in Airline Operations; Data Collection and Analysis; Basic Statistical Concepts: Summary of numerical knowledge, Probability, Sampling, Point forecast, Period forecast, Hypothesis testing, Correlation and regression

analysis, Variance analysis; Using Software in Analysis; Analysis of flight data, Data collection, Data categorization, Analysis, Reports.

**PLT506 Airlines 3+0 7.5**

Concept of Airline Transportation; Economic Characteristics of Airlines; History of Air Transportation; Airline Deregulation; Airline Operation Costs; Airline Marketing; Product Planning and Pricing; Demand for Air Transportation and Factors Affecting the Demand; Traditional Carriers, Charter Carriers, Regional Carriers, Low Cost Carriers, Air Cargo Carriers.

**PLT508 Aircraft Performance Optimization 3+0 7.5**

Maximum and Minimum Theory, Maximums and Minimums of Multi-Variable Functions, Lagrange Multipliers; Optimization; Optimization Conditions of Performances in Steady State Flight; Turns in Level Flight; Maximum Rate of Climb in a Constant Radius Helicoidal Climb; Maximum Bank Angle in a Helicoidal Climb; Minimum Radius of Turn in a Helicoidal Climb; Maximum Angular Velocity in a Helicoidal Climb; Calculation of Flight Altitude for Maximum Level Flight Speed; Maximum Range for a Given Flight Altitude; Optimization of Rate of Descent in a Helicoidal Descent; Minimum Flight Path Angle in a Helicoidal Descent.

**PLT509 Advanced Flight Mechanics 3+0 7.5**

Basic Definitions - Aircraft Control Surfaces and Characteristics; General Conditions of Equilibrium and Stability; Longitudinal Static Equilibrium and Stability; Symmetrical Maneuver Analysis; Aircraft Equations of Motion; Analysis of Symmetrical Maneuvers by Non-dimensional Equations; Longitudinal Static Stability Analysis; Longitudinal Dynamic Stability Analysis; Fixed Stick Stability Analysis; Free Stick Stability Analysis; Study of Longitudinal Behavior and Unsymmetrical Movements; Lateral Equilibrium and Stability; Equilibrium and Stability Analysis of Special Flight Maneuvers.

**PLT511 Aircraft Icing 3+0 7.5**

Introduction; Meteorological Aspects; Icing Physics; Parameters Affecting Icing; Ice Accretion Prediction: Supercooled droplet trajectories, Droplet impact, Droplet collection efficiency, Thermodynamic analysis, Ice growth rates, Extended Messinger Model, Runback water 2-D and 3-D ice accretion simulation, Supercooled large droplets, Icing related to ice crystals, Icing certification (Federal Aviation Regulations, Part 25, Appendix C, O, P).

**PLT512 Data Science in Aviation 2+1 7.5**

**PLT513 Mathematical Calculations in Aviation 3+0 7.5**

Ordinary Differential Equations: Modeling, Geometric meaning, Existence and uniqueness of solutions, Homogenous linear equations, Euler-cauchy equations, Nonhomogenous linear equations, High order linear equations, Phase plane, Laplace transforms; Linear Algebra and Vector Calculus: Linear system equations, Vector spaces, Eigenvalue problems, Vector differential calculus, Grad, Div, Curl; Partial Differential Equations: Fourier series, Integrals and transforms; Complex Analysis: Power series, Taylor series, Laurent series and Residue Integration, Conformal Mapping.

**PLT515 Aircraft Sequencing and Scheduling Modelling 3+0 7.5**

**PLT516 Introduction to Unmanned Traffic Management 3+0 7.5**

Basic Concepts: What is Unmanned Traffic Management, Scope of Unmanned Traffic Management, Unmanned Traffic Management Operational Concepts, Unmanned Traffic Management Stakeholders, Unmanned Traffic Management Structure, Unmanned Traffic Management Data Communication, Security and Privacy, Unmanned Traffic Management Safety Risk Assessment, Unmanned Traffic Management Operational Scenarios, The Future of Unmanned Traffic Management.

**PLT517 Forecasting Methods in Aviation Operations 3+0 7.5**

**PLT519 Machine Learning in Aeronautics 2+1 7.5**

**PLT521 Operations Research in Aviation 3+0 7.5**

**PLT523 Introduction to Data Science with Python 2+1 7.5**

Basic Concepts: Artificial Intelligence, Machine Learning, Deep Learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Jupyter / Colab Environment; General Recap; Linear regression: Data Preparation, Simple Regression, Multiple regression; Error Metrics: R- squared, MAE, MSE; Logistic Regression: Sigmoid Function, F1 score, Confusion Matrix, ROC; Decision Trees: Basics, Terminology, Gini index, Entropy; Regularization: Overfitting, underfitting, Lasso, Ridge; Ensemble Learning: XgBoost; Unsupervised Learning: Clustering, K-means, Silhouette Score; Aeronautics Applications.

**PLT525 Navigation in Aviation 3+0 7.5**

Basic Concepts: General Navigation, Fundamentals of Navigation, Solar System, Earth, Time and Time Conversions, UTC, LMT, Directions, Latitude and Longitude, Distance Calculation, Magnetism and Compasses, Graphs, Current Aviation Maps, Speed, Wind Speed and Direction Calculation, Altitude Calculation, Altitude Corrections, Climbing and Descent Navigation, Calculated Navigation, In-flight Navigation.

**PLT592 Seminar 3+0 7.5**

**PLT790 Thesis 0+1 30.0**

**PSi606 Psychology in Architecture Design 3+0 7.5**

Psychology- Architecture and Space Relations; Territory, Personality- Identity, Personal distance, Social distance, Privacy; Psychology of the user: The effects of spaces on people, Examples on the topic, Private and unprivate spaces, Analysis of Different Spaces; Psychology of the architect: Studies on designers and their approach.

**PZL532 Sport Marketing Management 3+0 7.5**

Introduction of Marketing Rules and Applications in Sport; Characteristic of Sport Marketing; Sport Marketing Management Process; Strategies in Sport Marketing Management; Planning and Object Determining; Sport Consumer Behaviors; Strategies of Segmentation and Positioning in Sport Marketing; Marketing Mix and its Strategies in Sport; Sponsorship and Promotion Techniques in Sport Marketing; Coordination, Application and Control of Marketing Management Functions; Current Developments in Sport Marketing Management; Case Studies in Sport Marketing.

**PZL533 Integrated Marketing Communications in Sport 3+0 7.5**

Sport and Communication; Concept and context of communication, Communication theories, Globalization and communication, Sport and media relation, Communication dimensions of marketing communication mix in sport, The process of IMC in sport. Applications of Marketing Communication Components in Sport; Sport public relation and management, Advertising activities in sport and management, Personal selling in sport, Sales promotion mix in sport and management, Direct marketing in sport, Sport sponsorship, Event management in sport. Sport Brand Communication; Case studies, Brand placement in sport. Marketing. Communication Planning Process in Sport.

**PZL610 Consumer Behaviours 3+0 7.5**

Introduction to Consumer Behaviour: Importance of consumer behaviour in marketing, Concept and characteristics of consumer behaviour, Interdisciplinary approach in consumer behaviour, Common pattern of consumer behaviour, Relationship between consumer behaviour and marketing strategy; Psychological Effects: Learning and memory, Motivation and interest, Perception, Manners and changing of manners, Personality, ego and lifestyle; Sociocultural Effects: Cuncelor groups, Family, Personal effects, Social class, Culture; Consumer Purchasing Process; Society and Consumer Behaviour: Protection of consumer and conscious of consumer.

**REK 629 Urban Life and Recreation 3+0 7.5**

Environment, City and Urbanization; City and Urban Space; Urban Life and Stress; Life Quality, Stress and Recreation; Urban Space and Recreation; Urban Landscape and Recreation; Leisure Requirements and Recreation; Recreation Activities and Participation; Recreation and Participants with Special Needs; Design of Recreation Areas and Spaces; Recreation and Accessibility for All.

**REK511 Academic Writing, Publishing and Presentation Techniques 3+0 7.5**

Preparing Scientific Texts: General spelling and rules, Formal structure and technical rules, Section of scientific text; Preparing Thesis Proposal and Writing Thesis; Scientific Article Writing: The structure of the article, Deciding the heading, The clues of writing the abstract, Deciding keywords, Introduction, Theoretical Framework/Literature Review, Research method, Data analysis and reporting the findings, Discussion and conclusion, Acknowledgement, References, Use of software in preparing the reference list; Mistakes in Writing Article; Formatting The Article for a Journal; Deciding The



Journal: Submitting the article to the Journal, Responding to editor and referee feedbacks; Planning and Preparing Presentation for Congress: Focussing on the aim and content of the presentation, Supporting the presentation with audio-visual tools; The Researcher's Self-Preparation.

**REK512                      Statistical Decision Making and Data Analysis in Leisure Research                      3+0    7.5**

Data in Statistics: The concept and importance of data, Types of data, Features of data types; Data Description and Classification Criteria: Location criteria, Average criteria, Diffusion criteria; Variable in Data Analysis: Variable types, Importance of variable types in statistical decision; Parametric and Nonparametric Test Assumptions: Data type, Sampling feature and number, Variance Homogeneity, Normal Distribution; Hypothesis Tests: One-sample tests, Independent-two-sample tests, Comparison of two independent groups, Dependent two-sample tests, Comparison of more than two dependent groups, Correlation tests; Validity Tests: Content validity, Reference-based validity, Structure validity; Reliability Tests: Parallel tests, Test-retest, Alpha coefficient, Dividing a test into two halves, Correlation between items, Kr method; Original Practices.

**REK513                      Project Management Techniques                      3+0    7.5**

Introduction to Project and Project Management; What is the project?, Classification of projects, What is project management ?, The main point of project management, Project shareholders, Project life cycle, Launch of the project; Project charter, As much as the shareholders, Project launch meeting, Project Planning; Time Management, Planning process, Creating an effective project team, Types of costs, Budgeting, Risk management and planning, Project execution; Project management, Techniques, Management and approaches, Quality management in the project, Monitoring and Control of the Project; Project monitoring and control, Risk monitoring & control, Project closure.

**REK514                      Commercial Recreation Industry                      3+0    7.5**

Basic Concepts of Commercial Recreation Industry; Historical Development of Commercial Recreation; Reflections of Commercial Recreation in the World; Reflections of Commercial Recreation in Turkey; Capitalism, Leisure and Recreation; Economic Dimensions of Commercial Recreation Industry; Sectors of the Commercial Recreation Industry: Private, sector, Public sector, Voluntary sector; Main Areas where Activity and Activity are Structured; Service Organizations and Applications in Commercial Recreation; Basic Characteristics of Recreation Expert; Research Subjects in Commercial Recreation; Points to Consider in Commercial Recreation Research; Techniques Used in Commercial Recreation Research; Applications in Commercial Recreation Research.

**REK515                      Recreation Research in Local Governments                      3+0    7.5**

Concept of Local Government Recreation; History of Local Government Recreation in Turkey and in the World; Recreation Role and Importance of the Local Government; Local Government Recreation Services in the World and in Turkey; Planning Recreation Services in Local Governments; Human Resources Management in Local Government Recreation; Volunteering in Recreation Services in Local Governments.

**REK516                      Quality Management in Recreation                      3+0    7.5**

Quality Concept; Quality Management and Development Process: Quality management approaches; Total Quality Management; Basic Elements of Total Quality Management; Techniques Used in Total Quality Management: Benchmarking, PDCA circle, Quality control circles; Service Quality: Quality in recreation services, Service quality dimensions in the recreation industry, Measuring service quality in recreation industry; Customer Orientation in Quality Management; Leadership in Quality Management; Human Resources Management in Quality Management.

**REK517                      Gender and Sport                      3+0    7.5**

Gender and Basic Concepts; Theoretical Approaches to Gender; Historical Development of Gender Studies in Sports; Woman in the History of Sports; Masculinity and Sport; Gender in Sports Institutions; Gender in International Sports Policy; Historical Process of Women's Participation in Sports and Physical Activity in Turkey; Female Body in Sports; Woman in Sports Media.

**REK518                      Employee Recreation Studies                      3+0    7.5**

The Concept Employee Recreation; Employee Recreation Programs; Employee-Centered Approaches in Employee Recreation; Employer-Centered Approaches in Employee Recreation, Existing Studies in the Scope of Employee Recreation; Employee Recreation and Employee Productivity: The Factors That Affect Employee Productivity on the Basis of Recreational Activities; Participants in Employee Recreation Studies.

**REK519                      Recreation and Brand Management                      3+0    7.5**

Changing Competition and Brand: Brand and Branding Process from Past to Present; Basic Concepts of Brand: Associations, Awareness, Image, Personality; Brand Management in Sports: Brand identity planning models in sports, Communication strategies, Brand positioning and factors which are affecting brand positioning in sports; Brand Management and Integrated Communication in Sports: Characteristics of sports consumers and brand, Corporate communication and brand management; Case Studies for Sports Brands.

- REK520**            **Body Composition and Wellness**            **3+0 7.5**  
Body Composition; Body fat mass, Fat free mass; Body Composition Assessment: Total Body, body segmen; Common Techniques To Assess Body Composition; Hydrostatic Weighing, bioelectrical impedance analysis, air-displacement plethysmography, dual-energy X-ray absorptiometry, skinfold and girth measurements; Effect of Body Composition on Performance Sports; Individual sports, team sports.
- REK521**            **Customer relationship strategies in recreation**            **3+0 7.5**  
Relationship marketing concept; Aims of relationship marketing; Relationship width; The concept of relationship quality; Relationship composition; Relationship strength; The concept of relationship activity; Relationships between relational marketing and performance outcomes; Traditional marketing; Differences between traditional marketing and relational marketing; Concept of management of relations with customers; The goals of customer relationship management; Relationship management with customers in recreation; Electronic customer relationship management strategies in recreation; Customer relations management strategies applied in recreation service facilities and organizations.
- REK523**            **Motor Development and Physical Fitness in Individuals with Special Needs**            **3+0 7.5**  
Basic Concepts: Motor development, Motor control, Motor learning, Motor skill, Motor performance; Motor Development Stages; Motor Development Theories; Motor Learning Principles; Classification of Motor Skills; Physical Fitness; Basic Components of Physical Fitness: Aerobic function, Body composition, Musculoskeletal function, Agility, Reaction, Balance; Body Awareness and Posture.
- REK525**            **E-sports Management**            **3+0 7.5**  
History of Esports and Esports Management: The beginnings of esports, Esports vs. traditional sports, Commercialization of esports; The Esports Industry: Structure, Stakeholders, Primary stakeholders, Secondary Stakeholders, Leagues and events, Professional vs. recreational esports; Managerial Issues in Esports management: Functional areas of management in esports; Marketing in Esports: The marketing mix, Esports marketing, Traditional marketing vs. esports marketing, Current issues in esports marketing; Careers in Esports and Esports Management: Esports careers, Esports players, Esports management, Job opportunities in esports.
- REK527**            **Qualitative Research Methods**            **3+0 7.5**  
The Characteristics of Qualitative Research; Strategies of Inquiry; The Researcher's Role; Data Collection Procedures; Data Collection Types: Qualitative observation, Qualitative interviews, Qualitative documents, Qualitative audio-visual materials; Data Recording Procedures; Data Analysis and Interpretation; Ensuring Quality in Qualitative Research: Reliability, Validity, Generalizability; Writing Qualitative Report; Ethics and Data Management in Qualitative Research.
- REK592**            **Seminar**            **3+0 7.5**
- REK611**            **Recreation Policies**            **3+0 7.5**  
Choosing Leisure: Social theory, class and generations; Outdoor Recreation and the Environment; Television, Deregulation and the Reshaping of Leisure; Leisure, Gender and the Citizenship: New leisure culture; Risky behaviors in leisure and young people; States, Markets and New Media; Web 4.0: Mashing Up Work and Leisure; Tourism and Transformation; Sport and Lifestyle: Politics in Leisure Activities; Music and Leisure in an Era of X Factor and Digital Pirates; Reflections of New Leisure Policies; Leisure Policies in Turkey.
- REK613**            **Psycho-Social Issues In Leisure Research**            **3+0 7.5**  
Relationship Between Psychology And Leisure: Personality and leisure, Subjective well-being and leisure, Satisfaction and leisure, Emotional disorders and leisure, Stress and the role of leisure in stress management; Relation of Sociology and Leisure: Gender and leisure participation, Socio-economic factors and leisure participation, Social problems and leisure participation; Psychosocial research with theoretical basis: Basic theories of psychology and leisure research, Basic sociology theories and leisure research; Specific Applications In Leisure-Time Psycho-Social Issues; Academic Research On Psycho-Social Issues For Leisure.
- REK615**            **Experimental Practicies in Recreation and Leisure Research**            **3+0 7.5**  
Experimental Research Model: Definition of experimental research, Types of experimental research, Differences of experimental research, Advantages and disadvantages; Variable in Experimental Research: Variable types, Variable control; Validity and Reliability in Experimental Research: Internal and external validity, Reliability; Experimental Research Model Studies: Experimental research samples from different fields, Examples from the field of sports sciences, Examples from the field of leisure and recreation; Planning.
- REK617**            **Technology Based Leisure**            **3+0 7.5**

Leisure in Digital Age; Electronic Leisure; Virtual Leisure; Leisure and Internet; Leisure and Digital Games: Active video games, Computer games; Leisure and Social Media; Home-based Digital Leisure; Digital Leisure Addiction Model; Artificial Intelligence Applications and Leisure; The Effects of Technology Based Leisure: Positive effects of technology based leisure, Negative effects of technology based leisure; The Place of Digital Applications in Research in the Field of Leisure.

**REK619 Risk Management in Recreation 3+0 7.5**

What is Risk: Key concepts; Distinctive Characteristics of the Sport and Recreation Managing Risk; An Overview of Risk Management Process for Recreation Activities: Defining the scope of the risk management activities; Risk Assessment; Components of a Risk Techniques and Approaches to Assessing Risks; Analyze the Risks: Types of analysis measurement and scales; Evaluate the Risks; Risk Tolerance, Risk Treatment and Preparing and Implementing a Risk Treatment Plan; Monitoring and Review; Risk Management Performance: Elimination of the risks in sports and recreation, Measurement of risk perception and measure instrument: indoor and outdoor; Trends in Risk Management Sector; Relationship Between Recreation And Perception Of Personal, Social And Cultural Risk.

**REK621 Human Resource Management in Recreation 3+0 7.5**

The Importance of Human Resources in Recreation; Volunteers and Volunteering in Recreation; Professionals and Professionalism Concepts; Customers as Human Resources in Recreation Services; Abilities and Personality; Values and Motivation; Organizational Justice; Job Design; Staffing and Career Considerations; Leadership; Performance Appraisal; Reward Systems; Internal Marketing in Recreation Services.

**REK623 Leisure Experience Design and Management 3+0 7.5**

Experience Concept: Experience from a marketing perspective, Tourism experience, Leisure experience; Leisure Experience Stages: Decision making phase, On-site experience, Recollection/Reflection phase; Expanded Leisure Experience; Leisure Experience Management Model; Leisure Experience Design: Experience value curve, Design phases of experience; The Measuring of Leisure Experience; Factors Related to Leisure Experience; Leisure Experience Quality; Factors Related to Leisure Experience Quality.

**REK625 Leisure Consumer Psychology and Behavior 3+0 7.5**

Psychological Bases of Consumption Behavior; Consumption Behavior and Related Theories; Consumption and Identity; Hedonic Consumption Psychology; Consumption Gender; Leisure Consumption in Digital Era; Consumer Purchasing Behavior; Internal Effects on Consumer Behavior; External Effects on Consumer Behavior; The Emergence of the Need; Researching Information; Evaluation and Selection of Alternatives; Purchasing; Post consumption Intention.

**REK627 Sustainability and Recreation 3+0 7.5**

Introduction to Sustainability: Basic dimensions of sustainability, environmental sustainability, social sustainability, economic sustainability, sustainable development; Relationship between Sport and Sustainability; Relationship between Recreation and Sustainability; Social Sustainability and Recreation, Environmental Sustainability and Recreation, Economic Sustainability and Recreation, Sustainability in Sports and Recreation Activities; Sustainable Approaches in Sports and Recreational Organizations and Event: sustainability practices in national and international organizations and events, case studies.

**REK631 Health and First Aid 3+0 7.5**

First Aid and Emergency Care; Basic Applications in First Aid; First Aid in Respiratory, Heart and Circulatory System Emergencies; Emergency Situations and First Aid in Schools: First aid in shock, First aid in bleeding, First aid in injuries, First aid in poisoning; First Aid in Spine Injuries; First Aid in Upper Extremity Injuries; First Aid in Lower Extremity Injuries; First Aid for Sprains; First Aid for Students with Special Needs.

**REK633 Qualitative Data Analysis 3+0 7.5**

The Nature of Qualitative Analysis; Data Transcription Methods; Qualitative Data Analysis: Thematic coding and categorizing, Grounded theory development; Analyzing Biographies and Narratives; Comparative Analysis; Phenomenology; Interpretative Phenomenological Analysis; Analytic Quality and Ethics; Getting Started With Computer-Assisted Qualitative Data Analysis; Searching and Other Analytic Activities Using Software.

**REK692 Seminar 3+0 7.5**

**REK701 Research in Area of Specialization 3+0 4.5**

**REK702 Research in Area of Specialization 3+0 4.5**

<b>REK790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>REK890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>REK890-0</b>	<b>Thesis( Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>REK901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>REK902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>RYL502</b>	<b>Entity in Charge of Maintenance and Certification for Railway Vehicles</b>	<b>3+0 7.5</b>
Quality Management System; Maintenance Management; Relationship and Responsibilities and of Main Actors in ECM Certification Process; Main Actors Responsibilities in Operation of Railway Vehicles; Maintenance Management Systems Before ECM Regulation; ECM Business Models; Management; Maintenance Development; Fleet Maintenance Management; Maintenance Supply; Relationship Between ECM Functions; Purpose of Maintenance Workshop Certification; Certification Process; Checklist for Evaluation of Maintenance Workshops; Procedure Example.		
<b>RYL503</b>	<b>Certification of Railway Vehicles</b>	<b>3+0 7.5</b>
Interoperability; TSI; Basic Requirements; ERA; OTIF; UTP; Subsystem; Interoperability Constituent; Actors in the Certification Process; EC Verification of Railway Vehicle as Subsystem; Certification Process of Railway Vehicle Constituents; Notified Body (NoBo); Nando; NB Rail; National Rules; Notif-IT; RDD; DeBo; DDGM; Evaluation Modules; Technical File; APS; Accreditation; ERADIS; NSA; National Vehicle Registration (NVR); IRIS.		
<b>RYL504</b>	<b>Energy Management in Rail Systems</b>	<b>3+0 7.5</b>
Energy Terminology: Energy units, Exergy analysis, Energy saving; Measurement and Control: Thermal Value Measurement, Maintenance of Measuring Devices; Turkey and the World Energy Outlook on Renewable Energy; Energy Consumption in Rail Systems; Energy Saving: Comparison of fuels; Energy Efficiency: Energy Efficiency in Transportation; Energy Analysis; Energy Recovery in Rail Systems; Energy Analysis Applications in Rail Systems: Energy flow diagrams, Energy scanning / audit.		
<b>RYL505</b>	<b>Introduction to Railway Vehicle and Track Interaction</b>	<b>3+0 7.5</b>
Relationship of Wheelset and Track; Characteristics of Wheel-Rail Contact Geometry; Vehicle Run in a Straight Track; Vehicle Run Through a Curve; Vehicles with Tilting Technology; Vehicle Guiding Through a Curve; Safety Verification Against Derailment; Rail Vehicle Suspension System; Mathematical Expressions of Suspension Elements .Mathematical Expressions of Suspension Elements. Mathematical Expressions of Suspension Elements.		
<b>RYL506</b>	<b>Urban Rail Transit System Design and Livable Cities II</b>	<b>3+0 7.5</b>
Urban Rail Transit Stations; Urban Vehicle Units, Array and Configurations; Operations, Performance, and Costs: Vehicle/Train travel control and automation, Performance characteristics of rail modes, Rail transit costs; Urban Rail Transportation System Networks, Lines and Organizations; Operating Elements: Lines, networks, stops and stations, Vehicles, transportation units and fleet, Intervals and frequencies, Capacity, Travel time and speed; Rubber-Tired Rapid Transit; Present and Future Role of Rail Transit.		
<b>RYL507</b>	<b>Dynamics of Railway Systems</b>	<b>3+0 7.5</b>
Introduction to Dynamic Analysis; Numerical Methods for Finding Dynamic System Response; Vehicle and Rail Models; Ray-Wheel Interaction: Geometric interaction, Normal interaction, Tangential interaction; Dynamic Response of a Wheel Set; Dynamic Response of a Rail Vehicle; Dynamic Response of Vehicle to Curve; Special Topics in Rail System Vehicle Dynamics; Experimental Study on Rail System Vehicles.		
<b>RYL508</b>	<b>Design of Experiment</b>	<b>3+0 7.5</b>

Use of Experimental Design and Statistics in Scientific Studies; Descriptive Statistical Techniques: Means, Mode, Median, Standard deviation, Variance, Measures of distribution, kurtosis and skewness; Distributions and Hypothesis Testing: Z-test, T-test, F-test, Analysis of variance; Regression and Correlation; Teaching the Use of Minitab Program; Modern Experimental Design Methods; Partial Factorial; Fully factorial; Taguchi Experimental Design: Taguchi Experimental Design Applications.

**RYL509                    Diagnostics and Monitoring in Railway Systems                    3+0   7.5**

Introduction; Fundamentals of Diagnostics and Prognostics; Mechanical Vibration; Preventive / Predictive Maintenance; Vibration Analysis; Transducers; Vibrodiagnostics; Acoustic Diagnostics; Model Based and Data Driven Methods; Stationary Techniques in Railway Vehicle Diagnosis; Wayside Techniques in Railway Vehicle Diagnosis; Wheel Defects and Detection; Bearing and Gearbox Fault Detection; Classification of Faults.

**RYL510                    Air Conditioning and Ventilation                    3+0   7.5**

Basic concepts; Psychrometry: Humid air, Relative humidity and enthalpy, Wet and dry thermometer, Psychrometric diagram; Air Conditioning Process and Cycles; Coolers and Cooling Cycles; Outdoor Design Conditions and Interior Design Criteria; Load Calculations; Refrigeration Components: Compressor, Condenser, Evaporator and flow control tools; Heating Systems; Cooling Systems; Thermal Storage Systems; Ventilation System Principles.

**RYL511                    Urban Rail Transit System Design and Livable Cities I                    3+0   7.5**

Classification of Transportation Modes; The Family of Rail Transit Modes: Categories and Descriptions: General characteristics, Definitions and characteristics of individual rail modes; Urban Rail Vehicles: Types and basic components, Bogies, trucks and mechanical/ electrical equipment, Vehicle body, Review of characteristics of different vehicle models; Urban Rail Transit Ways: Geometric elements, Track superstructure, Rights-of-way; Urban Rail Transit Stops and Yards.

**RYL512                    System Identification in Railway Systems                    3+0   7.5**

Introduction to Stochastic and Deterministic Processes; Correlation Analysis; Nonparametric Identification Methods; Spectral Estimation and Analysis: Application of Spectral Estimation for Fault Diagnosis of Gears in Traction Motors, Fault Tracking and Diagnosis of Bogies by Spectral Estimation and Analysis; Input Design; Pseudo-Random Series; Least-Squares and Maximum Likelihood Methods; Linear Predictors: Ar, Arma, Kalman; Iterative Estimation Methods; System Identification for Pantograph Simulations; Analysis of Breakdown Frequencies and Reliability of Railroad Vehicles; Analysis of Railroad Traffic Frequency and Congestion; Passenger Flow Estimation.

**RYL513                    Numerical Methods in Optimization                    3+0   7.5**

Introduction to Numerical Methods; Fundamental Concepts in Linear Algebra; Introduction to Nonlinear Equations; Iterative Methods for Solution of Nonlinear Problems; Interpolation; Various Solutions of Differential Equations: Euler Method, Runge-Kutta Method, Adams Method; General Definition of An Optimization Problem; Simplex Method; Gradient Methods; Constraint Optimization Problems; Heuristic Methods 1: Genetic Algorithm; Heuristic Methods 2: Particle Swarm Optimization; Heuristic Methods 3: Tabu Search; Heuristic Methods 4: Simulated Annealing.

**RYL514                    Safety Management Systems                    3+0   7.5**

Concepts of Danger and Risk; Definitions of Danger and Risk; Risk assessment; Risk mitigation methods; Emergency cases; Planning of emergency cases; Safety culture; Importance of Safety Management in Transportation; National Regulations regarding Transportation Safety; International Regulations regarding Transportation Safety; Duties, Authorizations and Liabilities of the Institutions and Organizations Responsible for Transportation Safety; Physical Security Precautions regarding Transportation Safety; Human Factor in Transportation Safety; Technology regarding Transportation Safety; Track-Trace and Baggage Scanning Systems in Passenger Transportation; Freight-Cargo.

**RYL515                    Selected Topics in Vehicle Design I                    3+0   7.5**

Rolling Stock; Variables of Railway Vehicle Design; Characteristics of Railway Vehicles; Vehicle Body Design: Running gear connection, Braking system, Couplers; Wheelset Design: Production of axles, Wheel design and production, Wheel wear, Suspension design; Contemporary Two-axle Freight Bogies; Many-axled Freight Bogies; Passenger Cars and Running Gear; Contemporary Types of Two-axle High-speed Bogies; Train Couplers; Axle-box Guiding; Operational Safety: Safety against derailment; Comfort; Interoperability; Environmentally Friendly Design.

**RYL516                    Special Topics in Fluid Mechanics                    3+0   7.5**

Fluid Characteristics; Fluid Statics; Basic Concepts of Flow: Streamlines and Stream Tube, Steady State Flow and Transient Flow, Laminar and Turbulent Flow, One Dimensional Flow; Viscous Liquids; Drag and Lifting Force; Dimension Analysis and Similarity Law; Measurement of Flow and Flow Rate; Ideal Fluids; Compressible Fluids; Transient Flow; Visualization of Flow: Classification techniques, Experimental methods, Computer aided methods.

**RYL517                    Vehicle Suspension System Design                    3+0   7.5**

Railway Vehicle Suspension Systems; Function of Suspension Systems; Components of Suspension Systems; Dependent and Independent Suspension Systems; Semi-active and Active Suspension Systems; Air Spring Based Suspension Systems; Kinematic and Kinetic Analysis of Suspension Systems; Instant Rotational Centers; Response of Impact Loading in Suspension Systems; Modal Analysis of Suspension Systems; Linear and Non-linear Suspension Systems; Analytical Modelling of Suspension Systems; Analysis and Design of Suspension Systems.

**RYL518 Selected Topics in Vehicle Design II 3+0 7.5**

Introduction to Motor Vehicles; Locomotive, Railcar, Tramway and Metro; Rail-wheel Adhesion: Transversal and longitudinal adhesion characteristics, Hertz theory, Creep, Driving dynamics-adhesion relationship; Power Transmission: Mechanical, Hydrostatic, Hydro dynamical, Electrical, Gearbox and connection; Wheelset Drive for Different Drive Types and Different Loading Modes: Forces, Torsional and bending moments analysis; Bogie and Body Connections; Wheelset guiding and primary suspension, Secondary suspension, Wheelset drive systems: Carbody connection, Suspension, Strain analysis; Modern Locomotives and Light Rail Vehicles; Technical Layout Planning.

**RYL519 Traction Control in Rail Vehicles 3+0 7.5**

Basic Concepts: Traction, Braking, Power, Control; Ray-Wheel Interaction for Traction Control: Geometric interaction, Normal interaction, Tangential interaction; Traction Control and Holding Model in Braking; Introduction to AC and DC Motors and Drive Systems Used for Traction Control; Extraction and Investigation of Torsion Model for Traction Control and Braking of a Wheel Set; Traction Control Under Different Holding Conditions; Investigation of Longitudinal Movement of a Train Set by Traction Control.

**RYL520 Vibration and Noise in Rail Systems 3+0 7.5**

Vibration Analysis: Free, Damped, Forced Damped Vibration, Multi Degree Of Freedom Systems; Vibration Standards: International Standards for Machinery and Vehicles, International Standards for Railway Vehicles and Components; Vibration Isolation: Dynamic Damper, Isolator Selection; Driving Comfort and Vibration of Human Body: Vibration of Human Body and Related International Standards, Effects of Vibration on Human Body; Vibration Measurement; Vibration Measurement and Maintenance Planning; Noise in Rail Systems: Noise Sources, Railway Noise, Noise Measurement, Preparation of Noise Maps, Noise Barriers.

**RYL521 Shell Structures 3+0 7.5**

Shell Buckling Behavior and Design Criteria; Shell Modeling; Material Assumptions; Geometric Tolerances and Imperfections; Rules for Plastic Limit Assessment; Rules for Buckling Limit Evaluation with Numerical Analysis; Rules for Buckling Limit Assessment Using Design Stress; Evaluations for Some Special Shell Structures Operating Under Different Load Cases: Cylindrical shell structures, Conical shell structures, Spherical shell structures.

**RYL522 Image Processing Applications in Rail Systems 3+0 7.5**

Introduction; Detectable Faults on Railways: Wheel defects, Rail cracks and surface defects, Sleeper cracks and misalignment; Change Analysis; Signal Sampling and Quantization; Perspective; Digital Images: Binary, Gray-level, Color, Multispectral; Image Transforms: Geometric transformations, Intensity transformations; Image Restoration: Linear and non-linear filters, Spatial and frequency domain image restoration; Edge detection; Corner detection; Morphological operations; SIFT- keypoints; Object Recognition: Preprocessing, Feature extraction, Bag of words, K-means clustering, Fisher linear discriminant classifier, Naive Bayes classifier, Support vector machines.

**RYL523 Tractive Systems 3+0 7.5**

Basic Principles; Mechanics of Railway Transportation; Under Vehicle Design and Drive of Traction Vehicles; Brushed Traction Motors and Their Controls; Synchronous Traction Motors and Their Controls; Asynchronous Traction Motors and Their Controls; Electric Traction Vehicles for Main Service Line; Multi-System Traction Vehicles; Commuter and Light Rail Traction Vehicles; Brake Technology; Power Supply of Power Lines.

**RYL524 Sensors and Actuators in Railway System 3+0 7.5**

Expectations of system; Differences Between Open-loop and Closed-loop system; Introduction of Sensors and actuators; Important Parameters of Sensors; Temperature Sensor and Comparison; Magnetic Sensors; Mechanical Sensors; Hall Effect Sensors; Pressure and Strain Transducers and Strain Gauge; Audio Sensors; Hydraulic and Pneumatic Actuators; Types of Motors: DC and AC motors

**RYL525 Signal Processing in Railway Systems 3+0 7.5**

Definition of Signal Processing; Sampling; Analog-to-Digital and Digital-to-Analog Signal Transformations; Conversion From Time Domain to Frequency Domain; Signal Processing Methods for Vibration Analysis; Signal Processing Methods for Noise Analysis; Multidimensional Signals and Introduction to Image Processing; Image Processing Methods for Fault Diagnosis; Introduction to Data Classification Methods; Fault Classification; Introduction to Wavelet Transforms; Wavelet Transforms for Fault Diagnosis; Signal Processing Methods for Driver Safety; Signal Processing Methods for Analysis of Driver Behaviours.

- RYL526 Corrosion and Surface Treatment 3+0 7.5**  
Corrosion, Principles of Corrosion; Types of Corrosion; Corrosion processes and Their types (chemical, physical, electrochemical); Types of Corrosion attacks; Particular Corrosion Environments. Corrosion Reactions a Corrosion Cells; Corrosions by Stray Current; Electrochemistry Protections; Electrochemistry Cells; Corrosion Resistance of Non-ferrous Metals. Corrosion of Glass and Plastics; Surface Threatment - Metallic Surface Coatings, Electroplating, Non-metallic Surface Coatings, Enamelling, Organic Coatings (paintings), Paintings Testing; Non Conventional Surface Treatment - Diffusion coatings, PVD, CVD, Anodizing, Plastics Coatings; Corrosion Resistant Steels.
- RYL527 Optimization in Railway Systems 3+0 7.5**  
Introduction to Optimization: Fundamentals, Models, Exact Solution Methods; Introduction to Metaheuristic Optimization; NP-hard problems, Necessity of Metaheuristic Optimization, Fundamentals; Single-solution based optimization algorithms: Simulated Annealing Algorithm, Tabu Search Algorithm, Implementation and Application to the Railway Systems; Evolutionary Algorithms: Fundamentals, Genetic Algorithms, Ant Colony Algorithms, Bee Colony Algorithms, Programming Algorithm and Application to the Railway Systems.
- RYL528 Durability of Railway Materials 3+0 7.5**  
Examination of the Durability of Railway Materials and Its Plasticity; Breakdown Models of Materials; Fatigue Limits of Materials and Brittle fracture; Structural and Mechanical Characters of Materials; Choosing Suitable Rail Materials; Types of Railway Steels and Its Comparison; Wear, Fatigue and Breakdown Mechanism of Railway Steels; Methods for Improving Railway Steels and Its Limitations
- RYL530 Transportation of Dangerous Goods on Railways 3+0 7.5**  
Definition of Dangerous Goods; Accidents in the Transportation of Dangerous Goods; National and international regulations on the Transport of Dangerous Goods on Railways; RID General Structure; RID Hazardous Material Classes; Packing Groups and Types of Dangerous Goods; Marking and Labeling of Packages; Types of Transportation of Dangerous Goods; Loading of Dangerous Goods and Characteristics of Transport Vehicles; Marking of Vehicles Carrying Dangerous Goods.
- RYL531 Tribology of Wheel - Rail 3+0 7.5**  
Introduction to the Wheel - Rail Interface; Basic Tribology of the Wheel - Rail Contact; Contact Mechanic of the Wheel - Rail; Friction and Wear Simulation of the Wheel - Rail Interface; Rail Materials; Wheel Materials; Wear and Fatigue of Railway Wheels; Rail Wear; Fatigue of RailRail Damages; Rail Welds; Effect of Contaminants on Wear, Fatigue and Traction; Wheel - Rail Isolation; Maintenance of the Wheel - Rail.
- RYL532 Electric Machines in Railway Systems 3+0 7.5**  
Induction Machines: Constructional properties, Equivalent circuit models of induction machines, Performance evaluation, Speed control techniques, Motor characteristics, Methods of starting induction motors, Linear induction motors; Traction Motors for Railway Vehicles; Single Phase Machines; Direct Current Machines: Constructional properties, Equivalent circuit models of direct current machines, Commutation and auxiliary poles, Compensation windings; Rotating Field Theory; Synchronous Machines: Equivalent circuit models of synchronous machines, Generator and motor operating conditions, Steady state power and angle characteristics.
- RYL533 Data Analysis and Machine Learning in Rail Systems 3+0 7.5**  
Safety, Reliability, Quality and Test Data in Rail Systems; Introduction to Data Analysis; Fundamentals of Probability; Probability Distributions; Univariate and Multivariate Distributions; Estimation Theory; Maximum Likelihood Method; Supervised Learning; Linear Regression; Decision Trees; Artificial Neural Networks; Unsupervised Learning; Clustering; Principal Component Analysis; Hidden Markov Models; Bayesian Decision Systems; Importance of Data Analysis in Rail Systems; Machine Learning Applications in Rail Systems
- RYL534 High Voltage Technique 3+0 7.5**  
Introduction to High Voltage Engineering; Conduction and Breakdown in Gases, Conduction and Breakdown in Liquid Dielectrics, Breakdown in Solid Dielectrics, Corona Discharges, Applications of Insulating Materials; Generations of High Voltages and Currents, Measurements of High Voltages and Currents; Overvoltage Phenomenon and Insulation Coordination in Powersystems; Non-destructive Testing of Materials and Electrical Apparatus; High Voltage Testing of Electrical Apparatus, Design, Planning and Layout of High Voltage Laboratories.
- RYL535 Introduction to Railway Systems I 3+0 7.5**  
Rolling Stock and Equipments; Bogie and Wheels; Vehicle Suspension Systems; Wheel Arrangement; Pantographs; Maintenance Depots and Workshops; Basics of Brake Technology; Automotic Air Brake Systems; Straight Air Brake Systems; Brake Calculations; Track Infrastructure; Track Superstructure; Ballast; Sleepers; Rail; Rail Welding; Rail Fastenings; Curves; Turnouts; Gauging; Railway Engineering Structures; Viaducts; Bridges; Tunnels; Track Maintenance.
- RYL536 Introduction to Railway Systems II 3+0 7.5**

Railway Electrification Systems; Catenary Equipments; Maintenance of Overhead Lines; Railway Signaling Systems; Block Systems; Train Control Systems; ERTMS; ATS; Railway Communication Systems; Railway Traffic Systems; TSI; TMI; Railway Transportation; Urban Rail Transit Systems; International Standards and Regulations; Liberalization and Restructuring of the Railway Sector.

**RYL537                  Soil Improvement and Seismic Slope Stability Analysis                  3+0   7.5**

Importance of Soil Improvement in Civil Engineering Applications; Soil Improvement Techniques: Deep compaction, Dynamic compaction, Preload, Stone column, Injection techniques, Compaction piles, Jet grouting, Deep mixing, Soil improvement by lime, cement and bitumen, Electro osmosis, Sand drain, Reinforcement concrete piles; Slope Stability and Geometric Definitions; Effects of Slope Movement; Slope Stability Analysis Methods; Geotextiles and Geosynthetics in Slope Stability.

**RYL538                  Infrastructure and Soil Dynamics in Rail Systems                  3+0   7.5**

Soil Structure and Texture; Earthquakes; Dynamic Loading and Vibration Principles: Fundamentals, SDOF Systems, Two DOF Systems and Basics of Wave Propagation; Stress-strain Behavior and Strength Properties of Soils Under Dynamic Loading; Shear Strength of Soils Under Dynamic Cyclic Loading; Behavior of Soils and Site Amplification; Elastic Behavior; Non-Linear Behavior; Soil Liquefaction and Analysis; Effects of Liquefaction and Liquefaction Related Settlements.

**RYL539                  Soil Investigation and Soil Mechanics in Risky Fields                  3+0   7.5**

General Definitions in Soil Mechanics; Soil Samples; Soil Classification and Index Properties: Soil moisture content test, Determination of soil consistency using the Atterberg Limits, Determining volumetric shrinkage of soil, Sieve analysis, Hydrometer test, Determining of soil density in situ, Specific gravity and relative density tests, Compaction-standard proctor test, Consolidation test, Permeability test, California Bearing Ratio test (CBR), Compressive strength test, Shear box test, Triaxial test.

**RYL540                  Transportation Economics                  3+0   7.5**

Fundamental Economic Concepts: Necessities, Goods and Services, Production Costs; Effect of Transportation on Economic Growth; Features of Transportation Industry; Sub-Systems of Transportation; Functions of Transportation; Supply, Demand and Equilibrium in Transportation; Factors Affecting Transportation Demand; Methods of Transportation Demand Forecasting; Internal and External Costs in Transportation Industry; Pricing in Transportation Industry; Transportation Policies in European Union; Criteria in the Selection Process of Transportation Systems and Analysis of Utility and Cost; Transactions of Transportation Systems with the Environment.

**RYL541                  Condition Assessment of Railway Ballast by Ground Penetratin Radar                  3+0   7.5  
(GPR) Method**

Railway Infrastructure; Functions of Ballast; Clean and Fouled (Spent) Ballast; Condition Monitoring Methods of Railway Infrastructure; Ground Penetrating Radar (GPR): History of GPR, Basics and fundamental working principles of GPR; Applications of GPR, Relative dielectric permittivity constant; Ballast Assessment with GPR: Distinguishing between clean and fouled ballast and maintenance/repair thresholds, Analysis of a case study from a sample railway infrastructure investigated by GPR, Determination of railway segments to be maintained, repaired and/or renewed as a result of analysis findings.

**RYL542                  Historical Development of Railways                  3+0   7.5**

Railway in the Ottoman Period; Ottoman Railway Construction Process; Stations; Locomotives; Passenger and Freight Wagons; Railways of Republic Period; Development process; Railways after 1950; Current state; Transportation Policies; Overview of Logistics, Railway Logistics, Overview of Rail Systems in Various Cities, Railway Logistics, Overview of Rail Systems in Various Cities.

**RYL543                  Field and Laboratory Tests of Soils Under Dynamic Loading                  3+0   7.5**

Fundamentals of Dynamic Loading; Geotechnical Soil Properties; Low Strain Tests: Seismic reflection test, Seismic refraction test, Suspension logging test, Steady-state vibration test, Spectral analysis of surface waves test, Seismic cross-hole test, Seismic down-hole and up-hole test, Seismic cone test, Resonant column test, Ultrasonic pulse test, Piezoelectric bender element test; High Strain Tests: Standard penetration test, Cone penetration test, Dilatometer test, Pressuremeter test, Vane shear test, Shear wave velocity test, Cyclic triaxial test, Cyclic direct simple shear test, Cyclic torsional shear test; Model Tests: Shaking table tests, Centrifuge tests.

**RYL544                  Investigation of Railway Infrastructure by Nondestructive Condition                  3+0   7.5  
Monitoring Methods**

Investigation Methods of Railway Infrastructure; Features of Nondestructive Methods: Advantages, disadvantages, application fields; Falling Weight Deflectometer Method; Sonic Echo Method; Impulse Response Method; Parallel Seismic Method; Ultrasonic Pulse Velocity Method; Ultrasonic Echo Method; Infrared Thermography Method; Spectral Analysis of Surface Waves Method; Ground Penetrating Radar (GPR)



<b>RYL545</b>	<b>Introduction to Finite Element Analysis</b>	<b>3+0 7.5</b>
<p>Linear Algebraic Equations; Review of Basic Mechanical Knowledge; Shape Functions: Shape functions in global coordinate systems, Shape functions in local coordinate systems; Equation of Motion and Virtual Work; Linear Spring element; Two Node Axial Elements: Assembling of element matrices, Transformation matrix, Boundary conditions and reaction forces; Torsion element: Boundary conditions and reaction forces; Bending and Frame Element: Two node element, Assembling of element matrices, Boundary conditions and reaction forces, Frame element; Two dimensional elements.</p>		
<b>RYL546</b>	<b>Detection Methods of Railway Infrastructure Deformations, Maintenance and Renewal Methods</b>	<b>3+0 7.5</b>
<p>Railway Infrastructure; Functions of Ballast; Clean and Fouled (Spent) Ballast; Condition Monitoring Methods of Railway Infrastructure; Ground Penetrating Radar (GPR): History of GPR, Basics and fundamental working principles of GPR; Applications of GPR, Relative dielectric permittivity constant; Ballast Assessment with GPR: Distinguishing between clean and fouled ballast and maintenance/repair thresholds, Analysis of a case study from a sample railway infrastructure investigated by GPR, Determination of railway segments to be maintained, repaired and/or renewed as a result of analysis findings.</p>		
<b>RYL547</b>	<b>Disaster Risks and Disaster Management in Rail Systems</b>	<b>3+0 7.5</b>
<p>Disaster and Disaster Types; Disaster Risks in Rail Systems: Earthquake Analysis in Tunnel, Tram and Metro; Earthquake Master Plan; Security Vulnerabilities of Transportation Facilities and Components; Disaster Risk Areas in Rail Systems; Meteorological Disasters: Flood and Flood; Buffer Zone Formation, Disaster Logistics and Disaster Logistics Processes; Disaster Procurement Management, Disaster Management Related to Global Climate Change; Rail System Safety Risk Management and Public Organization in Turkey: AFAD. Recommendations on Transportation Infrastructure in Disaster Management.</p>		
<b>RYL548</b>	<b>Business Management in Railway Systems</b>	<b>3+0 7.5</b>
<p>Rail Systems and Types, Emergence of Railways, Development in Turkey and the World; Definitions and Terms Used in Railways; Definition and Characteristics of Train, Classification of Trains, Definition and Types of Stations, Numbering of Stations, Numbering of Shears, Numbering of Trains, Order of Trains; Domestic Goods Transportation Provisions; Introduction and Issue of Transport Document; Calculation of Transportation and Other Fees, Applications; (COTIF) Uniform Rules for the International Carriage of Goods (CIM-Annex B of the Convention); Some International Railway Organizations and Conventions.</p>		
<b>RYL549</b>	<b>Risk Analysis and Management</b>	<b>3+0 7.5</b>
<p>Introduction to Risk Analysis and Management: Basic concepts; Traditional Risk Assessment: Identification of risks, Risk Assessment Matrix; Preliminary Hazard Analysis, HAZOP; Fine-Kinnet Method; Causality and Uncertainty in Risk Analysis; Probability Inference Methods; Causal Approaches for Risk Analysis: Fault Tree Method; Event Tree Method; Bayesian Network Method; Developing Policy Recommendations for Risk Management.</p>		
<b>RYL550</b>	<b>Integrated Logistics Management</b>	<b>3+0 7.5</b>
<p>Retail Logistics: Concept, Operation and Characteristics; Food Logistics: Concept, Operation and Characteristics; Textile and Apparel Logistics: Concept, Operation and Properties; Electronic Product Logistics: Concept, Operation and Characteristics; Automotive Logistics: Concept, Operation and Characteristics; Project and Construction Logistics: Concept, Operation and Characteristics; Tourism Logistics: Concept, Operation and Characteristics; Fair and Event Logistics; Pharmaceutical and Hospital Logistics; Waste and Recycling Logistics; Living Animal Logistics; Assistance and Disaster Logistics, Information Logistics, Military Logistics.</p>		
<b>RYL551</b>	<b>Railway Electrification</b>	<b>3+0 7.5</b>
<b>RYL552</b>	<b>Elastic Stability Analysis of Shells and Plates</b>	<b>3+0 7.5</b>
<p>Assumptions and Concepts in Thin-Walled Shell Theory; Calculation Methods in Elastic Mechanics; Shell Types; Boundary Conditions on Shells; Load Conditions and Applications on Shells; Variation Method; Surface Geometry and General Shell Equations; Rotational Shells: General rotational shells, Equilibrium method, Variation method, Numerical solutions of rotational shells; Plates: Plate equations, Plate analysis by finite difference technique.</p>		
<b>RYL553</b>	<b>Deep Learning and Artificial Neural Networks</b>	<b>3+0 4.0</b>
<b>RYL554</b>	<b>Energy Efficiency in Railway Systems</b>	<b>3+0 7.5</b>



<b>RYL702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>RYL790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>SHA511</b>	<b>Aircraft Performance And Operation Analysis I</b>	<b>3+0 7.5</b>
<p>Fundamental Definitions-Standard Atmosphere; General Performance Conditions-The Forces Effecting Aircraft and Axis Sets; General Flight Motions and Equations; Symmetric, Permanent; Rectiling Flight Motion-Flight Performance Characteristics Horigantal; The Cruising Flight Performance Characteristics; The Climbing Motion and Climbing Performance Characteristics; Descending Motion and Descending Performance Characteristics; Take-Off Motion-Take Off Length and Take Off Performance Characteristics; Landing Motion-Landing Length and Landing Performance Characteristics; Curved Path Flight Motion; The Bend Motion and Bend Performance Characteristics; Studies on the Curved Climbing and Descending Motions-Helisel and Spiral Climbing; Descending and Vrille; The Travel Length; The Travel Time.</p>		
<b>SHA513</b>	<b>Oil Analysis Program in Aircraft Maintenance</b>	<b>3+0 7.5</b>
<p>Introduction: Lubrication, Features of Lubrication Oil; Oil Contamination; Different Test Methods; Spectrometric Oil Analysis Program (SOAP); Spectrometric Oil Analysis Techniques; Detectable Failures By SOAP; Important Subject Related to Sample Analysis at Oil Analysis Laboratories; Ferro graph; Ferro graphic Analysis; The Use of SOAP Together With Ferro graph; Importance of Determining the Wear With Oil Analysis; Efficiency of Different Analysis Techniques in Determining the Wear.</p>		
<b>SHA515</b>	<b>The Effects of Construction Techniques Aircraft on Performances of Light</b>	<b>3+0 7.5</b>
<p>Introduction; Construction of Light Aircraft; Wing structure; Fuselage Structure; Power plant; Empennage; Landing Gear; Equipment; Typical Construction Materials Used in The Light Aircraft; Wood; Metals; Composite Materials; Basic Performances and Factors Affecting Basic Performances; Basic Performances; Effect of Changing Wing Structure; Effect of Changing Weight; Effect of Changing Engine Power; Examination of the Construction and Performance Features.</p>		
<b>SHA524</b>	<b>Modern Control Systems</b>	<b>3+0 7.5</b>
<p>State Variable Analysis of Control Systems: State Variables; State Concept; State Equations; Transfer Matrix; Solution of Time Invariant State Equations; Linear Time Varying Systems; Discrete Time Systems; Controllability and Observability; Controllability and Observability of Linear Dynamic Equations; Output Controllability; Obtaining State Equations in Canonical Forms; Design of Control Systems in State Space; Pole Placement; Observer Design; Optimal Control Problems; Performance Index; Selection of Performance Index.</p>		
<b>SHA525</b>	<b>CNS-ATM Systems</b>	<b>3+0 7.5</b>
<p>CNS-ATM Concept: CNS-ATM concepts and stages of development, Global and regional plannings, Communication Systems; Present and future communication systems, Data link communications, Aeronautical Telecommunication Network (ATN), Navigation Systems; Present and future navigation systems, Performance Based Navigation (PBN), Required Navigation Performance (RNP), Surveillance Systems; Present and future surveillance systems, Automatic Dependent Surveillance (ADS), Air Traffic Management (ATM); Air Traffic Services (ATS), Air Traffic Flow Management (ATFM), Airspace Management (ASM), Human factors and ATM Automation, CNS-ATM Applications; FANS 1/A applications, Studies on capacity increasing, ADS and CPDLC applications.</p>		
<b>SHA531</b>	<b>Industrial Aerodynamics</b>	<b>3+0 7.5</b>
<p>Wind Energy Resources; History of Wind Energy Appliances; Types of Wind Turbines: Horizontal Axis Wind Turbines, Vertical Axis Wind Turbines, Aerodynamics of Horizontal-Axis Wind Turbines: Betz Limit, Rotor Disk Theory, Angular Momentum Theory, Maximum Power, Rotor Blade Theory, Blade Geometry; Wind Potential Determination; Wind-Turbine Performance and Availability; New Developments and Trends on Wind Turbine Energy.</p>		
<b>SHA535</b>	<b>Helicopter Theory and Flight Principles</b>	<b>3+0 7.5</b>
<p>Types of Aircraft; Basic Laws of Mechanics and Aerodynamics; Blade and Rotor; Lift and Drag of a Rotor Blade; Center of Pressure of a Rotor Blade; Forces Acting on a Rotating Blade; Total Rotor Lift (Thrust); Dissymmetry of Lift; Flapping Motion; Lift Control; Collective Pitch; Cyclic Pitch; Tail Rotor; Aerodynamic Behavior of a Rotor Blade; Vortex; Ground Effect; Autorotation; Limits of Rotation Speed; Helicopter Flight Principles; Hover; Forward Flight; Required Power; Flight Ceiling.</p>		
<b>SHA536</b>	<b>Flight Control System Design</b>	<b>3+0 7.5</b>

Flight Control; Control Surfaces; Flight Control Systems; The Equations of Motion of an Aircraft; Axis Systems; Linearized Equations of Motion; State and Output Equations; Transfer Function; Aircraft Stability and Dynamics; Longitudinal Stability; Static and Dynamic Stability; Transfer Functions Related to Longitudinal Motion; Short Period and Phugoid Approximation; Lateral Stability; Transfer Functions Related to Lateral Motion; Control System Design; Generalized AFCS; Parameter Optimization; Stability Augmentation Systems; Actuator and Sensor Dynamics; Longitudinal and Lateral Control.

**SHA537 Exergy Analysis 3+0 7.5**

1st Law of Thermodynamic: Closed systems; Control Volumes; Energy Balance; 2nd Law of Thermodynamic: Heat machine; Reversible and Irreversible States; 2nd Law Analysis For Control Volumes; Entropy: Entropy Change of Pure Substances; Entropy Change of Ideal Gas; Isentropic Efficiency; Entropy Balance; Exergy: Change of Exergy; Exergy Transfer; Exergy Balance; Chemical Reactions: Stoichiometric Combustion; Thermochemistry; Second Law; Exergy and Irreversibility; Work Production From Chemical Reactions; Chemical Exergy of Fuels; Energy Analysis; Exergy Analysis.

**SHA538 Flight Procedures And Airspace Design 3+0 7.5**

Conventional Procedures; Area Navigation (RNAV) procedures; RNAV/ Barometric Vertical Navigation; Departure and Approach Procedures for Required Navigation Performance (RNP) Approved Systems; RNP Holding Procedures; Airspace: Criteria for Airspace Sectorisation, Sector Capacity; Terminal Airspace Design: Terminal Airspace Configuration, The Function of Terminal Airspace, Sectorisation of Approach Control and Terminal Airspace, Traffic Flow, The Establishment of SIDs and STARs, Methodology for Terminal Airspace design.

**SHA539 Advanced Aerodynamics 3+0 7.5**

Basic Relations: Continuity, Momentum and Bernoulli Equations; Potential Flow Theory: Ideal incompressible flow, Stream function, Basic types of flow; 2-D incompressible flow around cylinder: Circulation and lift, General thin airfoil theory, Symmetrical and cambered profiles; Incompressible Flow around Slender Wings: Vortex system, Effect of swept wing, Delta wings, Wing and fuselage configurations; Compressible Flow: Basic definitions, Energy equation, Adiabatic and isentropic flows, Shock waves; Transonic flow: 2-D transonic flow, Transonic flow around wings; Supersonic flow; Unsteady Aerodynamics.

**SHA541 Current Issues in Gas Turbine Engines 3+0 7.5**

Basic Notions: Classification and structure of gas turbine engines, General definitions; Exergy Analysis: Calculations, Application for gas turbine engines; Methods For Improving Efficiency Of Gas Urbine Engines; Methods For Improving Thrust Of Gas Urbine Engines; Vibration: Basic notions, Devices and cursors used for analysis; Noise; Corrosion; Emission Analysis For Gas Turbine Engines; Gas Turbine Engines Of Unmanned Aerial Vehicles; Auxiliary Power Units (APUs).

**SHA543 Parametric Cycle Analysis of Aircraft Propulsion System 3+0 7.5**

Introduction; Propulsion; Air-Breathing Engines; Thermodynamics Review; Compressible Flow; Classification of Aircraft Gas Turbines; Factors Effecting Thrust; Thrust Force; Engine Performance Parameters; Steps of Engine Parametric Cycle Analysis; Ideal Turbojet; Ideal Turbojet with Afterburner; Ideal Turbofan; Ideal Mixed Turbofan with Afterburner; Ideal Turboprop engine; Ideal Turboshaft Engine; Component Performance; Variation in Gas Properties; Inlet and Diffuser Pressure Recovery; Compressor and Turbine Efficiencies; Burner Efficiency; Exit Nozzle Loss; Component Figures of Merit; Parametric Cycle Analyses of Real Engines; Real Turbojet; Real Turbojet with Afterburner; Real Turbofan with Separate Exhaust Stream; Real Turbofan with Afterburning-Mixed Exhaust Stream; Computer Programing for Cycle Analysis.

**SHA545 Fuzzy Logic Applications in Aviation 3+0 7.5**

Introduction to Fuzzy Logic; History of Fuzzy Logic; Overview of Fuzzy Logic; Fuzzy Sets; Classical Control Systems; Fuzzy Systems; Fuzzification and Membership Functions; Rule-Base; Data Base; Defuzziciation; Middle of Maximum Method; Centroid Method; Fuzzy Control; Examples of Fuzzy Control; Applications of Fuzzy Logic; Application of Air-Condition; Application of the Inverted Pendulum; Control of Final Approach of the Aircraft; Application of the Flight Controls; Application of The Longitudinal Control of the Aircraft; Application of the Longitudinal Controller; Application of the Flap.

**SHA547 Flight Tests and Instrumentation 3+0 7.5**

Fundamentals; Phases of Flight Tests; Flight Performance Tests: Pitot static system performance; Stall speed determination; Level flight performance; Excess power characteristics; Turn performance and agility; Climb performance; Descent performance; Take-off and landing performance; Standard mission profiles; Design of Instrumentation: Factors influencing instrumentation system design; Basic elements of instrumentation; Flight Tests Applications.

**SHA548 Experimental Aerodynamics Analysis for Incompressible Flow 3+0 7.5**

Introduction; Fundamental of Aerodynamics; Aerodynamics Forces and Moments; Dimensional Analysis; Flow Similarity; Types of Flow; Applied Aerodynamics; Models of Fluid: Control Volume and Fluid Elements; Continuity Equation; Momentum Equation; Energy Equation; Incompressible and Compressible Flows; Fundamentals of Incompressible Flow;

Bernoulli's Equation; Incompressible in Duct: The Venturi and Low-Speed Wind Tunnel; Pitot-tube: Measurement of Airspeed; Measurement Equipment for Aerodynamics Experiments and Experimental Error; Flow Over a Circular Cylinder; Flow over Airfoils; Incompressible Flow over Finite Wings; Pressure Distribution and its Evaluation on the Aerodynamics Shapes; Boundary Layer Measurement; Velocity and Pressure Measurement over Finite Wings; Aerodynamic Analysis of Some Industrial Shapes

**SHA549 Gas Turbine Combustion 3+0 7.5**

Introduction; Combustion and Thermochemistry; First Law of Thermodynamics; Ideal Gas Mixture; Adiabatic Flame Temperature; Second Law of Thermodynamics; Chemical Equilibrium; Introduction to Mass Transfer; Chemical Kinetics; Simplified Conservation Equations For Reacting Flows; Introduction to Turbulent Flows; Premixed Turbulent Flames; Turbulent Nonpremixed Flames; Fundamentals of Aircraft Gas Turbine Combustor Design; Combustors for Low Emissions; Heat Transfer Mechanism for Combustors.

**SHA550 Preliminary Design of Unmanned Air Vehicle and Its Propulsion System 3+0 7.5**

Introduction; Unmanned Air Vehicles; Engine Types Used in Aeronautics; General Utilization Limits of Engines; Engine Selection by Mission Profile; Basic Parameters of Engine Design: Flight and aircraft system parameters, Design constraints, Design choices; Parametric Cycle Analysis of Engines: Component behaviour and efficiencies, General engine performance output parameters; Unmanned Air Vehicle Sizing; Performance Calculations for Unmanned Air Vehicle.

**SHA551 Airline Operations and Scheduling 3+0 7.5**

Planning Optimization: Networks, Network flow models, Shortest path problem, Minimum cost flow problem, Maximum flow problem, Multi-commodity problem, Integer programming models, Set covering/partitioning problems; Flight Scheduling: Hub-and-spoke, Route development and flight-scheduling process, Load factor and frequency; Fleet Assignment: Indicator definitions, Mathematical model; Aircraft Routing: Maintenance requirements, Mathematical model; Crew Scheduling: Crew pairing, Crew pairing mathematical model, Crew rostering, Crew rostering mathematical model.

**SHA552 Experimental Methods and Data Processing Techniques for Turbomachinery 3+0 7.5**

Introduction; Description of Measurement Chain and Its Components; Terminology Associated with Measurement Techniques; Pressure Measurement Techniques; Temperature Measurement Techniques; Velocity Measurement Techniques; Measurement of the Flow Angle; Optical Measurement Techniques; Classification of the turbine test rigs, Flow field measurements; Performance Measurement of Basic Engine Components; Fundamentals of Statistics; Frequency Analysis; Data Processing of Periodic Signals; Uncertainty analysis.

**SHA553 Air-conditioning Systems for Aircraft 3+0 7.5**

Introduction; Air-conditioning and Ventilation; External and Environment Conditions; Effects of Cabin Internal Conditions on Staff, Device and Hardware; Thermodynamics Conditions, Temperature, Humidity, Pressure; Indoor Air Quality, Comfort Parameters, Psychometry; Heat Loads in Aircrafts, Heat Stress Indices, Thermal Comfort for Heat Balance; Thermal Loads on Aircraft Cabins; Heat Balance in Flight Cabin, Air Distribution and Velocity, Fog and Permeability; Air-conditioning Systems in Aircrafts; Air Flow Open Systems and Closed Systems; Vapor-compression Refrigeration Systems; Environmental Control Systems in Aircrafts.

**SHA554 Aviation Lighting Technics 3+0 7.5**

Fundamentals of Photometric and Radiometric Quantities; Interior and Exterior Lighting; Lighting Calculations; Importance of Lighting in Aviation: Visual performance, Energy and cost effectiveness; Lighting Parameters: Lighting level, Uniformity, Luminance distribution, Glare, Colour temperature, Colour rendering; Lamps; Luminaires; Lighting Used in and on Aircraft; Airport Lighting: Public areas, Runways, Taxiways; Inspection and Maintenance of Lighting in Aircraft; Visual Illusion.

**SHA555 Airport Information and Communications Technology Service Management 3+0 7.5**

What is Information Technology Infrastructure Library: Service design, Service transition, Service operation; Airport Information Technology Infrastructure: Network systems, System rooms, Telecommunications, Database systems, Integrations, Message flow; Computer Applications of Airports: Flight info systems, Operational database, Resource management, Common use systems, Revenue management; Helpdesk Design: Service Level Agreements, Support system suggestions.

**SHA556 Mathematical Programming in Air Transportation 3+0 7.5**

**SHA557 Multidisciplinary Research Topics in Aviation 3+0 7.5**



Administration Units; Affects of Administration Properties; Education Types and Properties; Aircraft Selection; Constitution of Fleet; Technical; Economical and Political Interaction; Rentability Areas of Aircraft; Flight Planning; Selection of Flight Path; Forming New Path-Flight Profiles; Technical and Economical Operations Characteristics of Aircraft; Transportation and Personnel Price Policies; Revenues; Private Service air Transportation; Air-Taxi and Charter Companies; Airlines Transportation and Operations Rules; Authorities.

**SHA602 Aircraft Dynamics 3+0 7.5**

Fundamental Definitions; Aircraft Handling Qualities; Control Surfaces and their Characteristics; General Equilibrium and Stability Definitions; Conditions and Features; Longitudinal Static Equilibrium and Stability Definitions and Features; Symmetrical Maneuver Analysis; General Equations of Motion of Aircraft; Analysis of Symmetrical Movements With Dimensionless Quantities; Longitudinal Static Stability Analysis; Longitudinal Dynamic Stability Analysis Stick-Fixed Stability Analysis; Stick-Free Stability Analysis; Study of Longitudinal Behavior and Unsymmetrical Movements; Study of Lateral Equilibrium and Stability; Analysis of Equilibrium and Stability of Special Flight Movements.

**SHA604 Engineering Economic Analysis 3+0 7.5**

Cost Concepts; Time Value of Money Operations; Interest Calculations; Single Sums of Money; Series of Cash Flows; Multiple Compounding Periods in Year; Continuous Compounding; Equivalence; Variable Interest Rates; Consideration of Inflation; Principle Amount in Loan Payment; Measuring the Worth of Investments; Methods of Measuring Investment Worth; Capital Recovery Formula; Comparison of Alternatives; Defining Investment Alternatives; Defining the Planning Horizon

**SHA608 Optimization Methods in Flight Mechanics 3+0 7.5**

Maximum and Minimum Theory, Maximums and Minimums of Multi Variable Functions, Lagrange Multipliers; Optimization; Optimization Conditions of Performances in Steady State Flight; Turns in Level Flight; Maximum Rate of Climb in a Constant Radius Helicoidal Climb; Maximum Bank Angle in a Helicoidal Climb; Minimum Radius of Turn in a Helicoidal Climb; Maximum Angular Velocity in a Helicoidal Climb; Calculation of Flight Altitude for Maximum Level Flight Speed; Maximum Range for a Given Flight Altitude; Optimization of Rate of Descent in a Helicoidal Descent; Minimum Flight Path Angle in a Helicoidal Descent.

**SHA614 Airport Design 3+0 7.5**

Airport Planning; Airport System Planning Airport Master Planning; Airport Site Selection; Airport Characteristics Related to Airport Design; Airport Capacity; Forecasting in Aviation and Airport Planning; Airport Configuration; Geometric Design of the Airfield; Passenger Terminal Design; Air Cargo Terminal Design; Heliports; STOL Ports and Vertiports; Airport Lighting and Marking; Structural Design of Airport Pavements.

**SHA615 Advanced Mechanical Vibrations 3+0 7.5**

Non-dispersive Behaviour of Uncoupled Vibrations; Pure Torsional Vibrations; Pure Shear Vibrations of Beams; Dispersive Behavior of Uncoupled Vibrations; Transverse Vibrations of Euler-Bernoulli Beams; Transverse Vibrations of Timoshenko Beams; Dispersive Behaviour of Uncoupled Vibrations, Approximate Solutions; Transverse Vibrations of Euler-Bernoulli Beams; Free Wave Propagation in Uniform, Infinite and Periodic Structures.

**SHA617 Sliding Mode Control Theory 3+0 7.5**

Switching Strategies for Linear Time-invariant (LTI) Systems; Driving LTI Systems Into the Sliding Mode and Making Them Track Desired Trajectory; Chattering and its Elimination; Relay Control; Robustness; Modeling Errors; Disturbances; Switching Hierarchy in MIMO Systems; Driving Nonlinear Systems Into the Sliding Mode and Making Them Track Desired Trajectory; Two-Link Robot Arm Example; MATLAB Implementation of Sliding Mode Control Techniques; Discrete Time Sliding Mode Control.

**SHA618 Fault Tolerant Flight Control System Design 3+0 7.5**

Introduction; Some Aircraft Accidents and Importance of Fault Tolerant Control; Fault Tolerant Control; Definitions and Concepts; Fault Detection; Fault Isolation; Reconfiguration; Methods Used in Fault Detection and Isolation; Full-Order Observers; Reduced-Order Observers; Unknown Input Observers; Fault Detection Using Observers; Fault Isolation Using Observers; Fault Detection Using Unknown Input Observers; Fault Isolation Using Unknown Input Observers; Kalman Filter; Flight Control System; Equations of Motion And Pitot Static System; Sensor and Actuator Fault Detection; Isolation and System Reconfiguration in Flight Control System; State Estimation; Fault Detection; Isolation and System Reconfiguration In Flight Control System Using Unknown input Observers; Practical Applications

**SHA619 Cogeneration -Combined Heat Power Systems 3+0 7.5**

Thermodynamic Principles of The Combined-Cycle Plant; Otto Cycle; Carnot Cycle; Diesel Cycle; Rankine Cycle; Brayton Cycle; Combined Cycle Concept; Single -Pressure Cycle; Preheating; Dual-Pressure Cycles; Triple-Pressure Cycle; Triple-Pressure Reheat Cycle; Application of Combined-Cycle; Combined Heat Power Systems's Components; Gas Turbine; Heat Recovery Steam Generator; Steam Turbine and Other Components; Comparison of Thermodynamic Performance of Combined Heat Power Systems; Economic Analysis of Cogeneration.

**SHA620 Aircraft Performance and Operational Analysis II 3+0 7.5**  
Fundamental Definitions, Limit Airspeeds; Limit Loads; Structural Maximum Weights; Flight Maneuvering Envelope; Engine Limitations; Take-off Performance And Limitations, Factors Effecting Take-off Performance; Cruise Performance, Cruising Speed, Range And Endurance, Factors Effecting Cruise Performance; Landing Performance And Limitations, Factors Effecting Landing Performance; Weight And Balance, Determination of The Center of Gravity; Mission Profile; Operational Analysis of The Mission Profile Phases; Flight Preparation; Fuel Calculations; Airworthiness Regulations.

**SHA621 Advanced Gas Thermodynamics 3+0 7.5**  
Basic Concepts: Maxwell correlations, Clapayron equation, Internal energy, Entropy, Enthalpy, Equations of state, Joule Thomson coefficient; Changes of Thermodynamic State in Gases, Enthalpy Change in Real Gases, Entropy Changes in Real Gases, Gas Behaviors, Formation Entropy in Gases; Combustion Analyses in Reactive Systems, First Law Analysis, Second Law Analysis; Phase and Chemical Balance in Combustion, Chemical Balance and Analyses in Gases, Phase Balance in Gases.

**SHA625 Fatigue of Thermal Barrier Coating Systems 3+0 7.5**  
Introduction to Gas Turbine Engines: Principles of Operation; Compressor; Combustion Chamber; Turbine; Thermal Efficiency; Introduction to Thermal Barrier Coating Systems: Substrate; Bond Coat; Thermally Grown Oxide; Top Coat; Materials Used in Thermal Barrier Coating Systems; Coating Techniques: Thermal spray; PVD; CVD; Gas Turbine Engine Applications; Microstructure of Thermal Barrier Coating Systems; Testing of Thermal Barrier Coating Systems: Isothermal ageing tests; Thermal Fatigue Tests; Thermal Mechanical Fatigue Tests; Isothermal Low Cycle Fatigue Tests; Hardness Tests; Creep Tests; Thermal Conductivity Tests.

**SHA626 Genetic Algorithms and Applications of Control Systems 3+0 7.5**  
Introduction to Genetic Algorithm; Traditional Optimization Techniques; The Goals of Optimization; Genetic Algorithms as a Optimization Process; How are Genetic Algorithms Different From Traditional Methods; A Simple Genetic Algorithm; Theoretical Basis of Genetic Algorithms; Basic Theorems; Computer Coding of Genetic Algorithms; Reproduction; Crossover; Mutation; Some Applications of Genetic Algorithms; Application Areas of Genetic Algorithms in Control Systems.

**SHA627 Sizing of Propeller-Driven and Jet-Powered Aircraft 3+0 7.5**  
Performance Objectives; Sizing Procedure; Speed Prediction; Airport Performance; Stall Speed; Landing/Take-Off Performance; Climb Performance; Cruising Performance; Aircraft Lift-Drag Characteristics; Engine Characteristics; Cruise Matching; Off-Design Cruise Operation; Aircraft Matching; Take-Off and Climb Calculation; Gross Weight Estimation; Weight Relationships; Useful Weight Fraction; Gross Weight Estimation; Range and Fuel Fraction; Aircraft Sizing.

**SHA628 Airspace Management 3+0 7.5**  
The Concept of the Flexible Use of Airspace; Flexible air Space Management and Civil/Military Coordination; Airspace Management Levels; Flexible Airspace Structures And Procedures; Strategic Level; Conditional Routes; Temporary Segregated Areas; Pretactical Level: Airspace Management Cell Authority; Airspace Allocation Process; Harmonization of Airspace Management/Air Traffic Flow Management; Centralized Airspace Data Function; Tactical Level; Operational Requirements; Technical Support; Air Traffic Services Organization; Publication of Air Space Management Information; Airspace Use Plan; Updated Airspace use Plan; Conditional Route Availability Message.

**SHA629 Non-Destructive Inspection Methods for Aircraft Maintenance 3+0 7.5**  
Advantages of Non-Destructive Inspection in Aircraft Maintenance; Capacity of Non-Destructive Inspection Methods for Structural Defects; Special Non-Destructive Inspection Methods; Non-Destructive Inspection of Aircraft Elements; Fuselage; Wings; Tail Group; Landing Gear; Power plants; Inspection of Circular Holes With or Without Fasteners; Inspection of Bolts and Rivets; Inspection of Corrosion and Fatigue Defects; Inspection of Thermal and Impact Defects; Inspection of Composite Structures.

**SHA630 Current Issues in Gas Turbine Engine Combustion Systems 3+0 7.5**  
Basic Notions: Classification and structure of gas turbine engines, General definitions about fuel systems; Low NOx Combustion Systems; Knocking In Combustion Chambers; Catalytic Combustion Systems; Methods for Improving Efficiency In Combustion Chambers: Water injection, Vapour injection; Noise In Combustion Chambers And Methods For Preventing; Hydrogen Utilization In Aviation; Fuel-Cell Utilization In Aviation; Synthetic Gas Fuel (Syngas) Utilization In Aviation; Biofuel Utilization In Aviation.

**SHA631 Aerothermodynamic Optimization of Aircraft Propulsion Systems 3+0 7.5**  
Classification of aircraft gas turbines; Turbojet engines; Turboprop; Turboshafft engines; Propfan engines; Advance ducted engines; Factors effecting thrust; Introduction; Thrust force; Jet nozzle; Air speed; Air mass flow; Altitude; Ram Effect; Engine performance parameters; Propulsive efficiency; Thermal efficiency; Propeller efficiency; Overall efficiency; Take



off thrust; Specific Fuel consumption; Aircraft range; Range factor; Specific thrust; Optimization of turbojet engine cycle; Thermodynamic analyse; Ideal cycle; Real cycle; Afterburner effect; Optimization analyses of turbojet cycle; Optimization of high bypass turbofan engine cycle; Thermodynamic analyse; Ideal cycle; Real cycle; Optimization of high bypass turbofan cycle; Optimization analyses of turbofan engine with afterburner cycle; Thermodynamic analyse; Ideal cycle; Real cycle; Optimization analyses of afterburner turbofan engine cycle; Optimization analyses of turboprop and turboshaft engine cycle; Thermodynamic analyse; Ideal cycle; Real cycle; Optimization analyses of turboprop and turboshaft engine cycles

**SHA632 Free Flight Concept and Analysis 3+0 7.5**

Definition and Concept Description; Environment; Scheduling; Routing; RTCA Workshop Report; Free Flight with Airborne Separation Assurance (ASAS); User Preferred Separation Assurance; User Preferred Local Traffic Flow Management Conformance; ASAS with Cockpit Display Traffic Information; Overview on Conflict Detection and Resolution Methods; State Estimation and Conflict Detection; Conflict Resolution Methods; Flight Rule Evolution and Optimization Process.

**SHA633 Operational Risk Management in Aviation 3+0 7.5**

Basic Concepts Related to Risk Management in Aviation Operations; The Culture of Safety-Risk-Reporting; Evaluation of Primary and Secondary Risks in Operations; Data Collection and Assessment for Risk Management; Risk Matrix and Analysis of Probability and Severity; Operational Risk Tools and Techniques; Bow-Tie Risk Analyze Tool; Elimination of Risks; ALARP Principle in Aviation; Problem and Scenario Based Practices for Operational Personnel.

**SHA634 Project Management in Aviation 3+0 7.5**

**SHA635 Trending Topics in Unmanned Aerial Vehicle Technology 3+0 7.5**

Introduction to Unmanned Aerial Vehicle Technology; Classification of UAVs; UAV Missions; Target UAVs; Lighter Than Air UAVs; Importance of Modularity in UAVs; Morphing UAV Structures; Amphibious UAVs; Solar Powered UAVs; Hydrogen Fuelled UAVs; Bio Inspired UAVs; Micro Rotary Wing UAVs; Micro Fixed Wing UAVs; Swarm Technologies in UAVs; Formation Flight of UAVs; Flying UAVs with Motion Control.

**SHA636 New Approaches in Air Traffic Management 3+0 7.5**

**SHA637 Performance Analysis of Aero Engines 3+0 7.5**

Air Vehicle: Aircrafts, Helicopter/Chopper, Unpowered Airvehicle, Unmanned Aerial Vehicles; Aero Engines: History and Development, Engine Types, Engine Simple Drawing; Aviation Performance Metrics: Specific Fuel Consumption, Specific Impulse/Power/Thrust, Overall Pressure Ratio, Thermal Limiting, EGT limiting; Energetic Performance Metrics: Entalphy Limiting, Energy efficiency, Energy Losses Ratio; Exergetic Performance Metrics: Exergy Efficiency; Waste Exergy Ratio, Fuel Exergy Waste Ratio, Productivity Lack Ratio, Exergetic Improvement Potential, Environmental Effect Factor, Sustainability Index.

**SHA638 Network, Fleet and Schedule Planning in Aviation 3+0 7.5**

**SHA639 Leadership and Change Management 3+0 7.5**

Leadership Concept: Leader; Leadership Psychology; Innovative Leadership: The role of innovation; Leadership and Ethics: Professional ethics, social and social ethics, the role of honesty in leadership; Policy and Leadership: Politics; Leading global and national policies; Importance of Leadership in Creating Successful Team: Teamwork; Change: The characteristics of change, the causes of change, the relationship of change with other concepts, the types of change; Change Management Concept: Importance, Objectives, Process; Change Management Approaches; Dimensions of change management; Organizational Change; Exchange Management in Aviation; Leadership in aviation; The importance of leadership and change management in airline management.

**SHA640 Single Score Life Cycle Assessment (LCA) 3+0 7.5**

**SHA642 ICT Project Management for Airports 3+0 7.5**

PMI Project Management Method: Initiation, Planning, Monitoring, Control, Close out; Scope of Airport IT Project: Scope of work, Grouping the sub systems, Definition of the specifications; Managing of: Budget, Integration, Risk, Quality, Tests; System Installations and Commissioning: Hierarchy in between systems, Integrations of the systems, System tests, ORAT - Operational Readiness and Transfer.

<b>SHA644</b>	<b>Gas Turbine Engine Theory and Systems</b>	<b>3+0 7.5</b>
Gas turbine engine theory and systems basic principles; History of gas turbine engines; Working principle of gas turbine engines: Brayton cycle; Gas turbine engine types; Gas turbine engine components: Air intake, Compressor, Combustion chamber, Turbine, Exhaust (Nozzle); Ignition system; Fuels and combustion; Lubrication system; Air system; Indicator system; Injectors and spraying; Auxiliary power units; Noise in gas turbine engines; Efficiency of gas turbine engines and factors affecting efficiency.		
<b>SHA692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>SHA790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>SHA890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>SHA890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>SHY508</b>	<b>Air Traffic Management</b>	<b>3+0 6.0</b>
History of Air Traffic Control and International Authorities; Air Traffic Management Definitions and Components: CNS/ATM concept, Air traffic control services, Alerting services, Information services, Air traffic flow management, Airspace management; Elements of Air Traffic Control System: Airspace, Technique equipment, Staff, Aero plane; Operational Air Traffic Management: Air traffic management functions, Organization, Planning-control, Co-ordination; Capacity and Efficiency: Recent problems and solution techniques in air traffic management, Simulation models and SIMMOD; Free Flight Concept; EATCHIP Programme.		
<b>SHY517</b>	<b>Aviation Safety Management</b>	<b>3+0 7.5</b>
Safety Fundamentals; Factors Affecting Aviation Safety; Human Factors: SHEL model, Factors affecting human performance; Error Management Models: Reason model, Threat and error management model; Resource Management Programs: Communication, Leadership, Team work, Stress management, Conflict management, Situational awareness; Improving Safety Culture of Aviation Organizations; Safety Management System; Accident and Incident Investigation; Case Studies.		
<b>SHY527</b>	<b>Air Transportation Economics</b>	<b>3+0 7.5</b>
The Concept of Air Transportation Economics; Structure of Air Transportation Industry; Economic Regulations in International Air Transportation Industry; Supply; Demand and Balance in Transportation Service; Market Structure and Competition; Airline Costs; Traffic Forecast and Capacity Management; Network Management: Network design; Scheduling; Fleet management; Tariff Structure and Pricing; Revenue Management; Airline Operations Performance; Case Studies: Network carriers; Low cost carriers; Other models.		
<b>SHY529</b>	<b>Cost Management in Aviation Companies</b>	<b>3+0 7.5</b>
Introduction to Cost and Management Accounting; Cost Concepts: Definition of cost; Variable; fixed; and mixed costs; Cost Behavior and Cost Allocation; Activity Based Costing; Cost Volume Profit Relationship; Profit Planning and Budgeting; Overview to Cost Management Systems in Services; Cost Elements of Airlines and Airports; Cost Control Techniques; Cost Analysis and Assessment in Aviation Industry; Relevant Costs and Decision Making; Management Control Systems and Performance Measurement; Case Studies.		
<b>SHY531</b>	<b>Crisis and Risk Management in Aviation</b>	<b>3+0 7.5</b>
Concepts of Crisis and Risk Management; Understand the Linkage Between Crisis, Risk Management and Organization; Effect of Ethics; Corporate Governance; Internal Control and Regulation; Risk Management Policy and Framework Development; Risk Management Principles and Methods; Identify Risks; Risk Situation is Influenced by Human-behavior and Culture within the Firm; Develop the Competencies and Capabilities to Both Manage Risk and Crisis; Crisis Management; Develop and Implement Organization-based Framework Models for Aviation Organizations; Best Practice of the Process are Investigations.		
<b>SHY534</b>	<b>Service Marketing in Airline Industry</b>	<b>3+0 7.5</b>
The importance of the concept of service and the service sector; Airline industry and services; Classification of services; Airline marketing mix and elements of product; Distribution and price; Promotion and advertising; Sales promotion; Public		

relations; Personal selling and direct marketing; Personnel; Airline service and the customer; Physical evidence; Capacity and demand management; Service quality; Service encounters and real life experiences; Relationship marketing.

**SHY536 Aviation and The Environment 3+0 7.5**

The State of Aviation Industry; ICAO, EASA, ACI, SHGM latest trends, developments and challenges on environment; Regulatory Framework; Overview of regulatory issues; International and national bodies involved in the development of aviation environmental policy; Operational Measures; Managing the growing demand and increasing adverse traffic impacts; Economic Measures; The role of external costs and economic measures on environmental policy; Technological Measures; Technological advancements and approach to environmental issues; Social, Economic and Environmental Impact; Social and economic contributions of aviation related activities and main environmental impacts of each actor in this industry; Environmental Management System; Guidelines for developing airline and airport environmental management systems; Sustainable Aviation; Contributions of Aviation to sustainable development; Environmental vision for the near and far future; Case studies among aviation stakeholders.

**SHY538 Case Studies in Aviation Management 3+0 7.5**

Airline Business Models; Traditional Carriers, Low Cost Carriers, Regional Carriers, Unscheduled Carriers; Airline Competition and Competitive Strategies; Boeing and Airbus Competition; Relationship between Airports and Airlines; Airline Markets in Selected Countries; Current Issues in Airline Management; Airline Alliances; Successful Cases in Airline Industry.

**SHY540 Air Transportation Management 3+0 7.5**

Concept of Air Transportation; History of Air Transportation Industry; Cost and Production Analyses; Airline Infrastructure; International Economy and Aviation; Open Skies and Global Alliances; Structure of Air Transportation Market; Pricing and Revenue Management; Low Cost Carriers; Charter Airlines; Regional Airlines; Air Cargo Airlines.

**SHY541 Marketing Management in Airlines 3+0 7.5**

The Marketing Concept; Airline Industry-Marketing Environment; Airline Marketing and Features; Customer Marketing Strategies; Product in Airline Market Pricing and Yield Management; Distributing the Product; Airline Advertising and Promotional Policies; Brand Management in Airline Marketing; Evaluation of the Air Transportation Market.

**SHY542 Financing Applications in Air Transportation 3+0 7.5**

Financial Management Within Today's Air Transportation Industry; Accounting in Air Transportation; Finance Organization in Air Transportation; Financial Ratio Analysis in Air Transportation; Sources and Uses of Funds in air Transportation; Financial Control in Air Transportation; Cash Management in Air Transportation; Case Study 1; Case Study 2; Case Study 3; Case Study 4.

**SHY544 Airport Safety, Operations and Management 3+0 7.5**

Basic Concepts; Airport definition, Airport classifications; Airport Safety: Basic concepts of safety, Safety management; Airport Physical Characteristics: Runway, apron and taxiways, Markings and markers, Lighting; Airport Facilities and Services; Airport Operations: Passenger services, Ground operations and handling, Baggage operations, Ramp, Security, Cargo operations, ARFF, Crisis management, Emergency management, Snow removal, Air traffic services, Wild life management, Disabled aircraft; Airport Commercial Management.

**SHY545 Operations Management in Aviation 3+0 7.5**

**SHY546 Management and Leadership 3+0 7.5**

Management Concept and Functions; Management, Manager, Leader, Management functions; Overview of Leadership Theories; Traits approach, Behavioral leadership theories, Contingency leadership theories; Strategic Management and Leadership; Leadership in Empowerment and Empowerment Practices; Globalization and Leadership; Leadership Practices in Aviation Organizations; Case Analysis.

**SHY547 Supply Chain Management in Aviation 3+0 7.5**

Logistics and Supply Chain Concepts; Logistics Management; Scope of Supply Chain Management; Structure of Supply Chain and Models; Decisions of Supply Chain; Role of Supply Chain Management in Aviation Business; Integrated Supply Chain Management; Supply Chain and Inventory; Supplier Selection in Supply Chain Management; Reverse Supply Chain Management; Supply Chain Management Practices in Aviation: Airline companies, Airport operators, Ground handling companies.

**SHY548 Data Mining Applications in Aviation 3+0 7.5**

Data Mining Framework and Basic Concepts; Data Mining Process; Data Exploration: Types of data, Descriptive statistics, Data visualization; Getting Started to RapidMiner Studio; Classification: Decision trees, KNN, Naïve Bayes, Artificial neural networks, Support vector machines; Regression Methods: Linear regression, Logistic regression; Association Analysis; Clustering; Model Evaluation; Text Mining; Feature Selection; Anomaly Detection.

**SHY549 Strategic Management and Planning in Aviation 3+0 7.5**

General View of Aviation Industry: Industry stakeholders, History, Regulatory framework, International and national policies; Concepts and Principles of Strategic Management and Planning for Civil Aviation; Transport Policy and Intersystem Coordination; Environmental Analysis in Aviation: Global, regional and national changes, Aviation and society; Strategic Analysis Techniques: SWOT; Strategic Planning and Strategic Thinking: Planning, Plan types, System plans, Master plans; Strategy Formulation: International and national industry level aviation strategies; Corporate, Business and Operational Level Strategies.

**SHY551 Contemporary Approaches to Management 3+0 7.5**

Concept of Management: Definition of management, functions; Evolution of Management Thought and Practices; Modern Management Approaches; Post-Modern Management Approaches; Core Competence and Competitive Advantage; Outsourcing; Restructuring of Organizations and New Organization Structures; Learning Organizations; Benchmarking; New approaches to Leadership; Total Quality Management; Knowledge Management; Innovation Management; Management in Digital Age: E-Business, Virtual organizations, Network organizations, Business models; Globalization and Strategic Alliances; Governance, Sustainability and Corporate Social Responsibility.

**SHY555 Sustainability in Aviation Businesses 3+0 7.5**

**SHY557 Aviation Analytics 3+0 7.5**

Basic Concepts: Data literacy, Big data, Data driven aviation industry, Data mining; Business Intelligence Framework; Business Analytics Framework; Data Management: Database management, Relational databases, Entity-relation diagram; Data Collection: Data classification, Data cleaning; Data Visualization; Aviation Data Sources; Descriptive Analytics; Predictive Analytics; Data Modelling: CRISP-DM methodology, Modelling algorithms, Model validation; Aviation Analytics Applications.

**SHY592 Seminar 3+0 7.5**

**SHY609 Airport Planning 3+0 7.5**

Airport Planning: Airport system planning, Airport master planning, Airport site selection; Impact of Aircraft Characteristics into Airport Design; Financing Airport Construction; Airport Capacity; Demand Forecasting Methods in Air Transportation; Airport Components and Layout; Geometric Design of Airport Airside; Design of Passenger Terminal; Design of Cargo Terminal; Heliport, STOL Port, and Vertiport.

**SHY610 Airport Operations and Management 3+0 7.5**

Airport Organizational Structure; Airport Revenues and Expenses; Airport Marketing; Service Quality and Its Measurement; Public Relations; Management of Passenger and Cargo Terminal Buildings; Ground Handling of Passengers and Baggage; Airport Capacity And Delay; Sustainable Airports Management; Social Impacts of Airports, Economic impacts of airports, Environmental impacts of airports; Environmental Management System; Airport Privatization; Airport Benchmarking.

**SHY612 Corporate Strategies in Aviation Business 3+0 7.5**

The Nature of Corporate Strategy: Concepts and approaches; Concentration Strategies; Integration Strategies: Vertical integration and horizontal integration strategies; Diversification Strategies; Geographical Expansion Strategies: Internationalization and globalization strategies; Entry and Exit Strategies; Aviation Industry Analysis: Industry structure, Current trends and problems; Major Drivers of Corporate Strategy in Aviation Businesses; Corporate Strategy Formulation and Execution in Aviation Businesses; Case studies.

**SHY613 Fleet Planning and Aircraft Selection Practices 3+0 7.5**

General specifications of airline transportation and importance of fleet planning: Structure of market, Types of fleet planning, Fleet planning elements, Fleet planning phases, Financial dimension of fleet planning; Determination of flight network and agreements; Factors IN aircraft selection in fleet planning; Aircraft specifications: Performance specifications, Aircraft characteristics, Technological specifications, Aircraft evaluation; Safety and maintenance in fleet planning; Fleet planning analyses and aircraft selection practices.

**SHY615 Current Marketing Practices Air Transportation 3+0 7.5**

New Approaches to Airline Marketing; Postmodern Marketing; Value-Based Marketing; Market Orientation; Customer Satisfaction; Niche Marketing; Database Marketing; Direct Marketing; Internet Marketing; Customer Relationship Management; Mobile Marketing; Event Marketing; Social Marketing; Marketing Communications.

**SHY616                    Current Management Practices in Air Transportation                    3+0   7.5**

Historical Development of Management Approaches and Practices; External Factors Affecting Air Transport Management Practices; Industry and Internal Dynamics of Air Transportation; 20th Century Management Philosophy and Practices in Air Transportation; 21st Century Management Philosophy and Practices in Air Transportation; Effects of Industrial Structure and Characteristics of Air Transportation on Management Practices; Successful Practices in Air Transportation; Relationship between Strategic Choices and Management Practices in Air Transportation; New Developments Affecting Air Transportation Management Practices; Air Transport Dynamics in the Future; Management Practices.

**SHY617                    Simulation and Applications in Aviation                    3+0   7.5**

**SHY619                    Digital Transformation in Aviation                    3+0   7.5**

E-Business, E-Commerce, Digital Firm Concepts and Tools; New Digital Technologies; Ethical, Legal, Social, Cultural, Economic and Global Dimensions of E-Business; Management of Innovation and Technology; Knowledge Management in Aviation; E-Business Tools; Airline E-Business Applications; Airport E-Business Applications; E-Business Applications in Other Aviation Enterprises; Innovation in Aviation: Innovation Types, New business models; Opportunities, Threats and Problems of Digital Age; Case Studies.

**SHY620                    Human Resources Applications in Aviation                    3+0   7.5**

Personnel and Human Resource Management; Human Resource Management Responsibilities; Human Resource Planning: Factors in forecasting personnel needs; Job analysis; The Recruitment Process; The Selection Process; Building Employee Commitment; Orientation and socialization process; Training and Development; Performance Appraisal; Career Management; Compensation Management: Basic aspects of compensation, Basic factors in determining pay rates; Personnel Discipline.

**SHY621                    Airline Cost Analysis                    3+0   7.5**

Decision Making; Measurement of Operations in Service Industry; Cost Concepts and Classifications; Cost Elements of Airlines; Costing Methods; Cost Analysis Methods; Cost Analysis and Investment Decisions in Airlines; Network and routes costs, Fleet and aircraft selection; Price Decisions and Cost Analysis in Airlines; Performance Management and Cost Analysis in Airlines; Profit analysis for network and route, Aircraft operating costs and profit analysis, Staff cost analysis, Profit analysis for passenger; Cost Analysis Examples for Unexpected Events.

**SHY622                    Airline Management Strategies                    3+0   7.5**

Fundamentals of Strategic Management; Fundamentals of Airline Business; Contemporary Management Approaches for Airlines; Costs and Revenues in Airlines; Positioning Strategy for Airlines: Cost leadership strategy, Differentiating strategy, Focus strategy; Airline Business Models; Airline within Airline Strategy; Outsourcing as an Airline Strategy; Effects of the Liberalization on Airline Management; Strategic Airline Alliances; Airline Mergers and Acquisitions; Globalization of Airlines; Revenue Management of Airlines.

**SHY623                    Micro Organization Theory and Aviation Practices I                    3+0   7.5**

The Main Paradigms of Organizational Behavior: Organization-human interactions; Individual Characteristics: Cognition, Perception and Individual decision making, Personality and Values, Emotions; Introduction to Organization: Socialization and Organizational Culture; Theories of Motivation; Leadership Theories; Groups and Teamworks; Organizational Policy: Power and Influence; Stress; Positive Organizational Behaviors: Negative Organizational Behavior: Cases and Practices in Aviation Organizations.

**SHY625                    Power and Politics in Organization Theories: Applications to Aviation                    3+0   7.5**

Overview of Power and Politics: Concept of power, The effects of national culture, Dimensions of power and power in organizations, Relationship between power and politics, Political skill, Typology of political behavior in organizations, Antecedents and successors of political behavior, Interpersonal influence tactics and Impression management; Power in terms of Macro Organization Theories; Power and Politics in terms of Micro Organization Theory. Analysis of studies on the aviation industry.

**SHY626                    Change Management in Aviation                    3+0   7.5**

Aviation Industry; New Management Approaches in Aviation; Emergence of Change Management Concept; Chaos; Change Management and Aviation Industry; Case Study in Aviation in Change Management; Turkey Application Change Management, Change Management Practices Europe, Asia-Pacific Application Change Management, Change Management Practices in North and South America; Understanding Change Management; Change Management and the Future.

<b>SHY627</b>	<b>Behavioral Finance and Aviation Applications</b>	<b>3+0 7.5</b>
Finance: Financial Decision, Risk and Uncertainty, Rationality and Human Concepts; Traditional Finance Theory: Expected Utility Theory; Behavioral Finance Theory: Historical Development of Behavioral Finance Theory; Kahneman and Tversky's Prospect Theory: Prospect Theory Processes, Correction Process, Evaluation Process and Value Function, Weighted Probability Function; Applications in Aviation Businesses: Airline Companies, Airport Companies, National and International Applications.		
<b>SHY628</b>	<b>Micro Organization Theory and Applications in Aviation</b>	<b>3+0 7.5</b>
The Main Paradigms of Organizational Behavior: Organization-human interactions; Individual Characteristics: Cognition, Perception and Individual decision making, Personality and Values, Emotions; Introduction to Organization: Socialization and Organizational Culture; Theories of Motivation; Leadership Theories; Groups and Teamworks; Positive Organizational Behaviors: Extra role behaviors, Positive deviation and Organizational citizenship; Negative Organizational Behavior: Stress, Burnout and Counterproductive behaviors; Organizational Policy: Power and Influence; Practices in Aviation Organizations.		
<b>SHY630</b>	<b>Micro Organization Theory and Aviation Practices II</b>	<b>3+0 7.5</b>
Recent Concepts in Organizational Behavior; Psychological Contract; Psychological Capital; Organizational Trust; Organizational Justice; Organizational Citizenship and Organizational Commitment Relationship; Emotional Labor; Mobbing; Organizational Silence and Organizational Cynicism; Burnout Syndrome; Organizational Alienation; Counterproductive Work Behaviors; Glass Ceiling Syndrome; Organizational Identification; Whistleblowing; Cases and Practices in Aviation Organizations.		
<b>SHY632</b>	<b>Airline Marketing Strategies</b>	<b>3+0 7.5</b>
Marketing Thought and Strategic Thinking; Marketing Planning in Airlines; Industry and Competitive Analysis in Airlines; Measurement of Market Opportunities and Market Attractiveness Analysis in Airlines; Marketing Strategies for New Products in Airlines; Marketing Strategies for Growth Stage in Airlines; Marketing Strategies for Maturity Stage in Airlines; Marketing Strategies for Decline Stage in Airlines; Marketing Strategies for Market Positions in Airlines; Marketing Strategies to be Applied in Crisis Periods in Airlines; Strategic Control and Evaluation of Marketing Performance.		
<b>SHY634</b>	<b>Strategic HR Management and Aviation Applications</b>	<b>3+0 7.5</b>
The Concept of Human Resources Management: Definition, Objectives of the HRM, Characteristics of the HRM; The Concept of Strategy: Definition of the strategy, Phases of the strategy formulation, Relationship between organizational strategy and the human resources function; Concept of Strategic Human Resources Management: Definition of SHRM, Principles, Objectives, Strategic human resources policy and philosophy; Transition from Personnel Management to Strategic Human Resources Management: Globalization, Competition, Future of Strategic Human Resources.		
<b>SHY636</b>	<b>Global Leadership and Critical Decision Making in Aviation</b>	<b>3+0 7.5</b>
Basic Concepts; Ethics, Behavior and Leadership; Leadership Behavior in Different Cultures; Diversity Management; Human Relations in Aviation; Leadership Styles and Skills in Aviation; Leadership Approaches; Leadership Psychology; New Trends in Leadership: Distributed leadership, Hybrid leadership, Virtual leadership, Risk leadership; Leadership and Motivation; Organizational Performance and Leadership; Leadership and Employee Performance; Leadership in New Business and Work Models in Aviation; Critical Decision Environments and Risks in Aviation; Teams and Leadership in Aviation; Analysis of Leader Cases from the Aviation Industry.		
<b>SHY638</b>	<b>Lean Management and Cases and Insights from Aviation Industry</b>	<b>3+0 7.5</b>
Basic Concepts; Lean Management Origins, Philosophy and Principles; Kaizen and Continuous Improvement; Lean Organization and Organizational Behavior: Behavioral and Cultural Transformation; Transformation and Adaptation Strategies and Techniques; Corporate Strategy and Lean Management; Learning Organizations; Lean Leadership and Staff Empowerment; Managerial and Organizational Simplification; Lean Risk Management; Industry 4.0 and 5.0; Simplification in the Education Sector; Digital Lean Transformation and Business Transformation; Lean Operations, Lean Production Systems, Simplification and Human Resources; Lean Supply Chain, Sustainability and Business Value Chain.		
<b>SHY692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>SHY790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>SHY890</b>	<b>Thesis</b>	<b>0+1 30.0</b>

<b>SHY890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>SPY501</b>	<b>Sport Management Approaches</b>	<b>3+0 7.5</b>
Management, Basic concepts, Characteristic of sport activities; Historical Development of Management Science; Early Scientific Period, Scientific management, Movement of scientific management, Management process approaching, Bureaucracy approach; Human Relationship Approach: Research of Hawthorne, Studies of Harwood; Modern Management: System approach, Modern management approach; Sports Management: Basic concepts, Development of sport management, Sport management and manager, Planning in sport management, Organization of sport management, Leadership in sport management, Coordination and controlling in sport management.		
<b>SPY502</b>	<b>Sports Economy and Analysis</b>	<b>3+0 7.5</b>
Importance of Economics in Effective Sport Management, Current Issues in Sports Economics, The Economist's General Approach to Issues, Basics Tools: Supply and Demand, Applying Supply and Demand: Optimal Ticket Pricing Strategies, Market Structures: Measuring the Competitiveness of an Industry; Industrial Organization of Sports: Identifying Revenues, Expenses, & Profits, Effects of Revenue Sharing on Team Behavior, Importance of Leagues, Monopolistic Practices of Leagues, Competitive Balance Issues; Labor Economics of Sports: What Determines Players' Salaries?, Attempts to Restrict the Competition for Players: Monopsony, Labor Unions and Labor Relations, Discrimination: Causes, Forms, and Effects; Public Finance and Sports: Competition for Teams across Cities.		
<b>SRM501</b>	<b>Ceramic Forming Techniques</b>	<b>3+0 7.5</b>
Ceramic Powder Specifications and their Importance in Terms of Forming; Considerations for Selection of Suitable Forming Techniques; Forming Techniques; Dry Pressing; Isostatic and Semi-Isostatic Pressing; Slip Casting; Pressure Casting; Tape Casting; Extrusion; Injection Molding; Gel Casting; Forming and Densification Techniques; Hot Pressing; Hot Isostatic Pressing; Machining and Finishing Processes; Choosing the Right Equipment Depending on the Problem. Each Forming Technique is Explained as Follows; Advantages and Disadvantages; Selection of Suitable Processing Additives; Equipment; Product Properties; Cost; Possible Defects; Their Cause and Control.		
<b>SRM502</b>	<b>Rheological Behavior of Ceramics</b>	<b>3+0 7.5</b>
Definitions of Colloids; Colloidal Systems and Importance of Interfaces; Electric Double Layer; Electrophoretic Mobility and Zeta Potential DLVO Theory and Stabilisation of Slurries; Processing Additives; Water, Organics; Surfactants; Deflocculants; Stability of Clay Systems; Effect of Anions and Cations; Flow and Deformation; Rheologic Behaviours; Pseudoplasticity; Dilatency; Thixotropy; Yield Point; Factors Affecting Viscosity; Practical Usage of Rheological Properties.		
<b>SRM503</b>	<b>Dielectric Materials and Devices</b>	<b>3+0 7.5</b>
Transformations and Tensors; Crystals and Texture Symmetry; Curie Principle and Neumann's Law; Polar Tensors; Pyroelectricity; Permittivity; Piezoelectricity; Elasticity; Thermodynamics; Equilibrium Properties; Axial Tensors; Piezomagnetism; Magnetoelectricity; Pyromagnetism; Magnetic Symmetry-Time Reversal, Hysteretic Properties-Domains; Transport Properties; Thermal and Electrical Conductivity; Galvanomagnetic Phenomena; Thermoelectric Phenomena; Thermomagnetic Phenomena; Waves Acoustics and Optics; Optical Activity.		
<b>SRM506</b>	<b>Structure-Property Relationships in Ceramics</b>	<b>3+0 3.0</b>
Introduction to Crystal Structure of Ceramics; Packing of Atoms and Ions in the Crystal Structures (e.g., Fcc, Hcp, Perovskite, Spinel, etc.) and Variation of Physical Properties of Ceramics as a Function of Atom Positions (e.g., Anisotropic Properties, etc.); Point, Line and 3-D Defect Formation in Ceramic Crystals (Ionic and/or electronic Disorders, Defect Chemical Reactions, etc.) and Influences of Those Defects on Physical Properties of Ceramics (e.g., Color and Color Centers, Gas Sensing Ability of Some Ceramics, etc.); Review of Microstructure Development in Ceramics (i.e., Sintering, Capillary Forces, Grain Size and Morphology, Removal of Pores from the Microstructure, etc.) and Influence of the Microstructure on Properties (e.g., Effects of Pore Size, Grain Size, or Grain Boundary on Mechanical, Thermal and Electrical Properties of Ceramics, Secondary Phase Effects on Physical Properties of Ceramics, etc.); Ceramic Materials Selection Criteria for Specific Applications.		
<b>SRM510</b>	<b>High Temperature Properties of Ceramic Materials</b>	<b>3+0 7.5</b>
Basics; Chemical Bonds in Ceramic Materials and Their Effect on Mechanical Properties; The Parameters Effecting the High Temperature Properties of Ceramic Materials; High Temperature Properties of Ceramic Materials: Strength, Creep, Fatigue, Oxidation, Corrosion, Mechanical Wear; Application of Ceramic Materials for High Temperature; Improvement of High Temperature Properties of Ceramic Materials.		
<b>SRM513</b>	<b>Making of Heavy-Clay Products</b>	<b>3+0 7.5</b>

Introduction; Heavy Clay Product; Building Bricks; Face Bricks And Engineering Bricks; Roofing Tiles; Hollow Floor Blocks; The Raw Materials For Brick And Tile Making; Preparation of Raw Materials; Shaping; Surface Treatment; Cutters; Drying; Firing; Treatment of The Finished Product; Measurement And Control Technology; Quality Control of Products; Planning of Heavy-Clay Plants; Future of Brick as a Building Material.

**SRM517 Ceramic Body and Glaze 3+0 3.0**

Classification and Production of Ceramics; Earthenware, Stoneware; Sanitary ware; Porcelain and Tiles; Body Composition; Methods of Body Preparation for Shaping in the Liquid; Plastic and Dry States; Glazing; Body-Glaze Relationship; Glaze Composition and Calculation; The Properties of Glazes; Special Glazes; Opaque; Matt; Crackle; Salt; Luster; Crystalline; and Aventurine. Ceramic Colors; Preparation and Application Ceramic Stains and Engobes; Glaze Defect and their Control.

**SRM520 Ceramic Tiles and Sanitary ware Production 3+0 7.5**

An Introduction to Ceramic Industry; Tiles: Wall Tiles, Floor Tiles, Porcelain Tiles; Raw Materials and Preparation, Milling and Granulation; Pressing, Glazing and Decoration; Sintering and Kilns; Frit Production and Glazes; Product Characterization, Standards and Testing; Sanitary Ware: Products, Raw Materials and Preparation; Production Methods: Slip Casting, Pressure Casting; Slip Preparation and Slip Casting; Drying; Sintering and Kilns.

**SRM521 X-Ray Diffraction Techniques in Materials Characterization 3+0 7.5**

Importance of Materials Characterization; Importance of XRD Techniques in Materials Characterization; Techniques Used in Materials Characterization and their Difference; Electromagnetic Radiation; The Continuous Spectrum; The Characteristic Spectrum; Absorption; Filters; Production of X-rays; Detection of X-rays; Introduction of the XRD Device; Specimen Preparation Methods; Interpretation of XRD Spectra; Lattices; Crystal Systems; Symmetry; Primitive and Non-primitive Cells; The Stereographic Projection; The Stereographic Projection; Diffraction Theory I: Directions of Diffracted Beams; Diffraction; Bragg Law; X-ray Spectroscopy; Diffraction Directions; Diffraction Methods; Diffraction Under Non-ideal Conditions Diffraction Theory-II: Intensities of Diffracted Beams: Scattering by an Electron; Scattering by an Atom; Scattering by a Unit Cell; Structure Factor Calculations: Multiplicity Factor, Lorentz Factor; Absorption Factor; Temperature Factor; Intensities of Powder Pattern Lines;

**SRM526 Ceramic-Metallic Thin Films and Coatings 3+0 7.5**

The Semi-Classical Theory of Conduction in Metals and Ceramics and the Electronic Band Structure of Selected Metals and Ceramics; Dielectric Properties of Insulators; Magnetic Ordering; Films-Coatings and Surface Effects; Growth Modes and Zone Models for Coatings and Films; Plasmas; Magneto-Electronic and Mechanical Properties of Selected Metal and Ceramic Films and Coatings.

**SRM528 Advanced Composite Materials 3+0 7.5**

Introduction; Classification of Composites; Ceramic Matrix Composites; Nano-composites; Laminate Composites; Metal Matrix Composites; The Properties and Conditions Required for Matrix and Reinforcement Phases in Composite Materials; The Effects of Thermal Expansion Mismatch in Composite Materials; Fracture Strength of Composites; Mechanical Properties of Composites; Fracture Mechanisms of Composites; Toughening Mechanisms; Properties of Interfaces and Thermal Stresses; Thermal Shock Parameters; Stress-Strain Behavior of Ceramics with the Addition of Reinforcement Phase.

**SRM592 Seminar 3+0 7.5**

**SRM599 Term Project 3+0 0.0**

**SRM602 Transmission Electron Microscopy and Interphase Boundaries 3+0 7.5**

Importance of Interphase Boundaries; Classification of Interphase Boundaries; Low Angle Boundaries and their Properties; High Angle Boundaries and their Properties; Interphase Boundaries between Different Crystals; Interphase Boundaries between Metal and Ceramics; Techniques to Characterize Interphase Boundaries; Transmission Electron Microscopy; Energy Dispersive X-ray Spectroscopy; Parallel Electron Energy Loss Spectroscopy; Dark Field; Bright Field; Fresnel Defocus and High Resolution Imaging Techniques; Diffraction of Electrons.

**SRM604 Ceramic Sensors 3+0 7.5**

Physical-Chemical and Technological Principles of Ceramic Sensors; Physical and Chemical Bases of Ceramic Sensor Operation; Technological Principles of Ceramic Sensors; Ceramic Humidity Sensors; Semi Conductive Humidity Sensors; Pore Structure Control and Control of the Sensitivity of Ceramic Humidity Sensors; Testing and Stabilization of Ceramic Humidity Sensor Parameters; Ceramic Humidity Sensors Made of Solid Electrolytes; Ceramic Gas Sensors; Ceramic Alcohol Sensors; Ceramic Oxygen Sensors; Ceramic Sensors for Other Gases; Ceramic Temperature Sensors; NTC-



Thermistors; PTC-Thermistors, CTR-Thermistors (Critical Temperature Resistors); Capacitive Ceramic Temperature Sensors; Ceramic Pressure Sensors; Multifunctional Ceramic Sensors; Application of Ceramic Sensors.

**SRM606 Structural Advanced Ceramics 3+0 7.5**

Importance of Structural Advanced Ceramics; Classification of Structural Advanced Ceramics; General Properties; Processing Techniques and Applications of Non-oxide Structural Advanced Ceramics; Examples for Non-oxide Structural Advanced Ceramics; Silicon Carbide; Silicon Nitride; Sialons, Boron Nitride; Boron Carbide; Aluminum Nitride; General Properties; Processing Techniques and Applications of Oxide Structural Advanced Ceramics; Examples for Oxide Structural Advanced Ceramics; Alumina, Mullite; Zirconium.

**SRM608 Ferroelectrics Materials and Devices 3+0 7.5**

Crystal Structure and Ferro Electricity; Origin of Spontaneous Polarization; Origin of Field Induced Strain; Electro Optic Effect; Applications of Ferroelectrics; High Permittivity Dielectric; Pyroelectric Devices; Piezoelectric Materials; Piezoelectric Resonance; Piezoelectric Transformers; Ultrasonic Transducers; Surface Acoustic Wave Devices; Piezoelectric Actuators; Ultrasonic Motors; Electrooptic Devices; Wave Guide Modulators; PTC Materials; PTC Phenomenon; PTC Thermistors; Grain Boundary Layer Capacitors; Composite Materials.

**SRM609 Scanning Electron Microscopy and Chemical Analysis Techniques 3+0 3.0**

Introduction; What is the Importance of Microstructural Investigations?; What are the Reasons for the Use of Electron Microscopes; Which Techniques are Used for the Characterization of Microstructures; Specimen Preparation for Electron Microscopy; Interactions between Electrons and Specimen; Depth of Signals Produced as a Result of Interactions and their Use; Scanning Electron Microscopes (SEM) and its Parts; Chemical Analysis Techniques: Energy Dispersive X-ray Spectrometers (EDX) and Wavelength Dispersive X-ray Spectrometers (WDX); Parameters to be Known to Obtain Best Quality Images and Reliable Chemical Analysis; Comparison with Environmental Scanning Electron Microscopes (ESEM) and Other Techniques; Investigation of Different Materials in SEM.

**SRM612 Crystal Anisotropy 3+0 7.5**

Introduction and Overview; Permittivity; Polarization Mechanism; Dispersion and equivalent circuits; High Voltage Insulators; Electric Breakdown Mechanisms; Substrates and Packaging; Thick and Thin Film Processing; Resistance; Electronic Conduction; Fixed Resistors, PTC and NTC Thermistors, Varistors and Barrier Layer Capacitors, Humidity and Chemical Sensors; Ceramic Electrodes and Superconductors; Ionic Conduction and Batteries; Capacitors; Disk, tubular, Multilayer; Low k Ceramics: Temperature coefficient, Microwave dielectric resonators.

**SRM614 Colloid Chemistry and Rheological Behaviour 3+0 7.5**

Introduction to Colloid Chemistry and Classification; Colloidal Systems and Importance of Interface; Kinetic Properties; Surface Tension and Surface Energy; Gibbs Adsorption Equation; Adhesion, Cohesion, and Diffusion; Physical Adsorption by Solids; Physical Adsorption by Solids; Langmuir Isotherms; Freundlich Adsorption Isotherm; BET Adsorption Theory; Electrical Phenomena at Interfaces; Electrical Double Layer and Zeta Potential, DLVO Theory; Colloid Stability; Flotation; Surfactants; Wetting; Rheological Behaviour; Pseudo Plasticity; Dilatant Flow Behaviour; Thixotropy, Effective Parameters on Viscosity; Rheological Applications; Stability of Clay Based Mud; Slip Casting; Ceramic Glazes.

**SRM692 Seminar 3+0 7.5**

**SRM790 Thesis 0+1 30.0**

**SRM890 Thesis 0+1 30.0**

**SRM890-0 Thesis (Thesis Proposal) 0+1 30.0**

**SYR512 Customer Relationship in Sport 3+0 7.5**

Definition of Customer Relationship Management in Sports; Components in Customer Relationship Management in Sports; Characteristics of Customer Relationship Management in Sports; Customer Relationship Management Process in Sports; Strategies in Customer Relationship Management; Data Mining; Customer Orientation in Sports; Relationship Marketing; Purposes and Benefits of Customer Relationship Management in Sports; Electronic Customer Relationship Management in Sports; Fan Relationship Management; Electronic Fan Relationship Management; Relationship Quality Concept in Sports; Characteristics of Relationship Quality in Sports.

**SYR513 Leisure and Recreation Analysis 3+0 7.5**

Etymological Definitions of Leisure; Experiential Definitions of Leisure; Work and Leisure; Uses of Leisure: Essential elements of leisure, Abnormal leisure, Serious, casual and project-based leisure; Leisure and Consumption: McDonalidization or Ikeaization; Yin-Yang Theory in Leisure Researches: Qualitative and quantitative approaches, Uses of qualitative and quantitative approaches in recreation, Objective and subjective approaches; Life Style and Leisure.

**SYR514 Brand Management and Sports 3+0 7.5**

Changing Competition and Brand: Brand and Branding Process from Past to Present; Basic Concepts Related to Brand: Associations, Awareness, Image, Personality; Brand Management in Sports and Configuration: Brand identity planning models in sports, Communications strategies, Brand positioning in sports and factors affecting brand positioning; Brand Management in Sports and Integrated Communications: Features of sports consumers and brand, Corporate communications and brand management; Case Studies of Sports Brands.

**SYR515 Recreation Project Management 3+0 7.5**

Project and Introduction to Project Management: What is project?, Classification of projects, What is project management?, The basic functions of project management, Project stakeholders, Project life cycle; Project Initiation: Project initiation document, Identifying stakeholders, Project kick off meeting; Project Planning: Time management, Planning process, Creating an effective project team, Types of cost, Budgeting, Risk management and planning; Execution of the Project; Project planning, Technical management and approaches, Quality management in project; Project Monitoring and Control: Establishment of project monitoring and control system, Monitoring and control of risks; Project Closure; Project closure formats, Sub-processes of project closure, Termination of the project.

**SYR516 Leisure Education in Theory and Practice 3+0 7.5**

Introduction to Educational Sciences: Culture, Culturalization, Types of education, Teaching, Learning, Education and teaching program; Theoretical Perspective to Leisure Education: Relationship between education and leisure, History of leisure education, Leisure education need in society; Leisure Education Approaches and Applications; Leisure Education Components: Awareness, Motivation, Time management, Social interaction skills, Problem solving; Leisure Education in the World; Original Applications of Leisure Education; Scientific Studies on Leisure Education.

**SYR517 Theoretical Approaches on Leisure 3+0 7.5**

Historical View on Leisure Education: Leisure in prehistoric ages, Leisure in ancient times, Leisure in middle age, Leisure in new and modern eras; Understanding of Leisure Concept: Time based approaches, Activity based approaches, Quality based approaches, Attitude based approaches; Leisure Theories: Flow theory, Self determination theory, Leisure constraints theory, Serious and casual leisure, Theories on politic ideological values of leisure; Scientific Studies on Leisure: Studies on leisure in the domestic literature, Studies on leisure in the international literature.

**SYR518 Research Methods and Applications in Sports Management and Recreation 3+0 7.5**

Basic Concepts in Research: Knowledge, Science, Scientific method, Scientific research, Types of scientific research; Basic Concepts in Scientific Research: Assumptions, Structures, Proposition, Variable, Hypothesis, Assumption, Theory; Research Planning Principles: Defining the problem, Determining methods, Concepts related to the universe and sample, Data types and data collection methods, Data collection and organization; Reporting of Scientific Researches: Types of text writing, references and bibliography; Methods and Contents Used in Sports Management and Recreation Research; International Indexes, Publications and Case Studies in Sports Management and Recreation.678

**SYR519 Therapeutic Recreation Program and Practices 3+0 7.5**

The Meaning and Importance of Recreation and Sport for the People with Disabilities; Variety, Reasons and Classification of the People with Disabilities; The Effects of Recreative Activities and Sport for the People with Disabilities; Sport and Recreative Activities: Recreation and sport practices for the people with intellectual disabilities, Recreation and sport practices for the people with orthopedic disabilities, Recreation and sport practices for the people with visual impairments, Recreation and sport practices for the people with hearing impairments; Examination of the Literature of Recreation and Sport Practices for the People with Disabilities.

**SYR520 The Therapeutic Recreation Leadership 3+0 7.5**

Leadership in Therapeutic Recreation: The meaning of leadership; Basic Leadership Components: Leadership and Power, Basis for Leadership Power and Influence; Leadership Theories: Trait theories, Behavioral theories, Situational theories, Interactional theories; Leadership Styles: Principles and Methods of Leadership; Qualities and Traits of the Therapeutic Recreation Leader; The Role of the Therapeutic Recreation Leader: Individual and group leader, Recreational therapy groups and structure, Group elements and relationship, Group dynamic, Evaluation group, Principles for group leadership; Leadership, Activities and Program Planning in Therapeutic Recreation: Goal setting and activity selection, Specialized activities and treatment techniques; Strategies for Growth and Learning in Therapeutic Recreation Leadership: Motivational strategies, Instructional strategies, Growth promoting strategies. 905

- SYR522 Leisure and Ageing 3+0 7.5**  
 Leisure and Time; The Importance of Leisure; Leisure Throughout Life Cycle: Lifestyle and leisure, Leisure need of older adults; The Ageing: Biological processes, Cognitive processes, Psychological ageing; Theoretical Perspectives on Ageing and Leisure Involment: Leisure patterns, Constraints and social support; The Importance of Leisure; Leisure Benefits on Ageing; The Leisure Experience: Meaning and motivations on ageing; Planning a Leisure Lifestyle: Leisure in retirement.
- SYR523 Leisure and Consumer Culture 3+0 7.5**  
 Leisure Industry. In Consumer Society: Contemporary patterns, Leisure and Cultural structures. Participation in Leisure Activities: Identity, Gender, Social class, Race and Ethnicity effect. Evaluation of Participation Forms in Leisure Activities in Different Societies. Urbanization, Mass Media. Economic, Environmental and Political Analysis of Leisure Culture. 363
- SYR524 Organizational Behavior In Sport Management 3+0 7.5**  
 Scientific development of organizational behavior; Motivational theories; Individual characteristics, attitudes and values within the group; Individual and organizational decision making theories; Conflict management in sports organizations; Power relations and politics in sports organizations; Organizational change and management in sports organizations; Job satisfaction and job commitment in sports organizations; Environment-technology-organization relationship in sports organizations; Organizational silence and mobbing in sports organizations; Organizational communication in sports organizations; Recent research on organizational behavior in sport.
- SYR525 Leisure and Healthy Living 3+0 7.5**  
 Disadvantages of Still Life. Quality of Life and Sports of All Ages: The main goals of exercise, Scientific foundations of quality of life. Sport as a Leisure Tool. Effects of Regular Lifelong Sports Practices on Human Health; Aerobic exercise, Life-long sports applications. Exercise Examples: Obesity and exercise, Weakness and exercise, Children and sports. Exercise Programs That Can Be Recommended in Healthy Life Activities.
- SYR526 New Media and Digital Communication in Sports 3+0 7.5**  
 Development of New Communication Technologies: Web 2.0, Web 3.0, Web 4.0, Internet of Things; The Concept of Information Society; Concept of Digital Communication and Its Effect on Corporate Communication; Structuring Digital Communication Strategies; Social Media in Corporate Communication; Effect of Social Media on Sports; Social Media Marketing in Sports; New Media Applications in Sports: Sports related content in new media.
- SYR527 Academic Writing and Critical Thinking 3+0 7.5**  
 Introduction to Academic Writing and Critical Thinking: Types of academic writing, the importance of critical thinking in academic writing; Academic Writing Process and Types: Structural analysis and organizational strategies; Effective Research Questions and Hypothesis Development; Researching and Using References in Research; Critical Thinking Skills, Fundamentals and Perspectives; Academic Writing Styles and Critical Approaches in Social Sciences; Ethics and Critical Perspective in Academic Writing; Academic Writing and Scientific Publication; Effective Scientific Publication Editing Strategies and Problems in the Context of Academic Writing and Critical Thinking.
- SYR529 Current Approaches To Sports Fandom 3+0 7.5**  
 The concept of sports fandom; The process of being a sports fan; Sports fan typologies; Sports team-player-fan relationship; Gender and diversity in sports fandom; Individual and social effects of sports fan groups; The relationship between sports fans and violence; Theoretical approaches to sports fan behaviors; Digital transformations in sports fandom; Normative factors in sports fandom; Motivational factors in sports fandom; Emotional factors in sports fandom.
- SYR531 Data Analysis and Practices in Sport Management Research 3+0 7.5**  
 Fundamentals of Statistical Analysis: Research, Data Analysis, Types of Data; Selection of Appropriate Statistics for Data Analysis; Describing Data: frequency distribution, measures of central tendency and variability; Simple and Partial Correlation; Validity and Reliability Analyses; Related and Unrelated Measurements and Comparisons; Simple and Multiple Regression; Multivariate Statistics; Analysis of Covariance; Non-Parametric Statistics; Qualitative Data Analyses: Thematic Analysis, Content Analysis, Discourse Analysis; Uses of Quantitative and Qualitative Data Analysis Software and International Case Studies.
- SYR592 Seminar 3+0 7.5**
- SYR601 New Trends in Recreation 3+0 7.5**

- SYR610 Event Planning and Project Management 3+0 7.5**  
 An Overview of Sports Events and Planning; Structure and Types of Sports Events; Development of Sports Organizations; Phases and Planning of Sports Organizations and Events; Project Management and Basic Terms Related to Project Management; Effective Project Management Techniques; Characteristics of Project Management and a Project Manager; Process of Project Management: Planning, Monitoring; Control Related Methods, Approaches, Applications; Project Teams; Project Budgeting.
- SYR611 Contemporary Approaches in Sport Management 3+0 7.5**  
 An Overview of the Concept of Management; Concept of Organization and Its Importance; Classical and Neoclassical Management Approaches; Contemporary Management Approaches and Contingency Theory; System Approach; Characteristics of a System; System Model; Post-modern Management Theories; Transformational Management and Transformational Leadership; Learning Organizations; Coaching Style Management Approach; Charismatic Leadership Approach; Effects of Contemporary Management Approaches on Sports.
- SYR612 Modern Sport Marketing Applications 3+0 7.5**  
 Paradigm Changes in Marketing; Analysis of Environmental Changes Influencing Marketing in the New Era; Projections Towards Sports Marketing; Newly Emerging Areas of Marketing in Sports Business; Relationship between Management and Customer Relationship Marketing (CRM) in Sport; Database Marketing and One-to-One Marketing; Data Mining Application in Sport Contexts; Consumer Behavior Models in Sports; Electronic and Mobil Sports Marketing Applications; New Sports Marketing Trends in the Future.
- SYR614 Risk Management in Sport Organizations 3+0 7.5**  
 Relationships Between Sport Organizations and Risk Management; Identification of Risks; Valuation: Valuation of Risk; Decision Making and Risk Management; Problems in Risk Management; Developing and Implementing Risk Management; Medical Emergency Action Plans; Protecting Children; Lightning Safety; Drug Testing; Equipment, Premises, Construction and Supervision; Ground Safety; Insurance in Sports Activities and Its Applicability.
- SYR615 Strategic Sport Communication 3+0 7.5**  
 Relationships Between Sports Management and Sports Communications; Growth and History of Sports Communication; Strategic Sports Communication Model (SSCM) in Sports Communication; Personal Sports Communications; Organizational and Leadership Communication in Sports; Integrated Marketing Communications in Sports; Publishing and Print Communication in Sports; Electronic and Visual Sports Communications; Online Sports Communication and New Sports Media; Social Media; Sports Advertising; Public Relations and Crisis Communication in Sports; Sports Communication Research.
- SYR617 Measuring Tool Development 3+0 7.5**  
 Definitions of Questionnaire and Scale; Preparing Questionnaire and Scale; Performing Questionnaire or Scale; Determining Sample; Sources of Bias; Definition of Validity an Types: Content validity, logical validity, Concordance validity, Construct validity, Definition of Reliability: Reliability testing techniques and estimations, Item Analysis; Exploratory factor analysis: Assumptions and techniques, Factor loadings, Rotation techniques, Confirmatory factor analysis: Assumptions and techniques, Practice.
- SYR618 Recreational Leadership 3+0 7.5**
- SYR619 Leisure Economics and Applications 3+0 7.5**  
 Economic Analysis of Organizations; Activity dimensions, Mass participation, Social dimensions. Economic Effects of Participation Dimensions; Modeling, Consumer preferences. Public and Private Sector Analysis; Theoretical and practical examples, Expenditure, Economic effects, Market structure, Pricing, Materials. Volunteers; Profile, Dimensions, Restrictions. Motivation Elements. Evaluation of Local Government Examples.
- SYR621 Psycho-Social Issues In Leisure Research 3+0 7.5**  
 Relationship Between Psychology And Leisure: Personality and leisure, Subjective well-being and leisure, Satisfaction and leisure, Emotional disorders and leisure, Stress and the role of leisure in stress management; Relation of Sociology and Leisure: Gender and leisure participation, Socio-economic factors and leisure participation, Social problems and leisure participation; Psychosocial research with theoretical basis: Basic theories of psychology and leisure research, Basic sociology theories and leisure research; Specific Applications In Leisure-Time Psycho-Social Issues; Academic Research On Psycho-Social Issues For Leisure.
- SYR623 Strategic Human Resources Management and Applications 3+0 7.5**

The importance of human resource management strategies in globalizing world; Analyzes and applications for people working in sports facilities; Case studies of recruitment strategies in sports facilities; Performance evaluation strategies and applications in sports organizations; Investigations related to employment and job areas in sports organizations.356

**SYR625 Sustainability in Sport Management and Recreation 3+0 7.5**

Introduction to Sustainability: Basic dimensions of sustainability, environmental sustainability, social sustainability, economic sustainability, sustainable development; Relationship between Sport and Sustainability; Relationship between Sport Management and Sustainability; Sustainability in Sports and Recreation Activities; Sustainability in Sports Facilities: Sustainable facility management within the social, environmental and economic dimensions; Sustainable Approaches in Sports Organizations: sustainability practices in national and international organizations, case studies.

**SYR627 Customer Relationship Management Strategies and Applications 3+0 7.5**

Analysis of the effectiveness of relational marketing; Effective relational marketing components; Analyzing strategies and practices related to customer relationship management; Six critical success factors in managing customer relations; Fan relationship management strategies in sports clubs; Examining the strategies and applications related to the management of electronic customer relations in sports organizations and introducing new ideas.

**SYR629 Management in Therapeutic Recreation Services 3+0 7.5**

Therapeutic Recreation Management: Characteristics of management, Theories of management, Functions of management; Therapeutic recreation manager: Leadership, Leadership theories and styles, Integrative leadership, Vision, Mission, Philosophy and objectives, Organizational behavior in therapeutic recreation; Operational Management: Financial management and budgets, Decision making, Problem solving and conflict management, Therapeutic recreation and marketing; Human Resource Management: Effective communication, Motivation, Performance appraisal, Staff training and development; Consumer Management: Service delivery management, Risk management, Quality service management.

**SYR631 Sociology of Body 3+0 7.5**

The meaning, limits, nature of the body; the relationship between the body and philosophy; intervention on the body; the change of the body historically; the meaning and value of the body in the traditional period; transformation from love to drink, from the soul to the body; modern period body debates; the relationship between sports and the body; Postmodern body; the relationship between the body and consumer society; body and power; globalization and body debates.

**SYR633 Sports Betting and Behavioral Researches 3+0 7.5**

Introduction to Sports Betting and History; Introduction to Behavioral Research Methods; Policies and Statistics in Sports Betting; Sports Betting and Consumer Behavior as a Sports Product; Risk Management in Sports Betting; Behavioral Economics Approaches in Sports Betting; Psychological Factors and Decision Making Processes in Sports Betting; The Importance of Artificial Intelligence and New Media in Sports Betting; Behavioral Addictions in Sports Betting and Sports Betting Addiction; Sports Betting Researches in the Academic Field.

**SYR635 Academic Writing and Critical Thinking 3+0 7.5**

Introduction to Academic Writing and Critical Thinking: Types of academic writing, the importance of critical thinking in academic writing; Academic Writing Process and Types: Structural analysis and organizational strategies; Effective Research Questions and Hypothesis Development; Researching and Using References in Research; Critical Thinking Skills, Fundamentals and Perspectives; Academic Writing Styles and Critical Approaches in Social Sciences; Ethics and Critical Perspective in Academic Writing; Academic Writing and Scientific Publication; Effective Scientific Publication Editing Strategies and Problems in the Context of Academic Writing and Critical Thinking.

**SYR692 Seminar 3+0 7.5**

**SYR790 Thesis 0+1 30.0**

**SYR890 Thesis 0+1 30.0**

**SYR890-0 Thesis (Thesis Proposal) 0+1 30.0**

**TAÇ701 Thesis Research Study Course 3+0 7.5**

Introduction: The Laboratory/Studio Facilities; Teaching Staff; Expectations from Graduates within the Framework of Qualifications for Master of Science; Interdisciplinary Studies and Their Importance; Laboratory/Studio Planning; Scholarships and Project Opportunities; Scientific Research projects, National and International projects/competitions, Industry oriented projects; Project Writing, Managing and Concluding; Determining a Research Question; Patent / Design Registration Research and Writing; Scientific Databases; Journal's Impact Values and Importance; Writing Articles; Plagiarism Software Programs.

**TAÇ701 (Eng) Thesis Research Study 3+0 7.5**

Introduction: The Laboratory/Studio Facilities; Teaching Staff; Expectations from Graduates within the Framework of Qualifications for Master of Science; Interdisciplinary Studies and Their Importance; Laboratory/Studio Planning; Scholarships and Project Opportunities; Scientific Research projects, National and International projects/competitions, Industry oriented projects; Project Writing, Managing and Concluding; Determining a Research Question; Patent / Design Registration Research and Writing; Scientific Databases; Journal's Impact Values and Importance; Writing Articles; Plagiarism Software Programs.

**TAÇ801 Thesis Research Study Course 3+0 7.5**

Introduction: The Laboratory/Studio Facilities; Teaching Staff; Expectations from Graduates within the Framework of Qualifications for Phlisopy of Doctorate; Interdisciplinary Studies and Importance; Laboratory/Studio Planning; Scholarships and Project Opportunities; Scientific Research Projects, National and International projects/competitions, Industry Oriented Projects; Project Writing, Managing and Concluding; Determining a Research Question; Patent/Design Registration Research and Writing; Scientific Databases; Journal's Impact Values and Importance; Writing Articles; Literature Review; Plagiarism Software Programs.

**TAÇ801 (Eng) Thesis Research Study 3+0 7.5**

Introduction: The Laboratory/Studio Facilities; Teaching Staff; Expectations from Graduates within the Framework of Qualifications for Phlisopy of Doctorate; Interdisciplinary Studies and Importance; Laboratory/Studio Planning; Scholarships and Project Opportunities; Scientific Research Projects, National and International projects/competitions, Industry Oriented Projects; Project Writing, Managing and Concluding; Determining a Research Question; Patent/Design Registration Research and Writing; Scientific Databases; Journal's Impact Values and Importance; Writing Articles; Literature Review; Plagiarism Software Programs.

**TER501 Advanced Thermodynamics 3+0 7.5**

Summary of Thermodynamics: First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Analysis of The Second Law of Thermodynamics, Gas Power Cycles: Brayton Cycle, The Brayton Cycle With Regeneration, The Ideal Jet-Propulsion Cycle; Thermodynamic Property Relations; Gas Mixtures: The Ratio of Mole and Mass of a Gas Mixture, P-V Behavior of Gas Mixtures, Properties of Gas Mixtures; Gas-Vapor Mixtures and Air Conditioning: Dry and Atmospheric Air, Specific and Relative Humidity of Air; Chemical Reactions: Fuels and Combustion, Theoretical and Actual Combustion Processes.

**UBE901 Research in Area of Specialization 5+0 7.5**

**UBJ701 Research in Area of Specialization 3+0 4.5**

**UBJ702 Research in Area of Specialization 3+0 4.5**

**UBJ901 Research in Area of Specialization 5+0 7.5**

**UBJ902 Research in Area of Specialization 5+0 7.5**

**UBM701 Research in Area of Specialization 3+0 4.5**

**UBM702 Research in Area of Specialization 3+0 4.5**

<b>UBM901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UBM902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UCS506</b>	<b>Methods of Numerical Analysis</b>	<b>3+0 7.5</b>
<p>Linear Transformations: Approximation and matrices; Linear Geometry: Lines and Vectors; Linear Geometry in Space and Perspective; System of Linear Equations: Gauss and Gauss-Jordan Elimination Methods; The Rank of a Matrix and The Simplex Algorithm; Basic Matrix Algebra: Matrix multiplication and its properties; Determinants; LU Factorization; The Key Subjects of the Linear Algebra; Linear Composition and Subspaces; Linear Independence; Basis and Dimension; Vector Geometry: Scalar Product; Angles and Projections; Vector Product; Eigenvalues and Eigenvectors; Eigenspaces and Diagonalization; Symmetric Matrices and Probability Matrix; Matrices and Linear Transformations; Change of Basis, Orthogonalization and The Least Square Method; Orthogonality and the Gram- Schmidt Orthogonalization Method; Orthogonal Projections.</p>		
<b>UCS508</b>	<b>Interpretation and Analysis Techniques on Geographic Information Systems</b>	<b>3+0 7.5</b>
<p>The Quality of Graphic Data; Graphic Data Preparation for Analysis And Modeling Studies, Topological Analysis Applications: Neighborhood Relationship, Location Modeling Techniques; Raster and Vector Data Interactions with Database; Recoding Analysis on Raster and Vector Data; Physical Interactions Between Graphic Data: Union, Subtraction and Intersection and Neighborhood Relationship Between Vectoral Areas; Three-Dimensional Analysis and Modelling Techniques; Evaluation of the Data in Three-Dimensional Space; Data Interpolation Techniques In Two-dimensional (pixel) and Three-dimensional (voxel) Space Analysis and Modeling on Topographic Surfaces: Analysis of Slope, Aspect and Visibility, Evaluation of Elevation.</p>		
<b>UCS511</b>	<b>Remote Sensing and Geographic Information Systems Techniques in Disaster Management</b>	<b>3+0 7.5</b>
<p>What is Natural Disaster?; Types of Natural Disaster: Flood, Landslide; Earthquake; Remote Sensing Applications after Disaster; The Relationship between Emergency Management and GIS at Disaster; Using of Disaster Related Data in GIS; Use of RS and GIS for Geotechnical Research Regarding Earthquake; Use of GIS in Seismic Risk Analysis: Use of GIS for Regional and Local Analysis; Use of GIS Before and After Earthquakes.</p>		
<b>UCS512</b>	<b>Special Topics in the Natural Resources Management with the Use of GIS</b>	<b>3+0 7.5</b>
<p>Application of GIS for Different Natural Resources; Software and Hardwares Used for Natural Resources Management; Data Types for Geological and Mining Fields; Spatial Data Modelling: Raster Model, Vector Model; Attributes Used in Natural Resources; Spatial Data Structures in GIS; Use of Natural Resources Data in GIS; Using Different Formatted Data in the Same Project; Topology Concept; Map Analysis by Using GIS; Third Dimension in the Natural Resource Analysis; 3-Dimensional GIS; 3-D Modelling of Drilling Logs; 3-D Analyse and Interpretation.</p>		
<b>UCS513</b>	<b>Special Topics on City Information Systems</b>	<b>3+0 7.5</b>
<p>General Concepts for Planning and Design Terms; City Planning System; Planning Information Systems; Data Resources: Raster data, Vector data, Surveys; Base Map for City Information Systems: The layers for base map production according to the study coverage, Base map production techniques using GIS capabilities, Thematic maps as base maps for city information systems; GIS Aided Decision Making Mechanisms For City Information System; Inventory Preparation For City Planning System, Important Analyses Techniques Used For City Information Systems; Computer Support On Decision Making Progress.</p>		
<b>UCS514</b>	<b>Environmental Management and Integration With Geographical Information Systems</b>	<b>3+0 7.5</b>
<p>GIS Use for Air Quality Management: GIS Use for Air Pollution Inventory Studies; Preparation of Pollution Maps And The Clean Air Plans; GIS As A Tool For Water Quality Management; Water Quality Monitoring Studies On The Lake, River And Sea and Preparation of The Water Pollution Maps; GIS Use For Waste Management: Selection of the landfill area and monitoring of the pollution originating from the landfill area using GIS; Importance of the GIS applications for Solution of The Environmental Problems; GIS applications for Environmental Impact Assessment (EIA).</p>		
<b>UCS519</b>	<b>Automated Mapping and Facility Management Systems</b>	<b>3+0 7.5</b>
<p>Computer Aided Two Dimensional Drawing Applications; Proper CAD Drawing Preparations Techniques for Geographical Information Systems: Drawing cleanup, Creating topology; Proper Geo-data Base Preparation for AM/FM Systems:</p>		

Preparation of database, Linking the data; Surveying for mapping purposes; Application Development for AM/FM System: Application development for automated mapping, Application development for facility management; Examples for AM/FM System Studies.

**UCS525 Digital Photogrammetry 3+0 7.5**

Principles of Photogrammetry; Optics on Photogrammetry; Stereoscopic Vision; Principles of Stereo Photogrammetry; Preparation of Flight Plan to Take Aerial Photographs; Photogrammetric Triangulation; Digital Photogrammetry and Digital Map; Orthophoto.

**UCS527 Multicriteria Decision Making Methods 3+0 7.5**

Introduction to Multiple Criteria Decision Making Analysis; Components of MCDM Methods: Decision making concept and methodology, analytic hierarchy process and principles, analytic network process and principles; Combined Application of Geographic Information Systems (GIS) and Multiple Criteria Decision Making Methods; GIS and MCDM Applications on Environmental Decisions; Software Applications in AHP and ANP.

**UCS533 Fundamentals of Mapping and Geographical Information Systems 3+0 7.5**

Essential Definitions for Mapping; Surveying; Measurement Units; Angle Units; Arc Units; Unit Conversion; Scale; Measurement Errors and Reason of Error Increase; Simple Measurement Instruments and their Use; Area Calculation; Volume Calculation; Vertical Coordinate System; Projection; Map Sheet Names; Basic Map Features; Topographic Maps; Photogrammetry; Photogrammetry Applications; GPS Usage; Definition of Geographical Information Systems; Planning; Spatial Data Processes; Map Data and Elements; Digital Map; Layer Sense; Graphical Data and Properties; Topology; Elements of Topology; General Topology Concept; Topology Data Model; Analysis Functions; Classification; Feature Class Definition and Database; Database Approaches and Designing of a Database; Database terminology; Database models.

**UCS534 Geostatistics 3+0 7.5**

Probability; Normal Distribution Test; F Test; Variance Analysis; Chi-Square Test; Regression of Least Squares; Map Analysis; Geologic Maps; Distribution of the Points; Contouring; Trend Surfaces; 4 Dimensional Trend Surfaces; Moving Environments and Kriging; Comparison of the Maps; Data Analysis with Multiple Variables; Multiple Regression; Discriminant Analysis; Grouping Analysis; Factor Analysis.

**UCS535 Integration of Geographic Information Systems and Global Positioning Systems 3+0 7.5**

Introduction to Global Positioning System (GPS): Principals of System Operation; GPS Segments: GPS space segment, GPS control segment, GPS user segment; GPS Signal Structure; GPS Performance and Error Effects; Differential GPS; GNSS, GLONASS, GALILEO; Augmentation systems: WAAS, EGNOS, MSAS; GPS Navigation Applications: The utility of GPS on land, Navigation with GPS and a map, GPS navigation with or without a compass; Principals of Outdoor GPS Operation; The Use of Outdoor GPS and Applications; Evaluation of Received Data from GPS and Integration with GIS Graphical Database

**UCS536 Remote Sensing 3+0 7.5**

History of Remote Sensing; Database Structure ; Spectral Resolution; Basic Image Processing Analysis; Remote Sensing Methods; Parameters in the Visual and Digital Image Analysis; Model Building for Remote Sensing Projects; Remote Sensing Satellites; Material and Electromagnetic Wave Interaction in Remote Sensing; Spectral Reflectance Properties of Objects; Evaluation of Softwares and Hardwares for Remote Sensing; Properties of obtaining color images; Obtaining of screen view; Statistical Analysis Techniques for Remote Sensing Studies; Geometric and Radiometric Correction of Remote Sensor Data; Image Enhancement; Classification Techniques in Remote Sensing.

**UCS537 Geographic Information Systems in Social Sciences 3+0 7.5**

Thinking spatially in social sciences; Spatial analysis at individual and household levels: micro level spatial modeling; Neighborhood level analysis; Region level analysis; Spatial analysis of regional income inequality; The role of spatial analysis in demographic research; Geographical approaches in reconstructing past human behavior from prehistoric roadways.

**UCS538 Geographic Information Systems and Health 3+0 7.5**

Introduction to GIS and health research; Spatial statistics and analysis of health data; Statistical methods and spatial epidemiology; Health research and geographical data base; Modeling spatial variations in air quality using GIS; time geography and health; GIS and public health; Improving health need assessment using patient register information in a GIS; Applications: Atlas of Turkey Mortality Maps.

**UCS542 Raster and Grid Modeling on Remote Sensing 3+0 7.5**

Properties of Raster and Grid data. Data Sources and Techniques of Data Production. Point, Line, Polygon Projections on Data Formats. Geographic Sensitivity and Resolution. Change Detection Based on Time for Same Coordinate. Digital



Elevation Model Practices. Algebraic Functions Used for Data Modelling. Grading and Recoding in Data Analysis; Multifactor Modelling Techniques.

**UCS543 Applications of New Technologies in Geographic Information Systems 3+0 7.5**  
What is geoinformatics? Geodatabase structures On-line data collection for GIS What is GPS? GIS and GPS integration Applications for GIS and GPS integration: Mobile tracking What is wireless sensor networks (WSN)? Wireless sensor network applications: Pollution mapping, noise mapping

**UCS544 Seismic Data Acquisition Techniques and Quality Control 3+0 7.5**  
Seismic sources and receivers. Field configuration in seismic refraction and reflection methods. Acquiring land and marine seismic data. 3-D data acquisition techniques in seismic reflection. Seismic data quality control and criteria.

**UCS545 Bore-Hole Seismic Methods and Professional Software 3+0 7.5**  
Bore-hole seismic sources. Bore-hole three-component geophones and hydrophones. Sonic and density logs. Down-hole and up-hole shooting methods. Determination of seismic P and S wave velocities. Generating synthetic seismograms and correlation. Related professional software.

**UCS546 Seismic Tomography and Professional Software 3+0 7.5**  
Essentials of cross-hole tomography. Generation of coefficient matrices. Methods of matrix inversion: Singular-value-decomposition, Gauss-Newton method, damped least-squares and Lagrange coefficient, rank deficiency. Related professional software.

**UCS547 Seismic Surface Waves 3+0 7.5**  
Properties of body and surface waves. The concept of absorption and dispersion. Absorptive and dispersive properties of surface waves. Surface waves in earthquakes, structure ground interaction.

**UCS548 Data-Processing in Seismic Refraction Methods and Professional Software 3+0 7.5**  
Concept of critical angle and critical distance. Horizontal single-layer problem. Horizontal multi-layer problem. Dipping-layer problem. Blind-layer, hidden-layer problems. Intercept-time, cross-over distance, and time-distance equation solutions. Delay-time method. Related professional software.

**UCS549 Data-Processing in Seismic Reflection Methods and Professional Software 3+0 7.5**  
Concept of shot-gather and CDP-gather. Digital filters and gain. Data editing and muting. Geometry definition. Static and dynamic corrections. Velocity analysis and stacking. Deconvolution and migration processes. Time-to-depth conversion. Related professional software.

**UCS550 Seismic Interpretation and Professional Software 3+0 7.5**  
Factors affecting the seismic wavelet, Geometrical spreading, reflection and transmission coefficients, seismic absorption, interference; Pitfalls in seismic interpretation: Velocity pull-up, velocity pull-down Multiples. Definition of bright-spot, dim-spot, flat-spot. Related professional software.

**UCS551 Seismic Stratigraphy and Tectonics 3+0 7.5**  
Display of seismic sections. Concept of vertical and horizontal resolution. Incident-angle dependency of the reflection and transmission coefficients. Terms used in seismic stratigraphy: On-lap, top-lap, down-lap, truncation surfaces, etc. Determination of normal, reverse and strike-slip faults.

**UCS552 Satellite Technologies and Communication 3+0 7.5**  
Satellite Types and Orbits; General Principles of Satellite Telecommunication; Satellite Platforms; Introduction of Satellite Sub-Systems: Payload (Transmitter Sub-System); Electrical Power Sub-System; Impulse Sub-System; Avionics and Location Control Sub-System; Thermal and Structural Sub-System; Process and Tests of Satellite Production; Launching Services; Satellite Location Control Systems

**UCS553 Satellite Managership 3+0 7.5**  
Fundamental Principles of Satellite Managership; Individual and Institutional Services Presented via Satellites; Competition and Cooperations in Satellite Managership; Marketing Strategies in Satellite Managership; Contact Administration in Satellite Managership; Customer Relations Management in Satellite Managership; Satellite Managership in the World and Satellite Producers: Countries that have Satellite Managers and their Numbers; Leading satellite producers in the world; Firms that provide launching service; Satellite Purchasing and Ensuring

**UCS554 Geodatabase 3+0 7.5**

Basic Database Concepts: Database Management System, Database Components, Database model; Spatial Data Models: Geodata, Geoinfo, Steps of geodatabase establishment; vector data model: Attribute Domains, Topological relations, Feature Dataset; Raster Data Model: Resolution, Pixel value, Raster dataset, Raster catalog, Mosaic Dataset; Extraordinary Structures in Geodatabase: Annotation and Dimension Feature Class, Network dataset, geometric network; Topology in Geodatabase: Topology Rule Table, Topology rules for features; Geodatabase Design: Data Model for Geodatabase.

**UCS555                    Theoretical Basics of Remode Sensing                    3+0   7.5**

Introduction to Remote Sensing; Remote Sensing System; Electromagnetic Energy and Electromagnetic Spectrum; Spectral Properties of Objects; Sensing Systems in Remote Sensing; Sensing Platforms in Remote Sensing; Optical Remote Sensing; Thermal Remote Sensing; Microwave Remote Sensing; Digital Image Processing; Classification; Supervised Classification; Unsupervised Classification.

**UCS556                    Use of Geographic Information Systems in Planning                    3+0   7.5**

Effective Management ofing Natural Resources Effectively; Global Environmental Issues; Global Climate Change; Wars and Terror; Refugee Issues; Physical Planning in Sustainable Development and DevelopmentProgress; What is Physical Planning;: For what purpose it doWhy is it Done; Legal Legislation on Physical Planning in Our Country; National Planning Hierarchy; Physical Plan Types; Utilization of Geographic Information Technologies in Planning.

**UCS557                    Microzoning                    3+0   7.5**

Basic concepts of Micro-Zoning: Hazard, Risk, Scale; Natural and Technological Disasters: Definition of disaster, Types and causes of disaster, Disaster effects; Disaster Management: Phases of disaster management, Risk management, Crisis management; Micro-Zoning and Hazard Analysis: Fundamentals of micro-zoning, Phases of micro-zoning; Micro-Zoning and Geographic Information System: Data model design and geospatial data input, Spatial Predic-tion.

**UCS558                    Use of Geographic Information System in Local Governments                    3+0   7.5**

Basic GIS InformationKnowledge; Concept of Spacetial and Spatiality; GIS and Spatial Thinking; Examples of National Spatial Information System; Local Governments and Their Primary Functions; Use of GIS in Local Governments; Studies on the Development of Urban Information System Standards; Sample Urban Information System Applications; GIS Based Applications that can be Developed with City Urban Information System.

**UCS559                    Spatial Statistics                    3+0   7.5**

Concepts: Description, Inference, Classical Descriptive Statistics (Univariate), Classical Descriptive Statistics (Bivariate); Centographic Statistics; Mean Center, Centroid, Weighted mean center, Standart distance deviation; Point Pattern Analysis: Quadrat Analysis, Kolmogorov-Smirnov (K-S) test, Nearest Neighbour Analysis; Spatial Autocorrelation (One Variable): The weights matrix, Join-count statistic, Moran's I, Geary's C Ratio, General G, LISA; Correlation and Regression (Two Variables): Standard, Spatial.

**UCS560                    Database Usage in Geographic Information Systems                    3+0   7.5**

Basic Concepts: Data, KnowledgeInformation, Spatial Data, Spatial Knowledge; Introduction to Database; Database and Spatial Database; The Place of the Database in Geographic Information Systems; Spatial Data Model; Vector Data Model in Spatial Database; Raster Data Model in Spatial Database; Spatial Database Components; Types of Query; Queriesy Based on Attribute Data; Queriesy Based on Spatial Data.

**UCS563                    Geographical Information Standards and Basic Legislation                    3+0   7.5**

The Standard Concept of Standard; The Importance of Standards; Relationship between Information Technologies and Standard Relations; Standard Needy for Standards and Basic Problems in GIS; International GIS Standards and Significant Initiatives; National GIS Standard Development Studies; National GIS Professions and Standards; National Legislation on GIS; Evaluation of Legislation; Spatial Applications and Use of GIS within National Legislation.

**UCS564                    Disaster Management                    3+0   7.5**

Basic Concepts: Hazard, Risk, Risk Estimation, Vulnerability, Disaster, Urban Resistance; Hazards: Introduction;, Hazard definition and hazard identification, Hazard analysis, Natural hazards, Technological hazards; Risk and Vulnerability: Probability of risk, Result of risk, Risk assessment, Physical profile, Social profile, Environmental profile, Economic profile, Risk perception; Risk Reduction; Preparedness; Intervention; Rehabilitation.

**UCS565                    Introduction to Geographic Information Systems                    3+0   7.5**

Fundamentals of Geographic Information Systems (GIS): Concepts of Ddata, Geographic Ddata, Information and Iinformation Ssystems; Definition of GIS; History of GIS; Components of GIS; Spatial Reference Systems: Concepts of Ddatum and Ggeoid; Projection Systems; Coordinates Systems; GIS Data Types and Models: Attributes and Sspatial Ddata, Raster and Vvector Ddata Mmodels, the Concept of Topology concepts and its Rrules; Application Areas of Use of Geographic Information Systems.

- UCS566                    Geographical Information System Applications in Disaster Management                    3+0   7.5**  
Introduction to Geographical Information Systems: Geographical information system technology for disaster and emergency management; Natural and Technological Hazards; General An Overview of Disaster Management Legislation; Risk Estimation and Microzonation; Infrastructure Design for Seismic Microzonation Using Geographic Information System; Evaluation and Completion of Data; Mapping of the Raw Data; Application of Seismic Microzonation Maps to Urban Master Plans.
- UCS567                    Introduction to Remote Sensing                    3+0   7.5**  
Basic Concepts of Remote Sensing: Definition, History; Components of Remote Sensing; Electromagnetic Spectrum: Spectral signature of objects; Sensor Systems of in Remote Sensing: Sensors systems and platforms, Satellite systems and orbits; Remote Sensing Types: Optical remote sensing, Thermal remote sensing, Mmicrowave remote sensing; Digital Image Processing: Digital image specifications, Resolution concept, Image processing, Classification; Application Areas of Use of Remote Sensing: Land applications,; Water Applications,; Air and Atmospheric Applications.
- UCS568                    Statistical Applications in Geographical Information Systems                    3+0   7.5**  
Basic Statistical Concepts: Definition, Derivation, Classical descriptive statistics (Single Variable), Classical descriptive statistics (Two Variable); Central Weight Statistics; Center Average, Centroid - center of gravity, Weighted average center, Standard distance deviation; Point Pattern Analysis: Quadrat Analysis, Nearest Neighbor Analysis; Spatial Autocorrelation; Correlation and Regression (Two Variable): Standard, Spatial.
- UCS569                    Computer Aided Mapping                    3+0   7.5**  
Basic Cartography InformationKnowledge; What is a Map?; Map Components; Map Design; Map Sheet Segmentation; Map Labeling; Map Projections; Map Projection Selection; Deformation; BÖHHBÜY Regulation; Software Usage; Software Usage; Software Architecture; Basic Commands; Editing Commands; 2D and 3D Modeling Commands; Data Transformation Commands; Project Design; Design of Map Elements; Submission of Maps as Output.
- UCS571                    Open Source Geographic Information Systems Applications                    3+0   7.5**  
Open Source Software Using at GIS: Introduction and software architectures; Software Functions; Data Productioning: Raster georeferencing, Database design, Creating layer; Vector Data Productioning; Queries: Attributes queries, Spatial queries; Transformations: Projection transformations, Data format transformations; Thematic Map Productioning: Related Ttable and spatial data association, Producing different types of thematic maps; Vector Based Spatial Analysis; Raster Based Thematic Spatial Analysis; Producing LayoutOutputs: Generating graphics and report, Producing map layoutoutputs.
- UCS572                    Remote Sensing and Geographical Information Sytems in Environmental Management                    3+0   7.5**  
Introduction to Environmental Management; What is Environmental Management?; Components of Environmental Management; Environmental Legislation; Environmental Impact Assessment; Strategic Environmental Assessment; Risk Assessment; Life Cycle Analysis; Water Quality Management; Air Quality Management; Waste Management; Use of Geographical Information Systems in Environmental Management; Use of Remote Sensing in Environmental Management.
- UCS573                    Open Source Remote Sensing Applications                    3+0   7.5**  
Open Source Software Using in Remote Sensing: Introduction and software architectures, Software functions; Satellite Image Specifications; Image Preprocessing: Geometric correction process, Radiometric correction process; Satellite Image Analysis Methods: Arithmetic band operations, Vegetation indices, Principle components analysis, Spatial filters; Classification of Satellite Images: Unsupervised classifications, Supervised classifications; Topographic Analysis: Producing of slope, aspect, Shaded relief and contour map; Model Development for the Purpose of Study; Creating a Map Output.
- UCS574                    Map Production and Use                    3+0   7.5**  
Map introduction: Introduction to map features; Determination of working methods; Introduction of software and hardware; Introduction of map elements; Map production: Map production methods; Determination of rules in map production; Map generation from remote sensing data: Obtaining data; Use of Data; Internet-based cartography: use of Internet data; On-line Map production.
- UCS575                    Spatial Analysis                    3+0   7.5**  
Introduction to Spatial Analysis Methods; Buffer Zone and Proximity Analysis; 3D Surface Creation; TIN, DEM, DSM and DTM Concepts; Slope, Aspect, Visibility etc. Analysis; Three Dimensional Surface Analysis; Density Analysis; Continuous Surface Generation from Point Data; Spatial Interpolation; Weighing with Inverse Distance Weighted; Reclassification Techniques; Registration Overlay Analysis; Optimal Place Selection Analysis.
- UCS576                    Data Mining in Remote Sensing                    3+0   7.5**

Data Mining: Data, introduction to data mining concepts; Classification of Data; Classification Methods; Clustering Methods; Remote sensing data analysis: Data acquisition; Applications with remotely sensed data.

**UCS577 Basic Programming and Introduction to Python Language 3+0 7.5**  
Basic programming: Basic Concepts in Programming; Data Types; Variables; Conditions; Error Catching; Object Oriented Programming: Classes; Methods; Data Analysis: Image Processing; Machine Learning; Advanced Applications with Python.

**UCS578 Digital Elevation Models and Applications 3+0 7.5**  
Representation of Digital Elevation Surfaces, Digital Elevation Models, Digital Elevation Modeling; Elevation Descriptors and Sampling Strategies; Acquisition Techniques for Digital Elevation Model Source Data: Photogrammetry, Radargrammetry and SAR Interferometry, Airborne Laser Scanning (LIDAR); Digital Surface Modeling: Approaches for Digital Surface Modeling, The Continuity of Digital Elevation Model Surfaces, Triangular Network Formation for Surface Modeling, Grid Network Formation for Surface Modeling; Quality Control in Elevation Data Acquisition; Accuracy of Digital Elevation Models; Visualization of Digital Elevation Models; Interpretation of Digital Elevation Models; Applications of Digital Elevation Models.

**UCS581 Smart City Transformation and Data Management in Local Governments 3+0 7.5**  
Basic Concepts: Local Government Services, Smart City Components, Service Data and Data Infrastructure Concepts; Smart City Components: Governance, Strategy Management, Policy Management, Integrative Service Management, Business Management, Smart City Applications; Transformation Strategies of Services: Ecosystem Integration, Institutional Capacity Building and Environments, Transformation, Monitoring and Reporting; Data Management: Reference Architecture, Data and Management for Services.

**UCS582 Evaluation of Climatic Factors and Bioclimatic Comfort 3+0 7.5**

**UCS584 Introduction to Google Earth Engine 3+0 7.5**

**UCS586 Remote Sensing and Geographical Information System Applic. in Urban Climate Res. 3+0 7.5**

**UCS588 Machine Learning in Geographic Information Systems and Remote Sensing 3+0 7.5**

**UCS592 Seminar 3+0 7.5**

**UCS594 National Geographic Information System Data Themes and Institutional Applications 3+0 7.5**

**UCS596 Internet-Based Geographic Information Systems Applications 3+0 7.5**  
Introduction to Internet-Based GIS: Basic concepts, Usage of internet-based GIS, Advantages and disadvantages of internet-based GIS; Types of Internet-Based GIS: Web-based GIS, Cloud-based GIS, Mobile GIS; Data Types and Sources in Internet-Based GIS: Vector, Raster, File-based, Cloud-based; Spatial Analysis in Internet-based GIS: Data enrichment, Proximity analysis, Analyze patterns, Summarize data; Online GIS Softwares: ArcGIS Online, Mapbox, Carto; Internet-Based GIS Tools: WebApp builder, StoryMaps, Dashboards, Experience builder, Field maps.

**UCS598 Identification of Field Components by Spectral Band Analysis 3+0 7.5**  
Electromagnetic Energy: Physical structure of light and its wave-particle attribute, Interaction of light and field components, Information generation from light as data; Remote Sensing Satellites: Technical characteristics of satellites, Spectral band characteristics, Recording of data coming with light as bands in satellites; Band Analysis: Process variables in spectral bands, Advantages of different band combinations, Reflection of the structural properties of the field components on the spectral bands, Predictions and interpretations of the numerical operations and analysis results in the spectral bands for the field components, Transferring to the map.

<b>UCS599</b>	<b>Term Project</b>	<b>3+0 15.0</b>
<b>UCS601</b>	<b>Use of GIS in Earth Sciences</b>	<b>3+0 7.5</b>
Fundamentals of positional data models, Applications of positional data models, positional data structures, positional data input, display of positional data, inquiry of positional data, transformation of positional data, applications of positional data transformation, tools needed for single map analysis, tools needed for map pairs analysis, tools needed for multi-maps analysis.		
<b>UCS602</b>	<b>Earth Systems</b>	<b>3+0 7.5</b>
Global changes, energy equilibrium and greenhouse effect, atmospheric circulation system, circulation in oceans, modeling of atmosphere-ocean systems, plate tectonics, carbon cycle, ecosystems and biodiversity, effect of life on atmosphere: increase in oxygen and ozone, long period climate changes, paleobiodiversity, glaciations in Pleistocene, short period climate changes, global warming, ozone layer, human effect on biodiversity, climatologic stability in Earth and Earthlike planets.		
<b>UCS603</b>	<b>Advanced Photogeology</b>	<b>3+0 7.5</b>
Stereoscopy, stereoscopic vision, stereoscopes, radial displacement concept, air photographs, types of air photographs, informations printed on aerial photographs, taking areal photographs, handling of areal photographs, photogeological symbols and abbreviation, photointerpretation in geology, fundamentals of photointerpretation, essential interpretation elements in photointerpretation, application of photointerpretation to geology, structural analysis, lithologic interpretation.		
<b>UCS604</b>	<b>Environmental Hydrogeology</b>	<b>3+0 7.5</b>
Introduction to water quality, characterization of water bodies, hydrodynamic features, physico-chemical properties, biological characteristics, definition of water quality, water uses and human impact on water quality, pollutant sources and pathways, temporal and spatial variations of water quality, hydrological characteristics, rivers, major water quality issues in rivers, waste storage, geological aspects for assessment, clean up and siting of waste disposal sites, , sampling design, environmental impacts related to hydrogeological systems, environmental impacts on water resource systems..		
<b>UCS606</b>	<b>Hydraulics in Porous Media</b>	<b>3+0 7.5</b>
Properties of fluids, statics of fluid, dynamics of fluid, general properties of porous media, porous environments, determination of porosity, hydrostatics of porous media, hydrodynamics of porous media, Darcy's law, aquifer types, hydrogeologic units, hydrological properties of hydrogeological units, groundwater currents, groundwater current equations, solution to current equation.		
<b>UCS607</b>	<b>Advanced Technology Supported Archaeological and Architectural Documentation</b>	<b>3+0 7.5</b>
Concept of documentation, architectural documentation, archaeological documentation, advanced technology means, close picture photogrammetry, single picture evaluation, stereo photogrammetry, application of laser scanning, orthophoto production, evaluation.		
<b>UCS608</b>	<b>Multiple Criteria Stable Support System Applications in Disaster Management</b>	<b>3+0 7.5</b>
Geographic data, information and decision making, functions of geographic information systems, geographic information systems and decision support, introduction to multi criteria decision support systems, producing criteria for disaster management, alternatives and restrictions, weighting of criteria, producing risk maps for disasters.		
<b>UCS609</b>	<b>Use of Geographic Information Systems in the Applications of Seismic Microzoning and Urban Transformation</b>	<b>3+0 7.5</b>
Inner earth and geophysics, natural hazards and risks, earthquakes and effect of earthquakes on settlement areas, earthquake magnitude, building and operating local earthquake observation networks, earthquake risks and seismic hazard size, fundamentals of seismic microzoning, seismic data acquisition and evaluation, disaster risks and urban transformation, application of geographic information systems to urban microzoning studies.		
<b>UCS610</b>	<b>Application of High Speed Ground Penetrating Radar to Ballast and Subsoil Inspections of Runways, Highways and Railways</b>	<b>3+0 7.5</b>
Recent advances in electronics and software development technologies provided high quality Ground Penetrating Radar (GPR) data with horizontal resolution of less than 5 centimeters and vertical resolution of less than 5 picoseconds at line speeds of more than 100 kilometers per hour. Contemporary increase in airline, highway and railway traffic imposes periodical ballast and subsoil inspections for local defects, deterioration, fouling and moisture accumulations. Modern GPR		

hardware (400 MHz and 1 GHz Horn Antennas, Doppler Radars, Digital Video Films, etc) and dedicated GPR processing, interpretation, visualization and analyzing software will be introduced.

**UCS611                    Use of Geographic Information Systems in the Planning of Earthquake                    3+0   7.5**  
**Origin Risk/Damage Mitigation**

Earthquakes, earthquake effects in local soil conditions, fundamental principles of disaster management, damage mitigation essentials, hazard analysis, strategies of hazard minimization, application of geographic information systems in hazard mitigation planning.

**UCS612                    Modern Approaches to the City Planning                    3+0   7.5**

The birth of the first civilizations and urbanism, as the Greek and Roman, medieval period, the understanding of cities and planning; medieval Islamic cities, the Renaissance understanding of the planning period, the industrial revolution, cities and other effects; ideal cities, working cities, planned industrial cities, urbanism and planning in the west of the modern and the development of post-modern era and the historical development of the conceptual roots in the process of urbanization today and the future by examining the effects of urbanization and the dynamics of the contemporary features of urbanization in different economic strings of urbanization and

**UCS613                    Urban Conservation-Restoration                    3+0   7.5**

The protection of national and international scale in urban areas, renovation and restoration, basic concepts, scope and purpose; urban sustainability, urban conservation action, the principles of urban conservation, urban renewal, urban development and change in the tissues, the types of renovation, tissue renewal areas, the areas of urban renewal implementation issues, historical examples of application areas, urban renewal, historic environment restoration

**UCS614                    Urban Regeneration                    3+0   7.5**

Urban life style, urban growth speed, urban social and physical infrastructure, urban change and regeneration process, social, economic and physical aspects of regeneration process, urban development process and regeneration of implementation examples in the external and internal scope of urban regeneration, historical formation and structure of urban space, social and demographic development change in urban space, urban economic development change, physical development change in urban space, formation of urban culture and effect of urban space, implementation examples in country and the world.

**UCS615                    Resource Inventory and Analysis                    3+0   7.5**

Definitions of Basic Concepts: Resource, Inventory, Analysis, Resource inventory and analysis; Classification of Resources: Natural resources, Cultural resources; Importance and Basic Phases of Resource Inventory and Analysis; Equipment and Methods of Resource Inventory and Analysis; Simple and Detailed Survey Works for Natural and Cultural Resources: Topography, Hydrology, Geology, Climate, Soil, Flora, Fauna, Cultural values, Social values, Economical values; Capacity and Suitability Analysis.

**UCS616                    Physical Principles of Energy and Matter Interactions in Remote Sensing                    3+0   7.5**

Structure of Atom and Molecules; Transfer of Energy Mechanisms: Ionization, Excitation, Bremsstrahlung; Direct Ionizing Radiation; Indirect Ionizing Radiation; Quantum Structure of Electromagnetic Energy, Gamma absorption, Photoelectric effect, Compton scattering, Pair production; Neutron Interactions: Neutron reactions, Elastic and inelastic scattering, Reactions in biological systems; Structure of Earth Atmosphere; Energy Interaction in the Atmosphere: Scattering, Absorption; Interaction of Energy with Components of Earth Surface: Spectral reflectance of vegetation, soil and water.

**UCS617                    Special Subject at Remote Sensing                    3+0   7.5**

Introduction of Remote Sensing; Fundamentals of Remote Sensing; Sensing Systems and Platforms in Remote Sensing; Thermal Remote Sensing; Thermal Images and Their Interpretation; Thermal Remote Sensing Platforms and Their Application Areas; Thermal Remote Sensing Application Examples; Microwave Remote Sensing; Microwave Remote Sensing Systems; Radar Sensing Systems; Microwave Image Features and Their Interpretation; Microwave Remote Sensing Application Areas; Microwave Remote Sensing Application Areas.

**UCS618                    Network Analysis in Geographic Information Systems                    3+0   7.5**

Definitions of Terms Used in Network Analysis; Similarities and Differences Between Geometric Network and Network Dataset; Network Dataset Features; Build Network; Make Route Layer; Make Service Area Layer; Directions in Network Dataset; Make Closest Facility Layer; Make Location and Allocation Layer; Make Origin-Destination Cost Matrix; Solving Network; Turn Features and Tables.

**UCS619                    Spatial Hydrology                    3+0   7.5**

**UCS620 Remote Sensing and Geographic Information Systems Applications for Mine Reclamation 3+0 7.5**

Definitions of Terms Used in Mine Reclamation; Time Span of Mine Closure; Mine Closure Plan; Mine Closure Procedures; Environmental and Social Impacts; Mine Reclamation Planning and Management; Laws and Regulations; Mine Reclamation Techniques; Geographic Information Techniques in Mine Closure; Cost of Mine Reclamation; Monitoring and Control of Nature Destruction in Mining with Remote Sensing and Geographic Information Systems.

**UCS621 Mixed Methods Research in Geographic Information Systems 3+0 7.5**

What is Mixed Methods Research?, Overview of Qualitative Methods, Practice with Qualitative Research, Design Based Research, Steps in Designing a Mixed Methods Investigation, Mixed Method Models: Research Models, Diagrams and Examples, Mixed Methods Research in Geographic Information Systems: Content Analysis of Mixed Method Research Articles in GIS, Discussion of Mixed Method Research Design in GIS, Preparing a Mixed Methods Research Paper in GIS.

**UCS622 Basic Programming and Geometric Problems 3+0 7.5**

Introduction, Data structures, Geometric data structures and standards; Algorithms, Flow Diagrams; Operations; Comparison Operations; Loop Structures; Basic I/O Operations; Methods, Arrays, Solution of basic geometric problems: Field Calculation, Distance calculation, Distance between point and line, 2D linear coordinate systems, Calculating nearest point, Intersection.

**UCS623 GIS Applications with R 3+0 7.5**

Introduction to R Environment: R Interface and R Studio, R Applications with Spatial Data, Command Line, R Script File; R Libraries: Basic Packages, GIS Libraries, Installing Packages from CRAN; Spatial Data Processing: Reading and Writing Spatial Data, Coordinate System Assignment, Rasterstack and Rasterbick, Spatial Queries, Spatial Data Visualization; Spatial Data Analysis: Spatial Autocorrelation, Creating Weight Matrices, Spatial Interpolation; Spatial Data Modeling: Spatial Distribution Models, Spatial Regression Models.

**UCS624 Airborne Laser Scanning (LIDAR) Systems 3+0 7.5**

Introduction; Airborne Laser Scanning Technology and Functions; Physical Basics of Laser Beams; Full Waveform Principles; LIDAR Data and Their Accuracy; Data Processing; Data Adjustment; Data Filtering and Point Classification; Commercial Software and Hardware Systems; Application Examples; Quality Control of Laser Data; Advantages and Disadvantages of LIDAR Systems; Project.

**UCS626 Logistics Optimization 3+0 7.5**

Fundamental Definitions, Operations, Operations research; Modeling in Operations Research, Problems determining and problem solving, Logistics and logistics systems, Logistics operations, Logistics network design, Site selection, Route problems, Route optimization; Multi-Criteria Decision Making Systems; Demand Forecasting and Management, Information technologies in logistic management, Software solutions for logistics, Case studies for logistics optimization.

**UCS628 National Standards, Legislations and Public Applications 3+0 7.5**

Basic Definitions and Concepts, European Union countries status, Inspire directives, Current institutional structure of geographic information systems in our country, Spatial data producing public institutions, National spatial data standards, TUCBS, National legislation in cadastral studies, Mapping, Cartography, Planning and geographical information technologies, Infrastructure facilities, National studies, public applications, Future sectoral approaches.

**UCS630 Geographical Information Applications for Water Resources Planning 3+0 7.5**

Digital Elevation Model (TIN and GRID) Concepts; Drainage Basin Extraction and Determination of Properties; Various Spatial and Three-dimensional Analysis: Soil and Land Use Mapping, Point-to-area distribution (rain / snow / soil moisture / dirt etc.), Site selection and dimisioning for water structures; Disaster (flood, landslide, etc..) Risk Mapping; Geographic Information Systems Applications on the Field of Water Resources.

**UCS632 Government Projects and Spatial Relations in Turkey 3+0 7.5**

E-Government Structure: E-government elements, The application purpose and the factors which the transforma-tion, The benefits of the application, History, Spatial e-government practices in the world; E-Government and E-Transformation Process Adaptation Studies in Turkey: Information society strategy action plan, Integration stan-dards, Data sharing standards, IT and security standards; Spatial Data Infrastructure and E-Government: TUCBS, Spatial e-government projects sample and applications.

**UCS634 Property Law and Introduction to Land Survey Applications 3+0 7.5**

Introduction: The basic concepts of law, Real and personal rights, Property law and possession, The turkish civil code, People law, Family law, Inheritance law, Real law, The right to property, Real property; Title Deeds and Land Registry: Land registry in Turkey, Principles and elements of the land registry, Transactions in the land registry, Land registry





<b>UCS692</b>	<b>Seminar</b>	<b>3+0 7.5</b>
<b>UCS701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UCS702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UCS790</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>UCS890</b>	<b>Thesis</b>	<b>0+1 30.0</b>
<b>UCS890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1 30.0</b>
<b>UCS901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UCS902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UÇV701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UÇV702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UÇV901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UÇV902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UEB701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UEB702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UEB902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UEE701 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UEE702 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>

<b>UEE901 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UEE902 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UEN701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UEN702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UEN901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UEN902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UET701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UET702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UFZ701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UFZ702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UFZ901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UFZ902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UGM501</b>	<b>Advanced Human Factors in Aviation</b>	<b>3+0</b>	<b>7.5</b>
<b>UGM510</b>	<b>Failure Analysis of Aircraft Structures</b>	<b>3+0</b>	<b>7.5</b>
	Introduction; Definitions, Common causes of failures, Deficiency in design, Manufacturing defects, Deficiency in inspection and maintenance, Abnormal conditions, environmental effects, Failure analysis methodology and stages, Examination methods of failure analysis; Nondestructive inspection, Destructive inspection, Characterization, Special techniques, Failure analysis of aircraft structures; Fatigue, Creep, Corrosion, Fracture, Fretting, Wear, Distortion failures, Case studies of failures.		
<b>UGM511</b>	<b>Mathematical Programming and Aviation Applications</b>	<b>3+0</b>	<b>7.5</b>
	Linear Programming: Basic terms, Geometric solution; Linear Algebra: Convex analysis, Polyhedral sets; The Simplex Method: Extreme points and optimality; Mathematical Modeling: Coding of linear programming problems in LINDO and analysis of computer solutions; Integer Programming Models; Aviation Applications: Labor force planning in the airport, Aircraft route planning, Aircraft maintenance planning, Airline crew scheduling.		

- UGM512            Electric - Hybrid Propulsion Systems and Aviation Applications            3+0   7.5**  
Introduction; Electric Vehicles; Types of Electric Vehicles: Battery Electric Vehicles, Plug-in Electric Vehicles, Fuel Cell Electric Vehicles; Hybrid Propulsion Systems and Types: Serial Hybrid Vehicles, Parallel Hybrid Vehicles, Serial-Parallel Hybrid Vehicles, Advanced Hybrid Vehicles; Comparison of Hybrid Electric Vehicles with Other Electric Vehicles; Existing Electric and Hybrid Propulsion Vehicle Examples in Aviation.
- UGM513            Propeller and Windmill Aerodynamics            3+0   7.5**  
Introduction, Propeller theories: Momentum theory, Blade element theory, Power losses, Blade angle, Blade geometry, Blade loading, Blade shank geometry, Compressibility effects, Propeller performance, Ducted propellers, Propeller noise, Propeller selection, Propeller design: Betz minimum energy loss condition, Glauert, Larrabee, Adkins and Liebeck propeller design methods, Propeller analysis, Wind turbine technology, Aerodynamic design of wind turbines, Aerodynamic analysis of wind turbines.
- UGM515            Advanced Manufacturing and Assembly Technology for Aircraft            3+0   7.5**  
**Materials**  
Contents: Introduction of aircraft materials, Assembly; Aluminum; Magnesium and Beryllium; Titanium; High Strength Steels; Superalloys; Polymer Matrix Composites; Adhesive Bonding and Integrally Cocured Structure; Metal Matrix Composites; Ceramic Matrix Composites; Structural Assembly: Framing, Shimming, Hole drilling, Fastener selection and installation, Sealing, Painting.
- UGM517            Sustainability Analysis at Airports            3+0   7.5**  
Introduction: Airport organization structure, Airport air-and-land-side areas, Sustainability management models; Standards: National and international standards (ISO 50001, ISO 14001), Green airport certification; Sustainability: Economic sustainability, Environmental sustainability; Social sustainability; Economic Analysis: Estimation of investment, Principles of economic evaluation, Life cycle cost analysis; Energy Analysis: Determination of energy consumption and calculations, Modeling and analysis for process monitoring; Environmental Analysis: Determination of environmental impacts and damages, Life cycle assessment; Sustainability Analysis: Combination of method economically and environmentally, holistic life cycle analysis.
- UGM519            Batteries and Battery Systems            3+0   7.5**  
Fundamentals: Introduction to Aircraft Electric Storage; Fundamentals of Aviation Battery and Electrochemistry; Aircraft Battery Architecture: Lead Acid Batteries, Li-Ion Batteries; Super Capacitors and Applications; Battery Systems Integration; Battery Applications: Network Connected Electric Storage, Aviation; Battery Modelling And Simulation; SOC Calculation; Future Electric Energy Storage Technologies; Second Life of Batteries and Recycling; Battery Standards and Tests; Battery Safety.
- UGM521            Momentum and Heat Transfer            3+0   7.5**  
Introduction to Momentum Transfer; Systems and Control Volumes; Flow Models: Finite control volume, Infinitesimal fluid element; Basic Tools: The substantial derivative, The divergence of the velocity, The Reynolds transport theorem; Fundamental Governing Equations: Continuity equation, Momentum theorem, Energy equation; Angular Velocity; Stream Function; Circulation; Velocity Potential; Inviscid-Viscous Flow; Introduction to Heat Transfer; Conduction: Differential equations of heat transfer, Steady-Unsteady conduction; Convective Heat Transfer: Parameters, Dimension analysis; Radiation Heat Transfer: Emissivity, Absorptivity, Black bodies, Radiation from gases.
- UGM523            Physical Ergonomics in Aviation            3+0   7.5**  
Introduction to Ergonomics; Human Anatomy; Anthropometry; Physical Ergonomics; Work Systems and Classifications of Work; Model of Workload-Strain; Human Performance Capacity; Static and Dynamic Work; Human Energy Requirements and Continuous Performance Limit; Heart Rate in Dynamic and Static Work; Fatigue and Work Breaks in Workplace; Effects of Environmental Factors; Displays and Control Elements; Ergonomic Principles in the Design of Work Tools and Instruments; Aircraft Accidents and Literature Studies on Physical Ergonomics in Aviation.
- UGM592            Seminar            3+0   7.5**
- UGM601            Environmental Impact of Commercial Aircraft            3+0   7.5**  
Fundamental Combustion Thermodynamics; Emission Types: NOX, HC and CO; Emission Mechanisms; Emission Regulations; Emission Inventory Investigations: ICAO, SAGE, AERO2K, DLR; Actual Emission Tests; Emission Abatement Techniques in Engines; Emission Analyses with Flight Data; Engine Power and Emissions; Effect of Flight Phase on Emissions: Cruise, Climb, Descent; Emission Estimations Based on Airport; Emissions and Air Traffic Management.
- UGM603            Advanced Heat Transfer Calculations in Aviation            3+0   7.5**

Basics of Heat Transfer; Heat Conduction: Steady-state heat conduction, Concept of heat resistance, Determination of temperature distribution, Unsteady heat transfer, Lumped system analysis, Infinite and semi-infinite matters, Fundamentals of heat convection, Dimensionless numbers, Energy equation, Momentum equation, Mass equation, Forced convection, Forced external convection, Forced internal convection, Natural convection; Heat Transfer Analyses for Aviation Applications.

**UGM605                    Advanced Exergy Analysis in Aviation                    3+0    7.5**

Basic Concepts; Conventional Exergy; Exergoeconomic and Exergoenvironmental Analyses and Exergy Destruction; Definitions of the theoretical system and the unavoidable thermodynamic irreversibility, Endogenous and exogenous exergy destructions, Unavoidable and avoidable exergy destructions, Avoidable endogenous, avoidable exogenous, Unavoidable exogenous, unavoidable endogenous exergy destructions, Exogenous exergy destructions, Application of advanced exergy analyses to exergoeconomic and exergoenvironmental methods in aviation.

**UGM606                    Fuel Flow Rate Prediction Models and Optimization for Commercial                    3+0    7.5**  
**Aircraft**

Fundamental equations of aircraft motion; Aircraft performance parameters; Study of climb, cruise, and descent phases; Jet engines; Thrust; Specific fuel consumption; Fuel flow rate prediction models in the current literature; Logarithmic derivatives of aircraft performance parameters; Classical optimization by Lagrange multipliers; Non-conventional optimization methods; Thrust modelling; Fuel flow rate prediction using genetic algorithms; Modelling of fuel flow rate by the use of artificial neural networks; Fuel flow rate prediction using particle swarm optimization; Fuel flow rate prediction via cuckoo search algorithm.

**UGM607                    Aircraft Performance Modelling and Parametric Optimization                    3+0    7.5**

**UGM608                    Advanced Human Factors Research                    3+0    7.5**

Engineering Anthropometry and Workplace Design; Biomechanics of Work; Human and Performance; Physical and Mental Workload; Human Information Processing; Human Errors; Lifting, Carrying, Force Applications; Stress; Motivation and Job Satisfaction; Situational Awareness; Research Methods and Potential Applications of Human Factors; Safety, Accidents, and Human Errors in Aviation.

**UGM610                    Thermo-economic and Thermo-environmental Optimization in Aviation                    3+0    7.5**

Thermal system design, Life-cycle design, Economic and environmental studies in aviation; Thermodynamic Analysis: Energy and exergy analysis, Heat transfer, modeling, and design analysis; Economic Analysis: Estimation of investment, Principles of economic evaluation; Environmental Analysis: Determination of environmental impacts and damages; Thermo-economic Analysis and Evaluation; Thermo-environmental Analysis and Evaluation; Aviation Application of Thermo-economic and Thermo-environmental Analysis: Piston-prop engines, Gas turbine engines; Optimization: Determination of optimum points.

**UGM612                    Sustainable Aviation Fuels                    3+0    7.5**

Conventional Jet Fuels and Alternative Fuels in Aviation; Basic Characteristics: Specific energy, Energy density, Density, Viscosity; Drop-in and Neat Using; Synthetic Paraffinic Kerosene Fuels: Coal-to-liquid, Gas-to-liquid, Biomass-to-liquid; Hydroprocessed Renewable Jet Fuels: Jatropa, Camelina, Algae; Aviation Fuel Standards; Test Flights; Airport Infrastructure Compatibilities; Gaseous and PM Emissions; Range and Payload Effects; Alternative Fuel Targets.

**UGM614                    Finite Volume Method                    3+0    7.5**

Introduction; Conservation Equations for Fluid Flow: Continuity equation, Conservation of momentum equation and conservation of energy equation; Turbulence and Modelling; Fundamentals of Finite Volume Method (FVM); FVM for Diffusion Equation; FVM for Convection-Diffusion Equation; Solution Techniques for Steady Flow; Solution Techniques for Unsteady Flow; Solution of Linear Equations; Implementation of Boundary Conditions; Error Analysis; Engineering Application Examples of Finite Volume Method.

**UGM692                    Seminar                    3+0    7.5**

**UGM790                    Thesis                    0+1    30.0**

**UGM890                    Thesis                    0+1    30.0**

<b>UGM890-0</b>	<b>Thesis (Thesis Proposal)</b>	<b>0+1</b>	<b>30.0</b>
<b>UHE701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UHE702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UHE901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UHE902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UHT701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UHT702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UHT901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UHT902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>Uiç701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>Uiç702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>Uiç901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>Uiç902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UiN701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UiN702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UiN901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UiN902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>

<b>UiS701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UiS702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UiS901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UiS902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UiT701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UiT701 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UiT702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UiT702 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UiT901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
	Propose the thesis subject; Literature search about thesis subject; Determining the theoretical framework of the research in line with the findings obtained from the literature; collecting data and data analyse; Discussion of the findings of the research compared to the literature; Determining the contribution of the research to the literature and practice; Reporting the studies carried out.	
<b>UiT901 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
	Propose the thesis subject; Literature search about thesis subject; Determining the theoretical framework of the research in line with the findings obtained from the literature; collecting data and data analyse; Discussion of the findings of the research compared to the literature; Determining the contribution of the research to the literature and practice; Reporting the studies carried out.	
<b>UiT902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
	Propose the thesis subject; Literature search about thesis subject; Determining the theoretical framework of the research in line with the findings obtained from the literature; collecting data and data analyse; Discussion of the findings of the research compared to the literature; Determining the contribution of the research to the literature and practice; Reporting the studies carried out.	
<b>UiT902 (Eng)</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
	Propose the thesis subject; Literature search about thesis subject; Determining the theoretical framework of the research in line with the findings obtained from the literature; collecting data and data analyse; Discussion of the findings of the research compared to the literature; Determining the contribution of the research to the literature and practice; Reporting the studies carried out.	
<b>UKH701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UKH702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>

<b>UKH901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UKH902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UKM701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UKM702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UKM901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UKM902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UMi701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMi702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMi901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UMi902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UMK701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMK702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMM701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMM702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMM901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UMM902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UMT701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>

<b>UMT702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UMT901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UMT902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>UPL701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>UPL702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USH701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USH702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USH901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>USH902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>USi701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USi702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USi901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>USi902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>USM701</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USM702</b>	<b>Research in Area of Specialization</b>	<b>3+0</b>	<b>4.5</b>
<b>USM901</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>
<b>USM902</b>	<b>Research in Area of Specialization</b>	<b>5+0</b>	<b>7.5</b>



<b>USY701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>USY702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>USY901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>USY902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UUG701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UUG702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UUG901</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UUG902</b>	<b>Research in Area of Specialization</b>	<b>5+0 7.5</b>
<b>UYB701</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>UYB702</b>	<b>Research in Area of Specialization</b>	<b>3+0 4.5</b>
<b>YBL501</b>	<b>Earth Sciences</b>	<b>3+0 7.5</b>
	Introduction to Earth Sciences, Information about the earth, Earth's surface, Earth's internal structure, Atmosphere, Minerals and rocks, Volcanic rocks, Sedimentary rocks, Metamorphic rocks, The earth's general properties, Formation of the universe, Geologic date, Rock cycle, Motion of tectonic plates that make up the earth, Soil formation, Environmental geology.	
<b>YBL502</b>	<b>Geotechnical Earthquake Engineering</b>	<b>3+0 7.5</b>
	Earthquakes, Measurement and distribution of earthquakes, Characterization of seismicity, Engineering models of strong motion, Attenuation relations, Seismic risk and hazard, Response spectra, Stress-strain and shear strength characteristics of soils under earthquake excitations, Liquefaction and counter measures, Site amplification and microzonation, Earthquake codes related to geotechnical design.	
<b>YBL503</b>	<b>Geophysical Methods in Civil and Environmental Engineering</b>	<b>3+0 7.5</b>
	Introduction to Geophysical Methods, Geophysical applications in civil engineering: Determination of Seismic P and S Wave Velocities, Seismic quality factor Q, Computation of static and dynamic soil parameters, Concept of bed-rock and seismic-basement, Geophysical applications in environmental engineering: Determination and Prospecting of Dump-sites, Implementation of seismic and ground penetrating radar techniques.	
<b>YBL504</b>	<b>Shallow Marine Geophysics</b>	<b>3+0 7.5</b>
	Comparison of Land and Marine Geophysical Methods and Instrumentation; High-resolution Seismic, Multibeam-echosounder and side-scan-sonar techniques in shallow marine geophysics, Implementation of gravity and magnetic methods in marine environment, Seafloor classification, Geotechnical studies in marine environment: Docks, Bridges, Tunnels, Cables, Pipes, Offshore oil platforms, Dredging, Search for industrial materials and mines.	

- YBL505 In-situ Testing and Evaluation 3+0 7.5**  
 Borings and Soil Sampling; Standard Penetration Test (SPT); Cone Penetration Test (CPT); Plate Loading Test; In-situ Density Measurements; In-situ California Bearing Ratio Test (CBR); Pressuremeter; Dilatometer Tests; Field Shear Vane Test; In-situ Permeability Testing; Groundwater Pressure Measurements; Dynamic Soil Properties based on in-situ Measurements; Microtremor Measurements in Geotechnical Engineering; In-situ Stress and Deformation Measurements.
- YBL506 Geosynthetics 3+0 7.5**  
 Introduction to Geosynthetics, The history and development of geosynthetics, Standards and selection of geosynthetics, Geosynthetics- soil interaction, Geometrical, Physico-mechanical chemical and hydraulic properties of geosynthetics, Production technology of geosynthetics, Project realization, Soil reinforcement, Drainage, Bank and bed protection, Roads and railways, Lining system.
- YBL507 Experimental Soil Mechanics 3+0 7.5**  
 Introduction to Experimental Soil Mechanics, Information about soil samples, Contents of laboratory report, Determination of water content of soil, Atterberg limits of soils, Particle size analysis-mechanical method and hydrometer method, Specific gravity of soils, Relative density determination, compaction test, California bearing ratio (CBR) test, Coefficient of permeability, Consolidation test, Unconfined compression test, Triaxial test, Direct shear test.
- YBL508 Theoretical Soil Mechanics and Soil Models 3+0 7.5**  
 Rock Cycle and The Origin of Soil, Soil composition, Classification and identification of soil, flow of water in soil, Capillary rise in soils, Engineering properties of soil, Effective stress concept, Stress-strain behaviour of soils, Compressibility of soil, Yield criterion of soils, Some theories of failure, Classification.
- YBL509 Engineering Properties of Soils 3+0 7.5**  
 Evaluation of Site Conditions, Sampling of soil, Classification of soil and index properties, Composition of soil, Consolidation, Theory of consolidation, Consolidation and settlements of soil, Flow of water in soils, Permeability concept, Compaction of soils, Stress and strain properties of soil stress and strain behavior of soils, Shear strength of soils, Shear strength properties of soils.
- YBL510 Groundwater Hydraulics 3+0 7.5**  
 Definitions of Basic Concepts, Geological and hydrogeological classification of groundwater reservoirs; Aquifer Types, Unconfined, Confined, Leaky, Perch; Well Types, Small diameter, Large diameter, Deep, Shallow, Drilling, Completely and partially penetrations, Non-penetration; Groundwater Flow Types, Laminar, Turbulence, Steady, Unsteady, Compressible flows; Aquifer Parameters, Hydraulic conductivity, Specific yield, Specific retention, Storage coefficient, Transmissivity; Darcy Law, Hydraulic load, Piezometers, Well losses.
- YBL511 Geological and Hydro-meteorological Hazard Analysis 3+0 7.5**  
 Concepts Related to Natural Hazards; Fundamental Mechanism of Earthquakes; Seismic Hazard Analysis; Fundamental Mechanisms of Landslides and Erosion; Landslide Hazard Analysis; Erosion Hazard Analysis; Applications of Landslide Hazard Analysis and Erosion Hazard Analysis; Flood Hazard Analysis; Application of Flood Hazard Analysis; Multi-hazard Assessments.
- YBL512 Earth Systems 3+0 7.5**  
 Global Changes, Energy equilibrium and greenhouse effect, Atmospheric circulation system, Circulation in oceans, Modeling of atmosphere-ocean systems, Plate tectonics, Carbon cycle, Ecosystems and biodiversity, Effect of life on atmosphere: Increase in Oxygen and Ozone, Long period climate changes, Paleobiodiversity, Glaciations in pleistocene, Short period climate changes, Global warming, Ozone layer, Human effect on biodiversity, Climatologic stability in earth and earthlike planets.
- YBL513 Project Preparation and Management 3+0 7.5**  
 Project Cycle Management; Logical Framework; Needs Analysis; Problem Analysis and Strategic Planning Techniques; Stakeholder analysis, Problem analysis, Analysis of objectives, Analysis of Strategies, Communication strategies; Indicators of Success; Operational Planning; Quality Factors; Project Implementation; Project Monitoring and Evaluation; Designing a Monitoring System; Project Reporting.
- YBL514 Sustainability of Cities 3+0 7.5**  
 City, Urban geography, origins of city, urban geographic views, urbanization, features and concepts; Physical environment and urban population; Spatial regulation patterns of city and urban land use models; regions depending on cities, cities domains; classification of cities; Horizontal and vertical developments of city, geographical approach of urbanization problems: Squatters and earthquakes, etc.; Urban transportation, Management of urban resource, Urban renewal, Urban conservation; Urban tourism; Quality of urban life.

- YBL516 Geomorphology 3+0 7.5**  
 Definition and relationship with other disciplines of geomorphology; Structural geomorphology; Fluvial geomorphology; Karst morphology; Coastal morphology; Geomorphology of arid and semi-arid regions Volcano morphology, Glacial morphology; Main geomorphological features of Turkey; Geomorphology applications: Paleogeographic evolution of the archaeological site, erosion detection, identifying landslide risk areas, identifying the flood areas, road constructions.
- YBL518 Soft Computing and Data Mining in Earth Sciences 3+0 7.5**  
 Introduction; Soft Computing and Data Mining; Fuzzy Set Theory; Fuzzy Set Theory and Earth Sciences literature review; Application of Fuzzy Set in Hydrology and Hydrogeology; Application of Fuzzy Set in Landslides and Earthquakes; Artificial Neural Networks; Artificial Neural Networks and Earth Sciences literature review; Application of Artificial Neural Networks in Hydrology and Hydrogeology; Application of Artificial Neural Networks in Landslides and Earthquakes; Hybrid Systems; Hybrid Systems and Earth Sciences literature review.
- YBL519 Introduction to Data Science with Python for Earth Sciences 3+0 7.5**  
 Introduction: Python Programming Basics, Learn to use earth science and other data in Python; Data Science: machine learning algorithms, data processing, statistical research, Python for data analysis: Introduction to Numpy, Introduction to Pandas, Introduction to Matplotlib, Indexing, Operations, Exercises; Linear Regression Models; Nonlinear Regression Models; Classification; Clustering; Big Data Analytics.
- YBL520 Spectral Analysis of Earthquake Waves 3+0 7.5**  
 Seismology: Structure of the earth's interior, Seismic waves, Travel times and distance; Dispersion: Normal Dispersion; The dynamic and structural properties of the earth and faulting mechanisms; Seismic Network: General properties of recording systems, Structure of seismic network and management, National and international seismic networks; Strong Ground Motion; Microtremor and Application of Microtremor; Spectral Analysis.
- YBL521 Geotechnical Earthquake Engineering 3+0 7.5**  
 Basic Concepts: Seismicity, Magnitude and Intensity of Earthquake, Plate Tectonics, Fault Types; Dynamic Soil Properties: Stress-Strain Behavior of cyclically loaded soils and strength properties, Measurement of dynamic soil properties, Evaluation of the effect of local soil properties on earthquake damages; Ground Motions: Amplitude, frequency and duration parameters of ground motion, Attenuation relationships; Seismic Ground Response Analysis: Analysis methods, Response Spectra, Site Amplification, Design Spectra and Turkish Earthquake Code; Soil Liquefaction: Liquefaction analysis, Post liquefaction ground deformations.
- YBL522 Numerical Methods in Geotechnical Engineering 3+0 7.5**  
 Review of Analytical, Numerical and empirical Methods; Application of Numerical Methods in Geotechnical Engineering Topics; Definition of Geotechnical Problems; Preliminary Studies and Design Consideration in Geotechnical; FEM Numerical Methods: Plaxis; Introduction to Plaxis; Exercises and Case Studies Based on Plaxis Software; Solving Geotechnical Problems by Plaxis Program; An Underground Project Design by Using Plaxis Program.
- YBL523 Active Faults of Turkey and Their Earthquake Potential 3+0 7.5**  
 Active Fault Definition and Classification of: Earthquake surface rupture, Holocene fault, Quaternary fault, Probable Quaternary fault or lineament; Active Fault Map of Turkey: Source of data, Method, Principles of mapping; Active Faults in Turkey and its Vicinity: Dead Sea Fault Zone, Aegean Arc System, Cyprus Arc System, Causasian thrust belt, Pontic escarpment; Distribution of Turkey's Active Faults, General Characteristics and Their Earthquake Potential: North Anatolian Fault Zone, East Anatolian Fault Zone, South East Anatolian Thrust Zone, Active faults of East Anatolian Compressional Province, Active faults of Central Anatolia.
- YBL524 Introduction to Earthquake Engineering 3+0 7.5**  
 Engineering Seismology: Plate tectonics, Earthquake source, Earthquake parameters, Tsunamis; Earthquake Ground Motion: Instrumentation, Earthquake ground motion parameters, Ground motion prediction equations, Simulation of ground motion, Effect of local site conditions on earthquake ground motion; Earthquake Early Warning and Rapid Response Systems: Analysis methods; Seismic Hazard Analysis: Deterministic and Probabilistic hazard analysis, Seismic hazard deaggregation; Response of Structures to Earthquake Ground Motion: Single and multi of-freedom systems, Earthquake design spectrum; Seismic Design Codes: Turkish seismic design code.
- YBL525 Engineering Geology and Construction in Earth Sciences 3+0 7.5**  
 Sub-Division of Applied Geology Engineering Geology and Construction Relations; The Importance of Engineering Geology in Developing Societies Due to Increasing Energy, Transportation and Settlement Requirements; Engineering Geology in Underground and Surface Excavations, Rock and Ground Problems in Engineering Projects Regarding Construction of Building and Building Type Structures; Basic Applications During and After Construction in Geotechnical Field Investigations in Bridges, Tunnels, Dams and Highways. Importance of Engineering Geology in Earthquake Resistant Design.

**YBL526 Hydrogeochemistry 3+0 7.5**

Introduction: Groundwater quality, Sampling of groundwater, Chemical analysis of groundwater; The Hydrological Cycle: The composition of rainwater, Stable isotopes in rain, Overall controls on water quality; Flow and Transport: Flow in the unsaturated zone, Flow in the saturated zone, dating of groundwater, Retardation, Diffusion, Dispersion; Minerals: Equilibria and the solubility of minerals, Kinetics of geochemical processes: Carbonates and Carbon Dioxide: Carbonate minerals, Dissolved carbonate equilibria, Carbon dioxide in soils, Calcite solubility and PCO<sub>2</sub>, Carbonate rock aquifers; Ion Exchange: Exchange equations; Redox Processes: Theory, Redox diagrams.

**YBL527 Advanced Applied Hydrogeology I 3+0 7.5**

**YBL528 Seismology 3+0 7.5**

History and Development of Seismology: General Seismology, Plate Tectonics, Exploration Seismology; Main Principles of Seismology: Observational Seismology, Instrumental Seismology, Determination of Earthquake Parameters; Seismological Software: Seismological Data Analysis, Moment Tensor Solution, Earthquake Location Determination; Seismotectonics: Seismicity, Faulting Mechanism, Earthquake Occurrence Pattern, Relation of Earthquakes and Active Faults; Different Application of Seismology: Different Seismological Applications and Network Design.

**YBL529 System Identification and Structural Health Monitoring 3+0 7.5**

System Identification Techniques: Specific and stochastic input cases; Determination of Modal Parameters Using Frequency and Time Domain Techniques; Structural Health Monitoring Methods; Experimental Modal Analysis Technique; Operational Modal Analysis Technique; Introduction to Signal Processing; Data Collection and Characteristic Property Extraction; Vibration Instrumentation; Vibration Based Damage Detection Methods: Data and model based techniques; Model Calibration Methods.

**YBL530 Structural Earthquake Engineering 3+0 7.5**

Nature and Causes of Earthquakes: Earthquake magnitude and intensity; Earthquake Ground Motions; Seismic Response Analysis of Simple Structures: Elastic response spectra; Design Spectrum; Seismic Response Analysis of Building Structures: Equivalent lateral load procedure; Modal Superposition; Response Spectrum Analysis Procedure; Basic Design Principles and Performance Requirements for Buildings in Seismic Design Codes: Structural irregularities; Seismic Design of Reinforced Concrete Structures.

**YBL531 Potential Theory in Geophysics 3+0 7.5**

Vector analyses I: Gradient, Divergence, Curl; Vector analyses II: Divergence theorem, Stokes theorem; Introduction to potential field theory: Field types, Boundary value problems, Dirac delta function; Gravitational potential and fields: Newton's law of gravitation, Forces due to special bodies; Earth's gravity field: corrections; Electrostatics I: Coulomb's law, Electric fields, Gauss' law; Electrostatics II: Scaler potential, Poisson and Laplace equations, Work and energy in electrostatics; Magnetostatics I: Lorentz force law, Biot-Savart's law, Faraday's Law; Solution to Laplace equation; Method of images; Green's theorem; Geomagnetism and geomagnetic fields.

**YBL532 Geological Disasters 3+0 7.5**

**YBL533 Laboratory Methods in Earth Engineering I 3+0 7.5**

**YBL534 Geology for Civil and Environmental Engineers 3+0 7.5**

Fundamentals of Geology: Earth Structure and Composition, What is Earth Science, Layers of the earth; Geology and Civil Engineering Relationship; Geology and Environmental Engineering Relationship; Geological Structure and Geological Maps; Rock Mechanics; Solid Rock and Rock Mass Characterization; Weathering of Rocks; Erosion; Characterization of Soil Soils; Groundwater; Geological Hazards: Collapse and Karstification, Earthquake, Landslide, Coastal Hazards.

**YBL535 Laboratory Methods in Earth Engineering II 3+0 7.5**

Laboratory test and report preparation; determination of water content; specific gravity; sieve analysis; hydrometer analysis; liquid limit test; plastic limit test; shrinkage limit test; engineering classification of soils; constant head permeability test; falling head permeability test; standard proctor compaction test; modified proctor compaction test; determination of field unit weight of compaction by sand cone method; direct shear test; unconfined compression test; consolidation test; triaxial tests.

- YBL536 Paleoseismology 3+0 7.5**  
Principles of Paleoseismology: Object, Scope, Definition of paleoearthquakes, Dating methods of paleoearthquakes, Determination of recurrence intervals of paleoearthquakes; Techniques of Paleoseismological Investigations: Excavation and cleaning, Gridding, Photographing, Sampling, Logging, Interpretation; Geophysical Methods Applied in Paleoseismological Research; Sub-Aqueous Paleoseismology; Paleoseismology in Extensional Tectonic Environments; Paleoseismology in Compressional Tectonic Environments; Paleoseismology in Strike-slip Tectonic Environments; Paleoseismology in Volcanic Environments; Paleoseismological Investigations in Turkey.
- YBL537 Advanced Volcanology 3+0 7.5**  
The course will introduce students to Plate tectonics and volcanoes; including the processes that takes place at active volcanoes (eruptive mechanisms, effusive and explosive volcanism); methods and instrumentation used to study them; the hazards of different types of eruptions (hazards assessment, integrated hazard mapping, risk communication, and the complex challenges of scientist being involved in the response to a crisis or eruption). It will examine volcano geology (including petrology), and volcanism in Turkey (including economic aspects).
- YBL538 Injection Applications in Earth Sciences 3+0 7.5**  
Definition and Formation of Soil-Rock in Earth Sciences; Soil-Rock Transitions; Weathering Surfaces in Soils and Rocks, Increasing the Bearing Power of Weak Soils; Applications in Engineering Structures on Cracked Rocks; Definition of Injection and Injection Types, Materials Used in Injection; Injection Applications in Discontinuities in Underground Power Plants, Tunnels and Slopes; Injection Applications in Alluviums, Injection in Dam Sites; Anchors in Soils and Rocks, Geotextiles, Geomembranes, Geonets, Geogrids and Unified Geosynthetics
- YBL539 Sustainable Building Materials in Earth Sciences 3+0 7.5**  
Internal Structure in Building Materials: Atom, Mineral and Rock Relationship; Technological Properties of Rocks: Rock can be broken, drilled and cut; Use of Rocks in Building Materials: Igneous, Sedimentary and Metamorphic rocks; Main Industrial Rocks Used in the Building Sector; Sustainable Mineral Origin Building Materials; Building Materials with Pozzolan Feature; Rock Based Industrial Fibers Used in Building Materials: Properties of glass and basalt fibers; Investigation of Lunar and Martian Soils: Mineralogical properties, Importance of use as a building material.
- YBL540 The Earth's Physics and Lithosphere Dynamics 3+0 7.5**  
The Earth's physics and lithosphere dynamics: Evolution of continental and oceanic lithosphere; Plate tectonics; Heat flows from Earth's interior, Thermal modelling of deeper depths; Stress and strain; The lithospheric strength and effective elastic thickness, Correlation with seismic activities; Dynamic topography; Isostasy and gravity anomalies, Spherical gravity anomalies and modelling in deeper interfaces; Earth's gravitational and magnetic fields.
- YBL542 Landslide Investigations and Mitigation 3+0 7.5**  
Principles, definitions, and assessment: Landslide types and processes; landslide triggering mechanisms; landslide hazard and risk assessment; Site investigations: Organization of investigation process; slope instability recognition, analysis, and zonation; surface observation and geological mapping; subsurface exploration; field instrumentation; Strength and stability analysis: soil strength properties and their measurement; soil slope stability analysis; rock strength properties and their measurement; rock slope stability analysis; Mitigation: Important considerations in slope design; stabilization of soil slopes; stabilization of rock slopes.
- YBL544 Advanced Applied Hydrogeology II 3+0 7.5**  
Soil Moisture and Groundwater Recharge: Porosity and water content of soil, Unsaturated flow; Groundwater Flow to Wells: Basic assumptions, Determining aquifer parameters, Regional Groundwater Flow; Geology of Groundwater Occurrence: Unconsolidated aquifers, Lithified sedimentary rocks, Igneous and metamorphic rocks; Water Chemistry: Types of chemical reactions in water, Isotope hydrology; Water Quality and Groundwater Contamination: water quality standards, Groundwater monitoring, Mass transport of solutes; Groundwater Models: Data requirements for models, Finite element models.
- YBL546 The Solution of the Inverse Problem in Geophysical Modelling 3+0 7.5**  
Geophysical inverse solution: Data and model space, Parametrization; Forward solution; Theoretical principles of linear inverse solution, Physical parameter estimation and numerical examples, Resolution of linear inverse solution, Theoretical principles of derivative-based nonlinear inversion, Geometrical parameter estimation and numerical examples, Resolution of nonlinear inverse solution, Singular value decomposition and resolution; Optimization, Steepest descent optimization, Complex gradient optimization, Particle swarm optimization.
- YBL592 Seminar 3+0 7.5**
- YBL599 Semester Project 3+0 0.0**

**YBL790**

**Thesis**

**0+1 30.0**