



## Course Content Report

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 509	SCIENTIFIC RESEARCH TECHNIQUES AND PUBLICATION ETHICS	2	0	0	0.00	0.00	Compulsory

### Course Content

Identifying priorities and conducting research studies on the subject. Research methods Concept of ethics and its applications. Designing, organizing and writing a research proposal. Critical research. Main principles of research, analysis, validity and reliability.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 500	MASTER THESIS	0	0	0	0.00	30.00	Compulsory

### Course Content

Evaluation of the study subjects of all graduate students at the thesis level under the supervision of the advisor and new developments in these subjects, following the current scientific publications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 501	SEMINAR	0	0	0	0.00	7.50	Compulsory

### Course Content

Students are informed about the layout, writing and presentation of scientific work (seminar, paper, article, master's thesis) in front of the community. The processes and techniques of scientific research are explained. Information about accessing domestic and international publications is given. Individual studies and studies are checked. The study is written in article format. The work is handed over to the lecturer and advisor. My presentation is made on a predetermined date and time.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 801	SPECIALIZATION COURSE	4	0	0	4.00	0.00	Compulsory

### Course Content

Within the framework of the student's interests, a research project is created on the subject of interest together with the lecturer. The student reports on what he/she has read to the lecturer who teaches the course at the specified times each week. Along with these, the student continues the original work under the supervision of the lecturer on the subject they have determined. The course continues with the student presenting an interpretation of the latest literature on the subject to the faculty member, also mentioning the contributions that can be made to this literature. In this process, the student is also asked to prepare one or two mini-projects in this area. The course ends with the presentation of the work done at the end of the semester to the faculty member for evaluation.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 802	SPECIALIZATION COURSE	4	0	0	4.00	0.00	Compulsory

### Course Content

Within the framework of the student's interests, a research project is created on the subject of interest together with the lecturer. The student reports on what he/she has read to the lecturer who teaches the course at the specified times each week. Along with these, the student continues the original work under the supervision of the lecturer on the subject they have determined. The course continues with the student presenting an interpretation of the latest literature on the subject to the faculty member, also mentioning the contributions that can be made to this literature. In this process, the student is also asked to prepare one or two mini-projects in this area. The course ends with the presentation of the work done at the end of the semester to the faculty member for evaluation.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 502	MATHEMATICAL METHODS AND APPLICATIONS IN ELECTRICAL MACHINES	3	0	0	3.00	7.50	

### Course Content

Review of Electrical Machines, Understanding the Electromagnetic Analysis of Electrical Machines, Review of Classical Control Techniques for Electrical Machines, The Machine Characteristics and Typical Practical Applications, Introduction to Computational Methods, Finite Difference Method, Finite Elements Method, Genetic Algorithm, Neural Networks, Fuzzy Logic, Computer Simulation Tools for Numerical Methods such as MATLAB. Modeling of Magnetically Nonlinear Iron Core Characteristics of Transformers, Applications of Computational Solutions For Electrical Machines Design

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 503	SPECIAL ELECTRIC MACHINERY	3	0	0	3.00	7.50	

## Course Content

Structure, Classification, Distribution of Powers, Starting Methods and Comparison of Single Phase Induction Motors / Explanation of the Structure and Working Principle of Universal Motors / Extraction of the Operational Characteristics of the Universal Motor / Extraction of the Speed-Moment Characteristics of the Universal Motor at Different Supply Voltages / Structure of the Stepper Motor, Structural Classification and Investigation of Stator Windings / Obtaining Speed-Moment Characteristics in Bipolar and Unipolar Operation in Stepper Motor

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 506	COMPUTER AIDED DESIGN AND ANALYSIS OF ELECTRICAL MACHINES	3	0	0	3.00	7.50	

## Course Content

Electric Machine Types, Basics of Magnetics, Basics of Electromechanics, Materials in Electric Machines, Computer software for Electric Machine design, Electric Machine Design Applications: Induction Machines, Transformer.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 507	STATISTICAL SIGNAL PROCESSING	3	0	0	3.00	7.50	

## Course Content

Statistical decision theory. Hypothesis testing, detection of known signals and signals with unknown parameters in noisy environment, receiver performance and probability of error, radar and communication applications. Stochastic processes, signal modelling, AR/MA/ARMA processes. Complex and nonparametric decision theory. Statistical estimation theory, performance criteria and limits, efficient estimators. Estimation of unknown signal parameters, applications. Linear estimation, Wiener filter, Kalman filter, Levinson loop, lattice filters, spectrum estimation.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 509	DATA COMMUNICATION SYSTEMS	3	0	0	3.00	7.50	

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28	Week 29	Week 30	Week 31	Week 32	Week 33	Week 34	Week 35	Week 36	Week 37	Week 38	Week 39	Week 40	Week 41	Week 42	Week 43	Week 44	Week 45	Week 46	Week 47	Week 48	Week 49	Week 50	Week 51	Week 52	Week 53	Week 54	Week 55	Week 56	Week 57	Week 58	Week 59	Week 60	Week 61	Week 62	Week 63	Week 64	Week 65	Week 66	Week 67	Week 68	Week 69	Week 70	Week 71	Week 72	Week 73	Week 74	Week 75	Week 76	Week 77	Week 78	Week 79	Week 80	Week 81	Week 82	Week 83	Week 84	Week 85	Week 86	Week 87	Week 88	Week 89	Week 90	Week 91	Week 92	Week 93	Week 94	Week 95	Week 96	Week 97	Week 98	Week 99	Week 100	Week 101	Week 102	Week 103	Week 104	Week 105	Week 106	Week 107	Week 108	Week 109	Week 110	Week 111	Week 112	Week 113	Week 114	Week 115	Week 116	Week 117	Week 118	Week 119	Week 120	Week 121	Week 122	Week 123	Week 124	Week 125	Week 126	Week 127	Week 128	Week 129	Week 130	Week 131	Week 132	Week 133	Week 134	Week 135	Week 136	Week 137	Week 138	Week 139	Week 140	Week 141	Week 142	Week 143	Week 144	Week 145	Week 146	Week 147	Week 148	Week 149	Week 150	Week 151	Week 152	Week 153	Week 154	Week 155	Week 156	Week 157	Week 158	Week 159	Week 160	Week 161	Week 162	Week 163	Week 164	Week 165	Week 166	Week 167	Week 168	Week 169	Week 170	Week 171	Week 172	Week 173	Week 174	Week 175	Week 176	Week 177	Week 178	Week 179	Week 180	Week 181	Week 182	Week 183	Week 184	Week 185	Week 186	Week 187	Week 188	Week 189	Week 190	Week 191	Week 192	Week 193	Week 194	Week 195	Week 196	Week 197	Week 198	Week 199	Week 200	Week 201	Week 202	Week 203	Week 204	Week 205	Week 206	Week 207	Week 208	Week 209	Week 210	Week 211	Week 212	Week 213	Week 214	Week 215	Week 216	Week 217	Week 218	Week 219	Week 220	Week 221	Week 222	Week 223	Week 224	Week 225	Week 226	Week 227	Week 228	Week 229	Week 230	Week 231	Week 232	Week 233	Week 234	Week 235	Week 236	Week 237	Week 238	Week 239	Week 240	Week 241	Week 242	Week 243	Week 244	Week 245	Week 246	Week 247	Week 248	Week 249	Week 250	Week 251	Week 252	Week 253	Week 254	Week 255	Week 256	Week 257	Week 258	Week 259	Week 260	Week 261	Week 262	Week 263	Week 264	Week 265	Week 266	Week 267	Week 268	Week 269	Week 270	Week 271	Week 272	Week 273	Week 274	Week 275	Week 276	Week 277	Week 278	Week 279	Week 280	Week 281	Week 282	Week 283	Week 284	Week 285	Week 286	Week 287	Week 288	Week 289	Week 290	Week 291	Week 292	Week 293	Week 294	Week 295	Week 296	Week 297	Week 298	Week 299	Week 300	Week 301	Week 302	Week 303	Week 304	Week 305	Week 306	Week 307	Week 308	Week 309	Week 310	Week 311	Week 312	Week 313	Week 314	Week 315	Week 316	Week 317	Week 318	Week 319	Week 320	Week 321	Week 322	Week 323	Week 324	Week 325	Week 326	Week 327	Week 328	Week 329	Week 330	Week 331	Week 332	Week 333	Week 334	Week 335	Week 336	Week 337	Week 338	Week 339	Week 340	Week 341	Week 342	Week 343	Week 344	Week 345	Week 346	Week 347	Week 348	Week 349	Week 350	Week 351	Week 352	Week 353	Week 354	Week 355	Week 356	Week 357	Week 358	Week 359	Week 360	Week 361	Week 362	Week 363	Week 364	Week 365	Week 366	Week 367	Week 368	Week 369	Week 370	Week 371	Week 372	Week 373	Week 374	Week 375	Week 376	Week 377	Week 378	Week 379	Week 380	Week 381	Week 382	Week 383	Week 384	Week 385	Week 386	Week 387	Week 388	Week 389	Week 390	Week 391	Week 392	Week 393	Week 394	Week 395	Week 396	Week 397	Week 398	Week 399	Week 400	Week 401	Week 402	Week 403	Week 404	Week 405	Week 406	Week 407	Week 408	Week 409	Week 410	Week 411	Week 412	Week 413	Week 414	Week 415	Week 416	Week 417	Week 418	Week 419</
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Transmission Channel Models, Transmitter and Receiver Structures, Performance of Communication Systems, Estimation and Detection Techniques, Diversity and Combining Techniques, Multicarrier systems, Multiple Antenna Systems

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 510	SATELLITE COMMUNICATION SYSTEMS	3	0	0	3.00	7.50	

## Course Content

Introduction to satellite communications, satellite orbits, geostationary orbits, antenna look angle calculations, RF link calculations, Interference and rain attenuation, the earth segment, satellite transponder and functionalities, Radiowave propagation, atmospheric and ionospheric losses, satellite networks, intersatellite communications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 511	NEXT GENERATION WIRELESS COMMUNICATIONS SYSTEMS	3	0	0	3.00	7.50	

## Course Content

Introduction to new generation cellular communication systems, spectrum and operating frequencies technology selection, 2nd generation, 3rd generation, WiMAX, LTE, LTE-A, 4G, 4.5G and 5G technologies. Fading and path loss models Interference, Calculation of common channel and neighbor channel interference effects, Frequency reuse techniques. RIS, Collaborative Communication, Cognitive Radio and Visible Light Communication Technologies.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 512	WIRELESS COMMUNICATION NETWORKS	3	0	0	3.00	7.50	

## Course Content

Architecture and Layers of Communication Networks, Protocols and Standards, Communication Structures, Performance and Capacity, Wireless Network Examples, Recent Topics on Communication Networks.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 513	THEORY OF LINEAR SYSTEMS	3	0	0	3.00	7.50	

## Course Content

With this course, graduate students will be able to learn the basics of linear systems, linearization, mathematical modeling of systems such as discrete-time systems; linear algebra such as linear algebraic equations, similarity theorem, diagonal and Jordan form, Lyapunov equation, quadratic form and positive definiteness; linear time-varying systems with state-space solutions and implementations; input-output stability, internal stability, Lyapunov theorem and stability concepts; controllability and observability; prime factorization and minimum implementation; state feedback and state predictors; will gain a solid foundation for further systems theory, control system theory courses and academic studies by being informed about pole placement and model matching.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 514	ADAPTIVE CONTROL SYSTEMS	3	0	0	3.00	7.50	

## Course Content

Mathematical preliminaries; Vector, Matrix, series, convergency, Laplace transform, Matrix and Vector norms, Introduction to adaptive control systems, Model reference adaptive control systems, Self tuning regulator, Auto tuning, Gain scheduling, Hyper stability, Adaptive control for nonlinear systems, Adaptive control of robotic arms

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 515	CHAOTIC SYSTEMS AND ENGINEERING APPLICATIONS	3	0	0	3.00	7.50	

#### Course Content

Chaos theory, chaotic systems, chaotic oscillators, strange attractors, dynamic analysis of chaotic systems (orbital plan, phase space, Poincarè map, power spectrum, Lyapunov exponents, Lyapunov dimension, bifurcation diagram), fractal concept, fractal structures, computer simulations of chaotic systems, Design of chaotic systems with analog devices, digital system based design of chaotic systems, chaotic synchronization, chaos control, chaos based engineering applications (chaos based communication, chaos based random number generators, chaos based encryption etc.).

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 516	SYSTEM DYNAMICS, MODELING AND SIMULATIONS	3	0	0	3.00	7.50	

#### Course Content

Introduction to Mathematical Modeling and System Identification Mechanical Systems, Heat and Fluid Flow Models, Linearization and Scaling, Electrical Systems and System Elements, Mathematical Models of Electric Circuits, Demonstration of Similarities Between Electrical and Mechanical Models, Mechanical, Thermal and Hydraulic Systems Analysis by Modeling with Electrical Circuits, Models of n. Degree Linear Differential Equation, First Degree Systems, Step Response, Ramp Response, Frequency Response, First Degree Electrical Systems, Hybrid Systems, Second Degree Systems, Mechanical Second Degree Systems, Electrical Second Degree Systems

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 517	MATHEMATICAL METHODS IN CONTROL ENGINEERING	3	0	0	3.00	7.50	

#### Course Content

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 518	INDUSTRIAL AUTOMATION CONTROL SYSTEMS	3	0	0	3.00	7.50	

#### Course Content

Introduction to Industrial Automation Control Systems, Historical overview. Sensors, Transducers and its applications. Operational Amplifiers and its applications. Analog/Digital (ADC), Digital/Analog (DAC), Frequency/Voltage, Voltage/Frequency, Converters and its applications. Control applications with using discrete circuit component. Microprocessor based control applications. Microcontroller based small a temperature and motor control system design and application. LabVIEW control software and its applications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 519	ADVANCED ELECTROMAGNETIC THEORY	3	0	0	3.00	7.50	

#### Course Content

Time-varying electromagnetic fields, electrical properties of materials, wave equations, propagation, reflection and transmission of waves, electromagnetic theorems and principles.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 520	NUMERICAL METHODS IN ELECTROMAGNETICS	3	0	0	3.00	7.50	

#### Course Content

Basic concepts of electromagnetic (EM) theory, Classification of EM waves, Analytical methods and applications, Finite difference methods, Practical applications, Numerical integration, Variational methods, Moment method, Finite element method

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 521	ELECTROMAGNETIC WAVES AND APPLICATIONS	3	0	0	3.00	7.50	

#### Course Content

Review of electromagnetic wave theory, Classification of electromagnetic waves, Practical application of scattering, Applications of periodic structures, Applications of antennas and microstrip lines, Applications of metamaterials, Investigation of scattering by moment method, Investigation of microstrip lines by finite element method.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 522	MICROSTRIP ANTENNAS	3	0	0	3.00	7.50	

#### Course Content

Methods of analysis of microstrip antennas, transmission line method, cavity method, analysis and design of microstrip antennas of various geometries, analysis and design of broadband microstrip antennas, microstrip antenna arrays, millimeter wave microstrip antennas.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 523	MICROWAVE IMAGING	3	0	0	3.00	7.50	

#### Course Content

Electromagnetic scattering, Maxwell's equations, Wave equations, Scattering from dielectric targets, Integral equations, Scattering from perfectly conducting targets, Imaging configurations, Born-type imaging approach, Rytov imaging approach, Kirchoff imaging approach, Green's functions for inhomogeneous structures, qualitative imaging methods, quantitative deterministic imaging methods, quantitative stochastic imaging methods, hybrid imaging approaches, microwave imaging applications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 524	MICROWAVE RADAR SYSTEMS	3	0	0	3.00	7.50	

#### Course Content

Radar systems, radar equation, radar cross section, CW radar, FMCW radar, doppler radar, MTI radar, radar antennas, radar wave propagation, synthetic aperture radar.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 525	COMPUTER AIDED CIRCUIT DESIGN	3	0	0	3.00	7.50	

#### Course Content

Simulator operating principle, model parameters, usage of macromodel and library, filter design, rectifier and regulator design, digital integrated circuit design, analog integrated circuit design, mixed signal circuit design

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 526	EMBEDDED SYSTEM DESIGN	3	0	0	3.00	7.50	

#### Course Content

Introduction of embedded systems and system hardware, microprocessor selection, ARM microcontroller architecture, properties of elements, elements and circuits that make up embedded systems; Basic tools and software methods used in programming embedded systems, ARM microcontroller based embedded system application examples; GPIO, interrupts, timers, ADC, USART, DMA, loop resources and PLL, SPI, I2C communication.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 527	MEDICAL ELECTRONICS SYSTEM DESIGN AND MEASUREMENT SETTINGS	3	0	0	3.00	7.50	

#### Course Content

Basic concepts of medical electronics, biomedical measurement systems their implementations

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 528	INTEGRATED CIRCUIT DESIGN	3	0	0	3.00	7.50	

#### Course Content

Fundamentals of VLSI design / Design and testability / Integrated circuit design techniques: Hierarchical design, design abstraction, computer-aided design / Fabrication and layout/ Design tools and design rules / Digital and analog integrated circuit design techniques / Application Specific Integrated Circuit (ASIC) design / Floorplanning / Architecture design / Chip Design / Analysis and synthesis algorithms

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 529	FPGA PROGRAMMING WITH VHDL	3	0	0	3.00	7.50	

#### Course Content

FPGA technology, Hardware description language, Fundamentals of VHDL design, Combined Circuit Design with VHDL, Sequential Circuit Design with VHDL, Sub-circuits, Finite state machines, File and memory operations with VHDL, Structured circuit programming, Creating a VHDL simulation file (test bench), FPGA design applications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 530	ADVANCED TOPICS IN ANALOG ELECTRONICS	3	0	0	3.00	7.50	

#### Course Content

Basic concepts of two-port circuits, Operational Amplifiers - Operational Transconductance Amplifier (OTA) - Current Carriers (CC) and their derivatives, basic performance parameters, characteristics, behavioral models and applications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 531	BIOSENSORS	3	0	0	3.00	7.50	

#### Course Content

Description of Biosensors / Biomolecules used in biosensors and immobilization methods / Transducer materials, types and properties / The properties and factors affecting performance of biosensors / Enzymatic biosensors / Immunobiosensors / DNA biosensors / Cell based biosensors / Electrochemical biosensors / Optical biosensors / Other biosensor methods / Biosensors in food, healthcare and environmental analysis

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 532	HEURISTIC OPTIMIZATION ALGORITHMS AND ENGINEERING APPLICATIONS	3	0	0	3.00	7.50	

#### Course Content

Available and newly introduced heuristic methods to solve/optimize combinatorial problems. Objective, abilities and practical applications of heuristic methods in optimization theory.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 533	PROTECTION SYSTEMS FOR POWER SYSTEMS	3	0	0	3.00	7.50	

**Course Content**

Basic concepts for protection systems, phasors and polarity, per-unit (p.u.) values, symmetrical components, short circuit calculations, Instrument transformers, protection relays, ANSI codes for protection relays, examinations of sample protection systems, Coordination of protection relays

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 534	SMART GRIDS	3	0	0	3.00	7.50	

**Course Content**

Smart Grid, Renewable Energy Resources & Distributed Generation, Smart Prices, Smart Devices, Smart Usage, Energy Efficiency & Demand Response, Managing Energy, Smart Homes, Case Studies& Applications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 535	HIGH VOLTAGE LINES AND SCREENING THEORY	3	0	0	3.00	7.50	

**Course Content**

High-voltage and current electromagnetic field knowledge / Calculation and measurement methods / Various high-voltage equipment, electromagnetic field levels / Types of high-voltage lines / Cables to route detection / Electromagnetic field standards / Screening theory / Electromagnetic interference limit değeri / Home and business Shielding / Electrical panels Shielding / Computers and cable shielding / Examples of applications on the subject.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 536	TRANSITIONAL EVENTS IN POWER SYSTEMS	3	0	0	3.00	7.50	

**Course Content**

- Identification of transient events, - Investigate the effect of transient events, - Determination of system behavior during transient events - Effects of transient events on stability, - Fault analysis and protection systems

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 537	HYBRID ELECTRIC ENERGY SYSTEMS	3	0	0	3.00	7.50	

**Course Content**

1. Introduction 2. Hydrogen Energy 3. Fuel Cell Systems 4. Wind Energy Systems 5. Solar Energy Systems 6. Energy Storage Systems 7. Ultra Capacitor Systems 8. Battery Systems 9. Hydrogen Storage Systems 10. Applications of Hybrid Energy Systems 10.1 Fuel cell / Ultra capacitor Hybrid System for Residential Usage 10.2 Fuel cell / Ultra capacitor Hybrid System for Vehicular Usage 10.3 Wind / Fuel Cell / Ultra Capacitor Hybrid System 10.4 Solar Cell / Fuel Cell / Ultra Capacitor Hybrid System

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 538	MEASUREMENT AND INSTRUMENTATION IN ELECTRICAL SYSTEMS	3	0	0	3.00	7.50	

**Course Content**

Introduction. Definitions: Measurement, Accuracy and Precision, et al. Static and dynamic characteristics of measurement systems. Types of error, error analysis. Analogue meters: Principle of operating, accuracy. Digital multimeters; principle of calibration, common mode rejection. AC or DC current and voltage measurement - standards, methods and instruments. Bridge measurements (Wheatstone, Kelvin, Maxwell, and Hay Bridge). Measuring amplifiers with operational amplifier, converters of average and of RMS value, phase-sensitive rectifier. Principle of sampling and quantisation of analogue signal, DACs and ADCs - principle and properties. Measurement of power - definition, measuring methods, digital wattmeter; measurement of energy consumption. Sensors and transducers: Principles of operating and characteristics. Analog and Digital Data Acquisition Systems.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 539	BIOMEDICAL SIGNAL AND IMAGE PROCESSING	3	0	0	3.00	7.50	

**Course Content**

The features of biomedical signal and images; Transformation methods in signal and image processing; Signal and image denoising methods; Signal and image filtering methods; Signal and image enhancement methods; Statistical, morphological and spatial feature extraction methods; Linear/Non-linear dimension reduction methods; Unsupervised learning methods in the signal and image processing; Supervised learning methods in the signal and image processing; Semisupervised, ensemble and deep learning methods.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 540	ADVANCED METHODS IN MEDICAL IMAGING	3	0	0	3.00	7.50	

**Course Content**

X-ray Generation and Method, Interaction between X-rays and Matter, Dose and Exposure, Propagation Model, X-Ray Tubes and Generators, Scattering and Image, The Prevention of Scattered Light and Image Noise, Detectors and Grids, Image Geometry and Algorithms, The Parameters used in the Formation of Radiographic Image, Image Intensifier Screens, Introduction to Medical Imaging Instruments

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 541	PROCESSING OF AUDIO SIGNALS AND ITS MEDICAL APPLICATIONS	3	0	0	3.00	7.50	

**Course Content**

Production and perception of sound, mathematical foundations of sound, coding of sound signals, time domain analysis of sound signals, frequency domain analysis of sound signals, wavelet transform of sound signals, time scale modification of speech signals, tone modification of speech signals, synthesis of speech signals, speech recognition algorithms, Objective and subjective evaluation methods of sound quality, human factor in the evaluation of speech signals, examining the snoring sounds of patients with obstructive sleep and the effectiveness of snoring treatment, the effects of surgeries performed in otolaryngology clinics on voice change.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 542	BIOLOGICAL DATABASES AND DATA MINING	3	0	0	3.00	7.50	

**Course Content**

Introduction to data mining, Examination of new generation sequencing techniques and analysis of the resulting data, Galaxy database, R language, Identification of microRNAs by R language and determination of their expression levels, Determination of miRNA databases, Analysis of the obtained miRNA results, Protein database, 2D gel electrophoresis spot analysis, Interactom analysis and relationship analysis in database.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 543	MACHINE LEARNING AND BIOMEDICAL APPLICATIONS	3	0	0	3.00	7.50	

**Course Content**

Introduction to Machine Learning, Linear Regression, Decision Trees, Instance Based Learning, Bayesian Learning, Logistic Regression, Neural Networks, Support Vector Machines, Model Selection, Feature Selection, Clustering, Expectation Maximization, Ensemble Learning

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 544	ADVANCED BIOMECHANIC	3	0	0	3.00	7.50	

**Course Content**

Introduction to fundamentals of mechanical engineering, biological materials and system applications ; Analysis of linkages, tendons, bones, joints and all organelles of walking, physiology of exercising, orthopedic surgery and sports medicine ; Introduction to biomechanical and transport processes in biological systems ; Biorheology, biosolid mechanics, muscle mechanics, mass transfer-momentum transfer, energy transfer ; Bone and joint loading by orthopedic biomedical approaches ; Analysis and fixation of broken and cracked tissues, implant friction, polishing and deformation processes ; Molecular, cellular and histoid biomechanics: Molecular fundamentals of tissue structure and macroscopic properties, chemical and electrical effects of mechanical properties, cellular mechanics, motion and adhesion, biomembranes, biomolecular mechanics and molecular motors, experimental methods for structural analysis on the molecular, cellular and histoid level ; Advanced mathematical developments in biomechanics ; Selected topics on heart dynamics, heart beat, blood circulation, microcirculation and muscle mechanics ; Biomechanics and biocontrol: Optimal strategies on human motion ; Control strategies for patients who have anti-robotic and neuroplastic system damage ; Rehabilitation engineering, assistance for handicapped, orthopedic renewal devices, spinal biomechanics and sports biomechanics.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 545	DESIGN OF ARTIFICIAL NEURAL SYSTEMS	3	0	0	3.00	7.50	

**Course Content**

Artificial Intelligence and its history, Basic neural biology, Basic Elements of Artificial Neural Networks, Learning Strategies and Algorithms of Artificial Neural Networks, Artificial Neural Network Models (Perceptron, ADALINE, MADALINE, MLP, LVQ, ART, Elman, Hopfield, Cognitron, SOM), Composite and Hybrid network designs, Artificial Neural Network Design, Artificial Neural Network Applications.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 546	DEEP LEARNING	3	0	0	3.00	7.50	

**Course Content**

History and theoretical advantages of the deep learning, basic learning algorithms and architectures for deep learning, regularization of distributed models, optimization techniques for training deep networks, convolutional networks, backpropagating and recurrent networks, autoencoders and linear factor models, learning by demonstration, deep generative networks - Boltzman machines

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 547	OBJECT BASED DESIGN AND MODELING	3	0	0	3.00	7.50	

**Course Content**

Object oriented programming concepts, Unified Modeling Language(UML), Class design, Applets, Inheritance, Polymorphism, Interface and abstract classes, design patterns, frameworks, Application programming interfaces (API).

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 548	FUZZY SETS AND FUZZY LOGIC	3	0	0	3.00	7.50	

**Course Content**

Fuzzy Sets; The Operation of Fuzzy Sets; Fuzzy Relation and Composition; Fuzzy Graph and Relation; Fuzzy Number; Fuzzy Function; Probability and Uncertainty; Fuzzy Logic; Fuzzy Inference; Fuzzy Control; Fuzzy Expert Systems; Fusion of Fuzzy System and Neural Networks; Fusion of Fuzzy System and Genetic Algorithms

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 508	BLIND AND NON-BLIND ESTIMATION THEORY	3	0	0	3.00	7.50	

**Course Content**

Introduction to blind and non-blind balancing. Basic concepts and approaches. Blind and non-blind forms of adaptive parameter estimation. Single-input, single-output blind and non-blind estimation algorithms. Local convergence analyzes of single-input, single-output blind and non-blind equalizers. Multi-input, multi-output blind and non-blind prediction algorithms. Linear multi-channel detection methods based on quadratic statistics. Frequency domain approaches for single-user channel determination. Adaptive multi-channel equalization. Blind sign separation and subtraction. Blind convolution. Two-dimensional blind deconvolution algorithms.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 549	DESIGN AND SIMULATION OF SC AND MC VISIBLE LIGHT COMMUNICATION SYSTEMS	3	0	0	3.00	7.50	

**Course Content**

Introduction: Wireless Optical Communication Systems. Optical Sources and Detectors. Modeling of VLC Channels. Modeling of Mobile VLC Channels. Modulation Techniques. SC Based VLC Systems. MC Based VLC Systems. Unipolar OFDM Systems. HRO-OFDM Systems. ACO-OFDM Systems. DCO-OFDM Systems. Flip-OFDM Systems. Estimating and Equalizing VLC Channels. MIMO-SC and MIMO-MC Based VLC Systems. Computer Simulations.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 550	CHANNEL CODING TECHNIQUES AND COMPUTER APPLICATIONS FOR WIRELESS COMMUNICATIONS	3	0	0	3.00	7.50	

**Course Content**

Introduction: Channel Coding. Performance of Digital Communication Systems over Damped Channels. Galois Field Theory. Linear Block Codes. Overlay Codes. Turbo Codes. Bandwidth Efficient Coding Modulation. Low Density Parity Control Codes. LT and Raptor Codes. MIMO Systems. Space Time Coding. Polar Coding.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 551	NONLINEAR TIME SERIES ANALYSIS	3	0	0	3.00	7.50	

**Course Content**

Basic concepts in Time Series Analysis and stationarity and nonstationarity, autocorrelation and partial autocorrelation functions in time series data. Linear Time Series Models, Nonlinear Time Series Models, Nonlinear state space models. Nonlinear Dynamics and Chaos Theory, Nonlinear Estimation Techniques, Nonlinear Causality and Causality Measures, Applications of Nonlinear Time Series Analysis

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 552	SURFACE ELECTROMYOGRAPHY AND ANALYSIS TECHNIQUES	3	0	0	3.00	7.50	

**Course Content**

Introduction to Surface Electromyography (EMG), Muscle physiology and fundamentals of neuromuscular activation, Basic Biomechanics, Surface EMG Detection Systems and Signal Collection and Surface EMG Signal Processing, Analysis of Surface EMG in the Time, Frequency, v Time-Freakns domain, Surface EMG Feature Extraction, Surface Interpretation and Applications of EMG Data, Surface EMG in clinical applications