Tarsus University
Institute of Graduate Studies
Electrical and Electronic Engineering

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Course Content Report

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

Course Content

Determining research priorities and research planning. Research methods. Literature search and databases. Data collection, measurement and analysis. Validity and reliability. Experimental design and control. Critical research. Writing a research proposal. Reporting and patent preparation. Scientific ethics, plagiarism and publication ethics.

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

Determination of the thesis topic, literature review, design of the research method, experimental/simulation studies, analysis of the results, progress reports and presentations, article and thesis writing.

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

Course Content

Organization, writing and public presentation of scientific work (seminar, conference paper, article, master's thesis). Processes and techniques of scientific research. Accessing national and international publications. Individual study and review of the work. Writing the study in article format and submitting it to the instructor and the advisor. Giving a presentation on a predetermined day 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 Electromecahics, 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	

Course Content

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 and the frequency spectrum, satellite orbits, the geostationary orbit, antenna look angles, radio wave propagation and polarization, atmospheric and ionospheric effects, rain attenuation, satellite antennas and the space segment, the earth station, the RF satellite link budget, interference, multiple access techniques, satellite networks and topologies, intersatellite communications, direct broadcast and satellite internet services.

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

Mathematical modeling and linearization, vector spaces and linear operators, eigenstructure and singular values, matrix functions, state-space solutions, Lyapunov stability, controllability, observability, system realization, state feedback, state estimation, 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 and matrix norms, convergence, introduction to adaptive control systems, real-time parameter estimation, model reference adaptive control, self-tuning regulators, auto-tuning, gain scheduling, hyperstability, adaptive control of nonlinear systems and robot manipulators.

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 SIMULATIONSYSTEM DYNAMICS, MODELING AND SIMULATION	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 mathematical models of electric circuits, analogies between electrical and mechanical systems, linear nth-order differential equation models, first-order systems, step, ramp and frequency responses, hybrid systems, second-order systems, higher-order system behavior and simulation applications with MATLAB/Simulink.

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

Multivariable Calculus, First-Order Differential Equations, Linear Differential Equations, Series Solution Methods, Special Functions, Vectors and Tensors, Linear Analysis, Linear Algebra, Dynamical Systems.

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 automatic control systems and their historical development. Sensors, transducers, operational amplifiers, ADC, DAC, F/V and V/F converters, control with discrete circuit components, microprocessor-based control, design of a microcontroller-based temperature and motor control system, LabVIEW.

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 and time-harmonic electromagnetic fields, electrical properties of materials, wave equations and their solutions, wave propagation and polarization, reflection and transmission of waves, auxiliary vector potentials, radiation and scattering equations, 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 their applications, finite difference methods and their applications, numerical integration, variational methods, method of moments, 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

Electromagnetic wave theory, classification of waves, analytical methods, Laplace, wave and Poisson equations, scattering applications, time-domain finite-difference method, periodic structures, antennas and microstrip lines, metamaterials, method of moments and 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

Analysis methods of microstrip antennas (transmission line and cavity models), analysis and design of rectangular and circular microstrip antennas, analysis and design of broadband and dual-band microstrip antennas, microstrip antenna arrays and 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 equations, wave equations, scattering from dielectric targets, integral equations, scattering from perfectly conducting targets, imaging configurations, Born-type imaging approach, Rytov imaging approach, Kirchhoff imaging approach, Green 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 signal processing, matched filter, ambiguity function, radar wave propagation, radar clutter, continuous wave and FMCW radar, Doppler and MTI radar, radar cross section, radar antenna arrays, 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 to embedded systems and system hardware, microprocessor selection, ARM microcontroller architecture, register- and HAL-level programming, debugging, GPIO, interrupts, display units, timers, ADC and DAC, USART, DMA, clock sources and PLL, SPI and I2C communication, sensor-based embedded system design.

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 / Hierarchical design, design representations, computer-aided design / Fabrication and layout plans / Design tools and rules / MOS transistor models (EKV, BSIM) / Digital and analog integrated circuit design techniques / 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, combinational circuit design with VHDL, sequential circuit design with VHDL, sub-circuits, finite state machines, file and memory operations with VHDL, structural circuit programming, creating VHDL simulation files (test benches), 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), Operational Transresistance Amplifier (OTRA), Current Conveyors (CC) and their derivatives, and Four-Terminal Floating Nullor (FTFN) structures, their 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

Algorithmic complexity and combinatorial problems, branch and bound method, Lagrangian relaxation, local search, simulated annealing, genetic algorithms and genetic programming, tabu search, neural networks and random methods, hybrid methods and the Deluge algorithm. Reasons for the existence of heuristic techniques, their capabilities and their applicability to engineering problems.

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 değerlri / 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 Capasitor Systems 8. Battery Systems 9. Hydrogen Storage Systems 10. Applications of Hybrid Energy Systems 10.1 Fuel cell / Ultra capasitor Hybrid System for Residental Usage 10.2 Fuel cell / Ultra capasitor Hybrid System for Vehicular Usage 10.3 Wind / Fuel Cell / Ultra Capasitor Hybrid System 10.4 Solar Cell / Fuel Cell / Ultra Capasitor 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 (Wheatsone, 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 with matter, exposure dose, propagation model, X-ray tubes and generators, scattering, detectors and grids, image geometry, radiographic parameters, image intensifier screens, introduction of devices, Radon transform, inverse Radon transform, sinogram and tomographic image reconstruction algorithms.

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 o f 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 neurobiology, 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 deep learning, mathematical foundations (linear algebra, probability, information theory), basic artificial neural network architectures and learning algorithms, regularization of distributed models, optimization techniques, convolutional networks, medical segmentation models, feedback and recurrent networks, long short-term memory networks, autoencoders and linear factor models, representation learning, deep generative models (Boltzmann machines), deep learning applications (image recognition, robot control).

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, object-oriented program design with UML, class design, inheritance, polymorphism, interfaces and abstract classes, GUI programming, the Java object model, thread programming, design patterns, frameworks and application programming interfaces (APIs).

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

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 504	MOTOR CONTROL TECHNIQUES	3	0	0	3.00	7.50	

Course Content

Review of converters, Basic Power Electronics Pulse Width Modulation, Basic Power Electronics DC Motor Control Techniques DC Motor Control Techniques AC Motor Control Techniques. AC Motor Control Techniques. Modern Control Techniques – Field Oriented Control Modern Control Techniques – Space Vector Modulation Motor Control System Design Motor Control System Design Motor Control System Simulation Motor Control System Simulation Motor Control System Simulation Evaluation and Interpretation of Motor Control System Simulation

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 505	ADVANCED POWER ELECTRONICS	3	0	0	3.00	7.50	

Course Content

Power Electronics Systems A General Overview of Power Semiconductor Switches General Power Electronics Circuits Semiconductor Devices Power MOSFETs Rectifiers Inverters Midterm Exam Power Supply Applications Switched d.c Power Supplies Introduction to Motor Drive Systems D.c Motor Drive Systems Asynchronous Motor Drive Systems Synchronous Motor Drive Systems Final Exam

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 553	SYSTEM-ON-A-CHIP DESIGN	3	0	0	3.00	7.50	

Course Content

The System-on-Chip (SoC) concept and its historical development; SoC architectural components and processor cores (RISC-V/ARM, etc.); on-chip communication protocols and bus architectures (AMBA APB, AHB, AXI, Wishbone, etc.); memory mapping and memory controllers; design of peripherals (GPIO, UART, SPI, I2C, PWM, ADC, Timer, etc.) with hardware description languages (HDL) and their integration into the system; hardware accelerators; hardware–software co-design and partitioning principles; SoC verification and simulation techniques; synthesis of the hardware on FPGA and physical prototyping; development of low-level hardware drivers in C for the embedded processor and bare-metal application tests.

Course Unit Code	Course Name	T	U	L	Credit	ECTS	Type
EE 554	MICROPROCESSOR ARCHITECTURE AND DESIGN	3	0	0	3.00	7.50	

Course Content

Current approaches in microprocessor architecture, instruction set architecture (ISA) design and analysis, assembly language programming principles, design of microprocessor components with digital circuit design methods and with a hardware description language (HDL), and functional simulation, verification and testing of the designed processor by embedding it into FPGA hardware.