

Eskişehir Osmangazi Üniversitesi
Elektrik Elektronik Mühendisliği Bölümü

Lisans Eğitimi Kısa Ders İçerikleri (1993-2026)

Ders kod ve Kredileri Not Durum Belgesinden Görülebilir

Freshman Year Courses:

Physics I: Vectors, Motion in one dimension and in a plane, Particle dynamics, Work and energy conservation of energy and linear momentum, Collisions, Rotational kinematics, Rotational dynamics and the conservation of angular momentum, Equilibrium of rigid bodies, Oscillations, Gravitation.

Physics I Lab: The main object of the course is to strengthen insights into the fundamental concepts of physics related to Newtonian mechanics and heat through direct investigations and provide hands-on experience. Content of the course is as follows: Motion with constant acceleration; Newton's second law; spring; viscosity; surface tension; density; moment of inertia; heat of vaporization; specific heat; thermal expansion

Physics II: Charge and Matter, The electric field, Gauss' Law, Electric potential, Capacitors and dielectrics, Current and resistance, Electromotive force and circuits, The magnetic field, Ampere's Law, Faraday's Law, Inductance, Maxwell's Equations.

Physics II Lab: The main object of the course is to strengthen insights into the fundamental concepts of physics related to electricity, magnetism and optics through direct investigations and provide hands-on experience. Content of the course is as follows: Electrolysis; Ohm's Law; Wheatstone Bridge; transformer; frequency; light absorption coefficient; lenses.

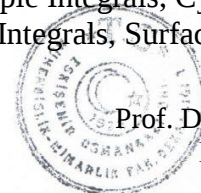
Introduction To Computers: PC hardware, Operating systems, Storage media, Input devices, Output devices, Internet, Word processing.

Introduction to Programming: Structure of computers, Number system and conversion, memory structure of a PC, Programming Basics, C language, Variables, Data types, Arithmetic expressions, Looping, Branching, Arrays, Pointers.

Computer Programming: Review of Introduction to Programming, Compiling in C, debugging, Control Structures, Functions, Arrays, Pointers, Strings, Memory Manipulation, Common Line Arguments, Variable Scope, Bitwise operators, Enumeration types, Structure and unions, Input/Output, Link List.

Calculus I: Real numbers, Cartesian coordinates, functions, circles, parabolas, ellipses, limits of functions, continuity, derivatives, derivatives of trigonometric functions, mean value theorem, extreme values, concavity, linear approximations, Taylor polynomials, sums, areas, definite integrals, properties of integrals, integration methods: substitution method, areas of plane regions, applications in Matlab, inverse substitutions, rational functions, improper integrals, approximate integration methods, volumes, surface areas, arc lengths, moments, conics, parametric curves, polar coordinates

Calculus II: Polar Coordinates, Sequences, Infinite Series, Power Series, Taylor Series, Fourier Series, Vectors, Cross Product, Quadric Surfaces, Vector Functions, Parametrizations, Limits and Continuity, Partial Differentiation, Chain Rule, Linear Approximations, Gradients, Implicit Functions, Taylor Series Approximations, Extreme Values, Linear Programming, Linear Regression, Applications in Matlab, Double Integrals, Triple Integrals, Cylindrical, Spherical Coordinates, Vector Fields, Conservative Fields, Line Integrals, Surface Integrals, Gradient, Divergence, Curl, Green's and Stokes's Theorems



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Expository Writing: Sentence variety and sentence combining, Introduction to the paragraph (topic sentence, support, unity and coherence), Types of paragraph (narrative, descriptive and expository), Introduction to the essay (thesis statement, introduction, developmental paragraphs and conclusion), Patterns of organization (example essay, comparison and contrast essay, classification essay, process essay, and cause-and-effect essay).

Technical Writing: Finding a topic for the research paper, Gathering data, Organizing ideas (note-taking and outline), Finding appropriate sources, Writing note cards (direct quotations, paraphrases, summaries and personal notes), Avoiding plagiarism, Writing the paper (introduction, body and conclusion, and editing and proofreading), Using reference material in the paper, Handling format and writing the works cited page.

Linear Algebra: Linear systems and matrices, Determinants, Vectors in the plane and in space, Vector spaces, Orthogonality and least squares, Eigenvalues and eigenvectors, Linear transformations.

Chemistry: Matter, Atomic structure, Chemical bonding, Chemical equations and quantitative relations, Gases, Liquid and solids, Solutions, Elements of chemical thermodynamics, Acid bases, Chemical kinetic and chemical equilibrium, Electrochemistry, Ionic equilibria.

Engineering Graphics: Introduction to technical drawing on the computer, Engineering computer applications Autocad, MATLAB, Spreadsheets.

Intro. Electrical Engineering I: Introduction to the department, the field of electrical engineering, electric current, dc and ac current, electric circuit, electrical safety, soldering, basic circuit components.

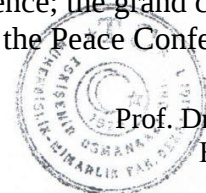
Intro. Electrical Engineering II: Introduction to electronic circuits, printed boards, circuit simulation software, assembly of a hobby circuit.

Intro. Electrical & Electronics Eng: Introduction to the University and Department, Concept of Engineering, Fundamentals of Electrical and Electronics Engineering (EEE), Historical Development of EEE, Main Research Areas in EEE, Some Important Concepts and Examples Related to EEE.

Türk Dili I: Description and features of language, languages of the world, Position of Turkish among other languages, historical development of Turkish, development of western Turkish, Atatürk's ideas and projects on Turkish, pronunciation and punctuation, language policies.

Türk Dili II: Word information, word types, sentence and word order of Turkish, composition, kinds of oral and written composition, oral and written narration techniques, present problems of Turkish, text (poetry, novel, story, article, etc.) analyzing methods.

History of Turkish Revolution & Principles of M. Kemal Atatürk I: The description of the term "revolution"; major historical events in the Ottoman Empire to the end of World War I; World War I; a general overview of Mustafa Kemal's life; certain associations and their activities; the arrival of Mustafa Kemal to Samsun; the congresses, the gathering of the last Ottoman Assembly and the proclamation of the "national oath"; the opening of the Turkish Grand National Assembly; the War of independence to the Victory of Sakarya; Victory of Sakarya; the financial sources of the war of independence; the grand counter-attack; the Armistice of Mudanya; the abolition of the Sultanate; the Peace Conference of Lausanne.



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History of Turkish Revolution & Principles of M. Kemal Atatürk II: The proclamation of the Republic in Turkey, the Abolition of the Caliphate, the Constitution of 1924, the Attempts of multi-party administration, the Sheikh Said Uprising, Other Reactions against the Republic, the Menemen Incident, the reforms in the field of education, law system, culture, economy, social life etc., the foreign relations of the Turkish Republic and the six principles of the Kemalist thought system, namely republicanism, nationalism, populism, statism, laicism and revolutionarism.

Sophomore Year Courses:

Engineering Mechanics: Introduction, Basic principles of statics, Force systems (in plane and in space), Rigid bodies and equivalent systems of forces, Equilibrium of rigid bodies, Centroids and centers of gravity, Forces in beams, Moments of inertia, Method of virtual work, Basic principles of dynamics, Kinematics and kinetics of rotation, Work, Energy and power, Impulse momentum and impact, Mechanical vibrations.

Differential Equations: First order equations, Exact differential equations, Higher order differential equations, Series solutions, Linear differential equation sets, Laplace Transform techniques, Existence and uniqueness theorems.

Advanced Calculus: Definitions and classifications, Existence of a unique solution, Exact equations, Separable equations, Homogeneous equations, Linear equations, Bernoulli equations, Riccati equations, Orthogonal trajectories, Oblique trajectories, Solving higher order linear differential equations, An order reduction technique, Homogeneous linear differential equations with constant coefficients, Undetermined coefficients method, Variation of parameters method, The Cauchy-Euler equation, Power series solutions, Differential operators, The Laplace transform, Solving Bessel's equation, Sturm-Liouville Boundary Value Problems, Picard's iterations, Euler Equation, Partial Differential Equations, PDE model of traffic flow, Phase plane analysis

Circuit Analysis I: Current, Voltage, Ohm's Law, Kirchoff's Law, Nodal and mesh analysis, Source transformation, Thevenin's and Norton's Theorems, Trees and links, Inductance and capacitance, Source free RL and RC circuits, RLC circuits, Sinusoidal forcing function, Phasor concept, Sinusoidal steady-state response, Average power, Polyphase circuits.

Circuit Analysis II: Complex frequency, Frequency response, Magnetically coupled circuits, Two port networks, Fourier Analysis, Fourier Transforms, Laplace Transforms.

Circuits Laboratory: Resistor color code and using the ohmmeter, Using the digital multi-meter, The short circuit and the open circuit, Serial and parallel connections, Power calculations, The combination circuits, Voltmeter loading, The Wheatstone bridge, Thevenin theorem, Signal sources and using the oscilloscope, Capacitors, RC circuits, Inductor and RL circuits, Resonant circuits, Op-amp circuits, Voltage and current conversion circuits, Active filters, Single power supply operation and instrumentation amplifiers.

Electromagnetics I Vector analysis, Static electric fields, Electromotive force and Kirchoff's laws, Solution of electrostatic fields, Poisson's and Laplace's equations, Steady electric currents, Static magnetic fields, Magnetic forces and torques.



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Electromagnetics II Faraday's law of Magnetic induction, Maxwell's equations, Electromagnetic boundary conditions, Wave equations and their solutions, Plane waves in lossless media, Plane waves in conducting media, Flow of electromagnetic power and the Poynting vector, Normal and oblique incidences at a plane conducting boundary, Normal incidence at a plane dielectric boundary

Electromagnetic Fields: Coulomb's law and static electric fields, electrostatic potential, Gauss's law, Laplace and Poisson equations, electrostatic phenomena in non-empty space, image principle, electrostatic energy, Lorentz force and static magnetic fields, Biot-Savart's law, vector potential, Ampere's law, magnetostatic phenomena in non-empty space, magnetostatic energy, magnetic circuits, Ohm's law, Maxwell's equations, Faraday's law of induction.

Electromagnetic Waves: Maxwell's equations and wave equation. Monochromatic waves. Electromagnetic spectrum. Helmholtz equation. Plane waves. Polarization of plane waves. Reflection and transmission of plane waves. Waveguides.

Digital Systems I: Number systems. Boolean algebra and logic gates, Karnough maps and combinational logic design. Combinational functions and circuits: encoder, decoder, multiplexer, demultiplexers. Arithmetic functions and circuits: adder, subtractor. Sequential circuits analysis and design.

Digital Systems II: Registers and counters. Register transfers. Sequencing and control. ASM charts. Memory basics. Computer design basics: single- and multiple cycle computers. Instruction set architecture: addressing modes, types of instruction. Input-output and communication

Logic Design: Introduction to digital systems and information representation, Combinational Circuit Analysis and Design, Combinational Functional Blocks (Decoder, Encoder, Multiplexer, Arithmetic), Sequential Circuits Analysis and Design Sequential Functional Blocks (Registers, Counters, Shift Registers, Accumulators).

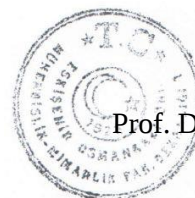
Digital Systems Laboratory: Logic gates and applications, Decoders and encoders, Multiplexers (data selection) and demultiplexers (data distributors), Flip-flops, Counters, Arithmetic logic circuits and registers, Sequential circuits, RAM-EPROM applications.

Systems and Signals: Definition and classification of systems and signals, Solution to linear time-invariant continuous-time and discrete-time systems, Convolution, State variables and equations, Z-transform, Laplace transform, Fourier analysis.

Numerical Methods: Taylor series, Number representation and error, Locating roots of equations, Interpolation and numerical differentiation, Numerical integration systems of linear equations, Ordinary differential equations, Monte Carlo methods and simulation, Systems of ordinary differential equations.

Complex Calculus: Complex numbers, Analytic functions, Complex integration, Power series, Taylor series, Laurent series, Residue integration method, Conformal mapping, Complex analysis applied to potential theory.

Fundamentals of Occupational Health and Safety: Definition and importance of occupational safety, Occupational safety culture, Occupational accidents, Occupational diseases, Factors affecting the work environment, Basic occupational safety in workplaces, Risk Assessment, Personal Protectors, Fire, Related legislation.



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Junior Year Courses:

Occupational Health and Safety in EEE: Occupational safety in electrical workplaces, definition of electrical quantities, cause of electrical accidents, electrical safety risk analysis and precautions for workplaces, effect of electrical current on human body, electric shock emergency, occupational safety laws in electrical work..

Communications: Spectral Analysis, AM and FM Modulation and Demodulation, Sampling and Quantization, PCM, Delta Modulation, PSK, FSK, BPSK.

Communications Laboratory: Hands-on Lab experiments on fundamentals of electronic communications, signal/noise power-energy, sampling and quantization, AM, DSB-AM, FM, PSK, QPSK, PAM, ADC/DAC principles.

Electronics I: Introduction to electronics, Operational amplifiers, Diodes, Bipolar transistors, Field-effect transistors, DC models for nonlinear components, Small signal models for diodes and transistors, Amplifiers at mid frequencies, Models for amplifiers.

Electronics II: Differential and multistage amplifiers, Frequency response of amplifiers, Feedback, Output stages and power amplifiers, Analog integrated circuits, Filters and tuned amplifiers, Oscillators, Bipolar and field effect logic families.

Electronics Laboratory: Diode, BJT, FET characteristics, Common emitter/source, Common collector/drain, Common base/gate amplifiers, Frequency response of amplifiers, Differential amplifiers, Operational amplifiers design and experiments.

Probability: Set theory, Concept of probability and its properties, Random variable and its special functions, Expected value and moments, Some important discrete distributions, Some important continuous distributions, Multi-dimensional random variables.

Fundamentals of Control Systems: Definition of control systems, Transfer functions and state-space representations, Stability, Root-Locus, Transient response and steady-state response analysis, Discrete and continuous-time design for stability, Asymptotic tracking and disturbance rejection.

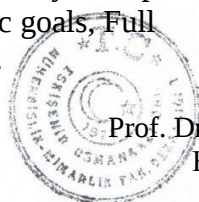
Control Systems Laboratory: Computer-aided control system analysis with MATLAB, mathematical modeling of the systems, open-loop and closed-loop control systems, transient and steady-state analysis, stability analysis, root-locus analysis, input and output transducers, characteristics of speed control systems.

Principles of Energy Conversion: Electromagnetic circuits, Properties of ferromagnetic materials, Single-phase and three-phase transformers, Per unit system, Principles of electromechanical energy conversion, Linear and nonlinear systems, Singly and multiply excited, Translational and rotational systems.

Introduction to Microcomputers: 8-bit microprocessors, Peripheral components, Basic PC, Assembly language instructions, Interrupts and other system sequences, and Memories. Fundamental structures in PIC16F877, Modules in PIC16F877, Programming of PIC16F877 by PIC assembly, MPASM

Microcomputer Laboratory: Assembly and C language programming, simulation and debugging, digital input and output, counter and timers, interrupts, text and graphic LCD, serial communication, ADC and DAC.

Economics: Demand and supply, Organization for production, Money and spending, The Economic "Isms": Philosophies and ideas, National economic goals, Full employment, Growth and stability, Poverty in an affluent society.



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Digital Signal Processing: Discrete-time signals and systems and their properties, frequency domain analysis of discrete-time signals and systems, Z transform, frequency analysis of linear time-invariant systems, filter structures, FIR and IIR filter design, discrete Fourier transform (DFT) and fast Fourier transform (FFT) algorithms, DFT and Fourier analysis of signals.

Introduction to Project Management: Definition of Project and Project management, Work Breakdown Structures and Network Representations, Project Planning Methods, Risk Management and Analysis, Introduction to Financial Management, Introduction to Quality Engineering.

Senior Year Courses:

Design Processes: Engineering design process, Project selection and needs identification, The requirements specification, Concept generation and evaluation System design-1: functional decomposition System design-2: behavior models Testing and system reliability Mid-Term Exams Professional skills: Teams and Teamwork Project management Ethical and legal issues How to make oral presentations Tübitak 2209 a&b program How to write the project proposal report

The Engineer and Society: Ethical issues in the practice of engineering, safety and liability, professional responsibility to clients and employers, whistle-blowing, codes of ethics, career choice, legal obligations; fundamentals of law, Labor Law, case studies, environmental issues, global energy issue.

Technical Electives:

Advanced Programming: Advanced C-programming, Complex structures and linked lists, Tips & tricks, Dynamic memory management, Preprocessor statements, File operations.

Computer Networks: Digital communication principles, Communication protocols & layers, Ethernet, TCP/IP, Routing and routing tables, Networking standards.

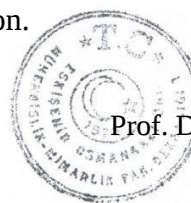
Introduction to Speech Recognition: Vector quantization, Distance ideas, Dynamic programming, Discriminant analysis, Neural nets, Hidden Markov Models, Gram-Schmitt orthogonalization method, Knowledge-based systems.

Linear Control Systems: Basic definitions, Transfer functions, Signal flow graphs, LTI system response analysis, Stability, Frequency-domain design, State-space design, Time varying systems, Introduction to optimal control.

Communication Electronics: Operational amplifiers, Filters, RF amplifier analysis and design, LC and crystal oscillators, PLLs and frequency synthesizers, Linear and exponential modulator and demodulator design.

Instrumentation and Control: Introduction to process control, Analog signal conditioning, Digital signal conditioning, Thermal sensors (RTD, thermistor, thermocouple), Mechanical sensors (displacement, location and position, strain, motion, pressure, flow sensors), Optical sensors (photodetectors), Signal conversions, Actuators, Control elements.

Uncertain Control Systems: Interval systems, Kharitonov's theorem, Frequency response of interval systems, Parameter dependent uncertainties, Affine linear uncertainty structure, Edge theorem, Singular value decomposition.



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Semiconductor Devices: Semiconductor materials, Energy bands, Carrier concentrations, Carrier transport, pn junction devices, Photonic devices, Unipolar and bipolar devices, Design and fabrication of integrated circuits.

Electrical Machinery: Study of DC commutator machines, Generator and motor characteristics, Synchronous machines, Generator and motor operations, Induction machines, Equivalent circuits, Control techniques and motor characteristics.

Introduction to Power Electronics: Semiconductor power devices, Thyristor protection circuits, Single and three phase rectifying circuits, AC switching controllers, Choppers, Inverters.

Power Systems Analysis I: Introduction, Fundamentals, Symmetrical components, Power transformers, Transmission line parameters, Transmission line steady-state operation.

Communication Electronics Laboratory: Mixing, PLL systems, Amplitude modulation, Transmission and reception, Single sideband communication, Angle modulation, Transmissions and receivers, Frequency modulation, Transmission and reception, Digital and data communication, Microwave circuits, FDM, TDM.

Seminar in Electrotechnology I: Students registered for this course do a literature search and present their findings on a topic specified by the instructor. The topics are in the broad spectrum of electrical engineering.

Electromagnetic Wave Propagation: Maxwell's equations, Electromagnetic wave propagation, Transmission lines, Waveguides, Antennas, Numerical methods.

Programmable Logic Controllers: Introduction, On-off inputs and outputs, Fail-safe circuits, Ladder diagrams, Basic PLC functions, Timer functions, Counter functions, Arithmetic functions, Number comparison functions, Data move functions, Matrix functions.

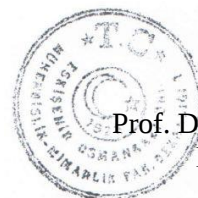
PLC Automation Systems: Introduction to PLC and PLC components. S7-1200 PLC and its features. Input-Output devices. Step-7 TIA Portal software development tool. Software development with LAD. PLC instruction set and applications. Open- and closed-loop control.

Nonlinear Control Systems: Phase plane analysis, Stability concepts for an equilibrium point, Lyapunov's direct method, Feedback linearization, Input-state linearization, Input-output linearization, Internal dynamics of nonlinear systems.

Digital Control Systems: Discrete-time systems and the Z-transform, Sampling and reconstructing, Open-loop discrete-time systems, Closed-loop systems, System time-response characteristics, Digital controller design, Pole-assignment design and state estimation, Sampled data transformation of analog filters, Digital filter structures, Finite word length effects.

Object Oriented Programming: Object oriented approach to programming, C++ classes, Inheritance, C++ operators, Function & operator overloading, Access specifiers, Virtual and friend keywords, Templates, Macros, C++ class libraries.

Object Oriented Programming I: Basic Concepts, Classes and Objects, Encapsulation, Operator Overloading, Inheritance, Polymorphism, Standard Template Library.



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Object Oriented Programming II: Basic Concepts, Input/Output, Decision and Repetition Structures, QT-IDE, Functions, File Processing, Exception Handling, String and Lists, Classes

Computer Architecture: 16-bit microprocessors and components, PC structure, Assembly language instructions, DMA, Caching memories, Bios, and Interface systems.

Microwave Devices and Antennas: Electromagnetic plane waves, Transmission lines, Waveguides, Components, Simple antennas and antenna arrays.

Fuzzy Logic: Classical sets and Fuzzy sets, Classical relations, Fuzzy relations, Membership functions, Fuzzy to crisp conversions, Fuzzy arithmetic, Numbers, Vectors and The extension principle, Classical logic and Fuzzy logic, Fuzzy ruled based systems, Fuzzy nonlinear simulation, Fuzzy classification, Fuzzy control systems.

Fuzzy Logic Lab.: Fuzzy gates, Fuzzy flip-flops, Fuzzification and defuzzification methods, 16-bit FMC card applications, Fuzzy MATLAB Toolbox simulation.

Special Electrical Machinery: Principles of step motors, Operation and control of linear motors, Traction technology, Single phase machines, Machines for special applications as reluctance motors and synchros.

Power Systems Analysis II: Power flows, Symmetrical faults, Unsymmetrical faults, Power-system control, Transmission lines, Transient operation, Transient stability.

Network Synthesis: System function, Response in networks, Synthesis of LC and RC networks, Ladder networks, Low-pass approximations, Low-pass, High-pass, Band-pass, Band-stop approximations and realizations.

Seminar in Electrotechnology II: Students registered for this course do a literature search and present their findings on a topic specified by the instructor. The topics are in the broad spectrum of electrical engineering.

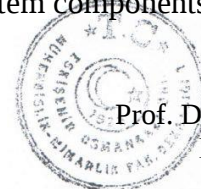
Power Electronics Application: Switching power supplies, zero-current and zero-voltage switching, resonance converters, gate drive circuits, snubber circuits, heat sink calculations, motor drives applications, uninterruptible power supplies, power electronics applications.

Digital Control Lab.: Discrete-time systems and Z-transform, Open-loop discrete-time systems, Closed-loop systems, System time-response characteristics, Compensator design, Experiments by using Digiac 2000 Microprocessors training system, Applied project.

Power System Protection: Introduction and general philosophies, Fundamental units: per unit and percent values, Phasors and polarity, Symmetrical components: A Review, Relay input sources, Protection fundamentals, System grounding principles, Generator protection, Transformer, Reactor, and Shunt capacitor protection, Bus protection, Motor protection, Line protection, Pilot protection, Stability, Reclosing and load shedding.

Introduction to DSP Processors: Digital signal processing and DSP systems. DSP processors. Numerical Representations: fixed- and floating point. Datapath and memory architecture. TMS320C6000 DSP processors. Software development tools: assembler, compiler and linker. Code Composer Studio (CCS) 6000 and TMS320C6713 DSK. DSP applications.

Electrical Distribution Systems: This electrical distribution course introduces the component of the distribution system and the way in which the systems delivers power to end-use customers. Included in the course are descriptions of key system components including single and three phase lines as wye and delta lines.



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High Voltage Techniques: Introduction to high-voltage technology, conduction and breakdown in gases, liquids and solids, corona, insulation materials, high-voltage and current generation techniques, high-voltage and current measurement techniques, overvoltages and insulation coordination in power systems, high-voltage testing of materials and electrical equipment, design, planning and layout of high-voltage laboratories.

Introduction to Image Processing: Components of an image processing system and its applications, Introduction to the human visual system, Low level image processing, Image histograms and gray level transformation, Spatial filters, Color Spaces, Image enhancement, Image morphology, Edge detection, Segmentation, Introduction to computer vision.

Introduction to VHDL- FPGA: Introduction to programmable devices, FPGA structure, design flow using VHDL, use of ISE software, VHDL signal/data types, design and use of components, connections, synchronous design, waveform and VHDL simulation test benches, use of LEDs and switches on the development kit, pitfalls in VHDL, variables, more complicated keywords in VHDL, correct use of arithmetic and logical operators, state-machines, functions and procedures, memory components, communication with external components using examples.

Power Systems Quality: Power Systems Quality Terms and Definitions, Electrical Transients, Transient Overvoltages, Harmonics, Applied Harmonics, Long Term Voltage Variations, Wiring and Grounding, Power Factor, Power Quality Benchmarking, Distributed Generation and Power Quality, Electromagnetic Interference, Static Electricity, Power Quality Monitoring.

Energy Transmission Lines: Transmission Line Structures, Transmission Line Parameters and Equivalent Models, Electrical Analysis of Transmission Lines, Mechanical Analysis of Transmission Lines, Transmission System Protection, Direct-Current Power Transmission, Underground Power Transmission

Optimization Methods for Engineering Applications: Formulation of Optimization Problems, Concept of Constrained and Unconstrained Optimization, Search Methods, Linear Programming, Simplex Method, Genetic Algorithm, Differential Evolution Algorithm, Particle Swarm Optimization, Simulated Annealing Algorithm, Tabu Search Algorithm.

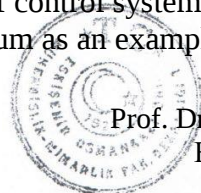
Machine Learning: Decision Trees, Ensemble Learning, Linear Regression and Classification Models, Neural Networks, Kernel Methods, Sequence Models, Deep Generative Models, Reinforcement Learning.

DSP System Design: Real-time DSP processing, DSP processors, program development tool and DSK, input and outputs, interrupts, analog to digital converter, multichannel serial port, numerical representations, DSP fundamentals, FIR filters, circular buffers, IIR filters, fast Fourier transform, IQ math library.

Introduction to Embedded Systems: Reviewing the fundamental hardware and software background needed for embedded system architectures. Studying the theory and applications of the embedded software structures, commonly used hardware sub-modules. Case studies of embedded design examples

Engineering Synthesis & Design Electives

Nonlinear System S&D: Introduction to nonlinear control software applications, Matlab and ordinary differential equation solutions, Root locus, Bode and Nyquist diagrams using Matlab commands, Simulink and block diagram representation of control systems, Mapple and symbolic solutions of differential equations, Inverted pendulum as an example, Sliding mode control as an example.



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Pattern Classification S&D: Applications of Bayes Classification Theory, Derivation of the Common Vector Approach for Pattern Classification, Classification of the Two Dimensional Geometric Figures under Rotation, Translation, and Magnification, Classification of the Texture Faults in Textiles, Common Vector Applications on the Real-time Sampled Signals, Restoration of the Three Dimensional Image from Stereo Photographs

Signals S&D: Discussion of new techniques used in signal analysis techniques, analysis of voice, speech, sound signals in a digital environment, application of digital signal communications, electronic circuit design applications for sound signals, signal communication networks and principles, image processing techniques, computer applications in signal processing

Fuzzy Logic S&D: Overview of general fuzzy systems, simulation of fuzzy control systems, case studies in design and implementation, fundamentals and applications of nonlinear analysis, fuzzy identification and estimation, adaptive fuzzy control, fuzzy classification, and fuzzy pattern recognition

Semiconductor S&D: Numerical solution of semiconductor equations, modeling of semiconductor devices, electronic circuit design with semiconductor components, new semiconductor devices, semiconductor detectors, semiconductor optoelectronic devices and applications, semiconductor device applications in telecommunication systems, power semiconductor devices and applications.

Computer Architectures S&D: Industrial Computer Applications, Factory Automation, Remote (Tel/RF/Infrared) Controlled Systems, Appliance Control, Developing graphical user interfaces for Control Applications, Developing Client/Server and/or WEB applications for automation.

Robot Control: Overview of coordinate systems, coordinate system transformations, kinematics, robot dynamics, trajectory planning, Iapunov control, sliding mode control, performance, design applications

Microprocessor Based S&D: Digital system hardware principles, memory requirements, input/output interface principles, data and address buses, microprocessor training sets and simulators, specific microprocessor based design applications.

Linear Systems S&D: System models in different bases, controllability and observability for some selected systems, eigenstructure assignment and transient performance, analysis of linear systems in transformed domain.

Digital Systems S&D: Introduction to digital system design, digital system architecture, memory and I/O interface, interrupts, data communication principles, software development principles, software development tools, design of digital systems for specific purposes, hardware design and software development applications including applications that utilize microprocessors, microcontrollers and digital signal processors.

Electronic Systems S&D: Overview of linear opamp circuits, active filters, stability and frequency compensation, nonlinear circuit applications, signal generators, DA and AD converters, analog multipliers, operational transconductor amplifiers, switched-capacitor circuits, active-only filters, and design of various electronic systems for specific purposes.



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Signal Recognition S&D: Analysis of all kinds of signals such as speech, audio, image and machine sounds. Application of the common vector approach to speech and speaker recognition, speaker identification and machine's fault detection. Use of various methods such as common vector approach, Wiener filtering and spectral subtraction on signal enhancement in noisy environments.

Programming S&D: Overview of object oriented programming, developing client/server applications (Microsoft SQL, Oracle), developing applications for Windows using API related with network, fundamentals of Linux and Unix operating systems, C/C++, PEARL, Java Script programming on various operating systems.

Engineering S&D for Education: Various software as well as hardware projects that will be used in education will be assigned and supervised in this course. Problems that are faced by the educators of all grades—from the kindergarten to adult education—will be brought to the engineers for solutions. The use of the state-of-the-art electronics and computer technology in education will be encouraged and alternative engineering solutions will be explored.

Electrical Engineering Design: Design and implementation of a device or system which is subject to real constraints and conditions. This is a senior design project course.

Electrical Engineering Design Electives *(These are senior project design courses)*

Antenna Design: Developing innovative solutions to real-world problems in the field of antennas by applying design principles and engineering methodologies.

Automation Process Design: The course covers the design of AI-enabled automation systems for industrial processes, including process analysis, sensors and machine vision, data acquisition, image processing, machine learning for quality inspection, control system integration, and real-time decision making. Students complete a hands-on project by developing an AI-based vision system to automatically detect, for instance, defective cookies on a production line and integrate it into an automated inspection process.

Biomedical Design: To develop innovative solutions to real-world problems in the field of biomedical electronics by applying design principles and engineering methodologies.

Electromagnetic System Design: To develop innovative solutions to real-world problems in the field of electromagnetics by applying design principles and engineering methodologies.

Engineering Design with FPGA: Practical designs using Field Programmable Gate Arrays and VHDL. FPGA structure, design flow using VHDL, use of ISE and Vivado software, design issues on FPGAs, clock management, I/O considerations and user interfaces, communication with external devices and sensors, complex designs with user interfaces like ADC/DAC, display devices like VGA, input devices like key-pads etc.

Engineering Design with Fuzzy Logic: Students will form teams to design a complex engineering project. Teams will go through the entire process of engineering design, from understanding the problem to developing and presenting their solutions. Topics include fuzzy logic fundamentals, project management principles, and effective teamwork.

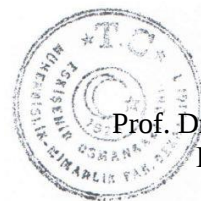
Power Systems Design: Design and/or optimal operation of an electrical power system (or a subsystem of an electrical power system) under realistic operation constraints and conditions



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Renewable Energy Design: Design and/or optimal operation of a renewable energy system (solar, wind, biomass, etc., or a sub-component of these systems) under realistic operational constraints and environmental conditions

Waveguide Design: To develop innovative solutions to real-world problems in the field of waveguides by applying design principles and engineering methodologies.



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