Eskişehir Osmangazi University
Electrical and Electronics Engineering Department
Brief Course Contents (1993-2010)

Freshman Year Courses:

Physics I (3+0): 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 Lab I (0+2): 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 (3+0): 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 Lab II (0+2): 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 (2+2): PC hardware, Operating systems, Storage media, Input devices, Output devices, Internet, Word processing.

Introduction to Programming (2+0): 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 (2+2): 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 (3+2): 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 (3+2): 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

Expository Writing (3+0): 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 (3+0): 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 (3+0): Linear systems and matrices, Determinants, Vectors in the plane and in space, Vector spaces, Orthogonality and least squares, Eigenvalues and eigenvectors, Linear transformations.

Chemistry (3+2): Matter, Atomic structure, Chemical bounding, Chemical equations and quantitative relations, Gasses, Liquid and solids, Solutions, Elements of chemical thermodynamics, Acid bases, Chemical kinetic and chemical equilibrium, Electrochemistry, Ionic equilibria.

Engineering Graphics (1+2): Introduction to technical drawing on the computer, Engineering computer applications Autocad, MATLAB, Spreadsheets.

Intro. Electrical Engineering I (1+0): 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 (1+0): Introduction to electronic circuits, printed boards, circuit simulation software, assembly of a hobby circuit.

Turkish Language I (2+0): 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.

Turkish Language II (2+0): 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.

Sophomore Year Courses:

Engineering Mechanics (2+2): 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 (2+2): First order equations, Exact differential equations, Higher order differential equations, Series solutions, Linear differential equation sets, Laplace Transform techniques, Existence and uniqueness theorems.

Circuit Analysis I (3+0): 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 (4+0): Complex frequency, Frequency response, Magnetically coupled circuits, Two port networks, Fourier Analysis, Fourier Transforms, Laplace Transforms.

Circuits Laboratory (0+2): 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 Wheatsone 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 (3+0) 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.

Digital Systems I (3+0): Number systems. Boolean algebra and logic gates, Karnough maps and combinational logic design. Combinational functions and circuits: encoder, decoder, muxtiplexer, demultiplexers. Arithmetic functions and circuits: adder, subtractor. Sequential circuits analysis and design.

Digital Systems II (3+0): 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

Digital Systems Laboratory (0+2): 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 (3+0): 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.

Complex Calculus (3+0): Complex numbers, Analytic functions, Complex integration, Power series, Taylor series, Laurent series, Residue integration method, Conformal mapping, Complex analysis applied to potential theory.

History of Turkish Revolution & Principles of M. Kemal Atatürk I (2+0): 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 abolution of the Sultanate; the Peace Conference of Lausanne.

History of Turkish Revolution & Principles of M. Kemal Atatürk II (2+0): The proclamation of the Republic in Turkey, the Abolution of the Chaliphate, 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.

Junior Year Courses:

Communications (3+0): Spectral Analysis, AM an FM Modulation and Demodulation, Sampling and Quantization, PCM, Delta Modulation, PSK, FSK, BPSK.

Electronics I (3+0): 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 (3+0): 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 (1+2): 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.

Electromagnetics II (3+0) 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

Numerical Methods (3+0): 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.

Probability (3+0): 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 (3+2): 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.

Principles of Energy Conversion (3+2): 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 (3+0): 8-bit microprocessors, Peripheral components, Basic PC, Assembly language instructions, Interrupts and other system sequences, and Memories.

Senior Year Courses:

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.

Technical Electives:

Advanced Programming (3+0): Advanced C-programming, Complex structures and linked lists, Tips & tricks, Dynamic memory management, Preprocessor statements, File operations.

Computer Networks (3+0): Digital communication principles, Communication protocols & layers, Ethernet, TCP/IP, Routing and routing tables, Networking standards.

Introduction to Speech Recognition (3+0): Vector quantization, Distance ideas, Dynamic programming, Discriminant analysis, Neural nets, Hidden Markov Models, Gram-Schmitt orthogonalization method, Knowledge-based systems.

Linear Control Systems (3+0): 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 (3+0): Operational amplifiers, Filters, RF amplifier analysis and design, LC and crystal oscillators, PLLs and frequency synthesizers, Linear and exponential modulator and demodulator design.

Digital Signal Processing (3+0): DT Signals & Systems, LTI systems, The Z transform, DT system structures, DT filters, The Discrete Fourier transform, Experiments.

Instrumentation and Control (1+4): 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 (1+4)): Interval systems, Kharitonov′s theorem, Frequency response of interval systems, Parameter dependent uncertainties, Affine linear uncertainty structure, Edge theorem, Singular value decomposition.

Semiconductor Devices (3+0): 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 (2+2): Study of DC commutator machines, Generator and motor characteristics, Synchronous machines, Generator and motor operations, Induction machines, Equivalent circuits, Control techniques and motor characterstics.

Introduction to Power Electronics (3+0): Semiconductor power devices, Thyristor protection circuits, Single and three phase rectifying circuits, AC switching controllers, Choppers, Inverters.

Power Systems Analysis I (3+0): Introduction, Fundamentals, Symmetrical components, Power transformers, Transmission line parameters, Transmission line steady-state operation.

Communication Electronics Laboratory (0+2): 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 (0+2): 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 (3+0): Maxwell's equations, Electromagnetic wave propagation, Transmission lines, Waveguides, Antennas, Numerical methods.

Programmable Logic Controllers (2+2): 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.

Nonlinear Control Systems (3+0): 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 (3+0): 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 (3+0): Object oriented approach to programming, C++ classes, Inheritance, C++ operators, Function & operator overloading, Access specifiers, Virtual and friend keywords, Templates, Macros, C++ class libraries.

Computer Architecture (2+2): 16-bit microprocessors and components, PC structure, Assembly language instructions, DMA, Caching memories, Bios, and Interface systems.

Microwave Devices and Antennas (3+0): Electromagnetic plane waves, Transmission lines, Waveguides, Components, Simple antennas and antenna arrays.

Fuzzy Logic (3+0): 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. (0+2): Fuzzy gates, Fuzzy flip-flops, Fuzzification and defuzzification methods, 16-bit FMC card applications, Fuzzy MATLAB Toolbox simulation.

Special Electrical Machinery (3+0): 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 (3+0): Power flows, Symmetrical faults, Unsymmetrical faults, Power-system control, Transmission lines, Transient operation, Transient stability.

Network Synthesis (3+0): 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 (0+2): 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 (3+0):

Digital Control Lab. (0+2): 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 (3+0): 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 (2+2): 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.

Engineering Synthesis & Design Electives

Nonlinear System S&D (4+2): 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.

Pattern Classification S&D (4+2): Applications of Bayes Classification Theory, Derivation of the Common Vector Approach for Pattern Classification, Classification of the Two Dimentional 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 (4+2): 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 (4+2): 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 (4+2): 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 (4+2): 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 (4+2): Overview of coordinate systems, coordinate system transformations, kinematics, robot dynamics, trajectory planning, Igapunov control, sliding mode control, performance, design applications

Microprocessor Based S&D (4+2): 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 (4+2): 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 (4+2): 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 (4+2): 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.

Signal Recognition S&D (4+2): 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 (4+2): 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 (4+2): 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.