T.C.

DUMLUPINAR UNIVERSITY

FACULTY of ENGINEERING

ELECTRICAL-ELECTRONICS ENGINEERING DEPARTMENT

COURSE SYLLABUSES

I. Semester (Freshman Year)

Introduction to Electrical-Electronics Engineering (3+0) 3 AKTS 3

Historical development of electrical energy usage and first energy transmission and distribution lines, various thermal-hydroelectric-nuclear power plants, alternative energy resources, various electrical machines and generation of AC current, conducting wire cross-section, breakers, cables, relays and various illumination circuits, FET and BJT transistors, power electronic circuit element and basic circuits, logic gates and truth tables, basic computer structure and peripherals.

Mathematics I (3+2) 4 AKTS 6

Functions, limit and the concept of continuity, intermediate value theorem, derivatives, tangent curve approaches and differential, Newton-Raphson method, derivative applications, second order derivative, concavity and turning points, graph drawing, integration, integration application, volume-area-curve dimension calculation, moment and balance point, and polar coordinates.

Physics I (3+2) 4 AKTS 6

Physics and measurement, vectors, motion in one dimension, motion in two dimension, rules of motion, circular motion, particle dynamics-I, particle dynamics-II, work and energy, conservation of mechanical energy, dynamics of particle systems, collision, rotation of rigid body balance of solids, oscillations, mass attraction, fluid dynamics, waves in elastic environment, sound waves, heat, heat and the first law of thermodynamics, the kinetic theory of gases, the second law of thermodynamics and entropy.

General Chemistry (2+2) 3 AKTS 5

Chemistry and matter, symbols, formulas and equations, gases, solids, thermo chemistry, reaction rate and equilibrium, aqueous solutions equilibrium, periodic table and electron structures of atoms, chemical bonds, atomic nucleus, S-block, P-block, D-block, and F-block in periodic table, organic chemistry, organisms chemistry, electrochemistr.

Introduction to Computer and Programming (3+0) 3 AKTS 4

Basic computer terminology, the computer architectures, the operating systems, the office application programs, the computer networks and data communication, internet applications, introduce to algorithms and Matlab, the computer programming using Matlab.

English I (2+2) 3 AKTS 4

English grammar, vocabulary, reading comprehension, oral production and writing skills for students to follow occupational courses. (Content determined by YÖK)

Turkish Language I (2+0) 2 AKTS 2

To teach the properties of the language and the historical periods of Turkish, to enable the learners to understand the vocal and structural properties of Turkish and use the punctuation well. 1. Expression 2. Question and Answer Teaching Method 3. Exercise & Practice 4. Demonstration (content determined by YÖK)

II. Semester (Freshman Year)

Computer Aided Technical Drawing (2+2) 3 AKTS 4

Introduction of basic drawing equipments and tools, The basics of technical drawing, Basic geometrical drawing problems, Perspective drawing methods and problems, Orthographic views, scaling and marking rules and applications, Auxiliary views and applications, Cross-sectional views of parts of machines, engineering drawing terminology, multiview and pictorial sketches using Computer Aided Design, Design of printed circuits and schematics with the aid of computers.

Computer Programming (3+0) 3 AKTS 4

Definition of variables and input-output functions in C++ programming, flow control in programming: IF ELSE and SWITCH CASE, loop operations: FOR, WHILE and DO WHILE. Operands: arithmetic and logic operators, pointers, structures, declaration of arrays, one and multiple dimensional arrays, functions definitions, and reading and writing from the file.

Linear Algebra (3+0) 3 AKTS 4

Matrices, determinants and linear equation systems, vector space, Euclidian space, linear transformations, eigenvalues, eigenvectors, diagonalization, and quadratic forms.

Mathematics II (3+2) 4 AKTS 6

Integration techniques, sequences and series, vectors, partial derivatives, integrals, double and triple integrals and surface integral.

Physics II (3+2) 4 AKTS 6

Charge and matter, Coulomb Force, electric field, electric flux, Gauss's Law, electrical potential, capacitors and dielectrics, current formation and resistor, electromotive force, circuits of direct current,
Kirchhoff's Laws, magnetic field, Faradays Law, induction, Biot-Savart's Law, Lenz's Law, electromagnetic oscillations, alternative current, Maxwell equations, and electromagnetism.

English II (2+2) 3 AKTS 4

English grammar, vocabulary, reading comprehension, oral production and writing skills for students to follow occupational courses. (Content determined by YÖK)

Turkish Language II (2+0) 2 AKTS 2
Spelling rules and punctuation, expression and expression disorder, and composition works and practice. (Content determined by YÖK)

III. Semester (Sophomore Year)

Circuit Theory I (3+2) 4 AKTS 6

Introduction to electrical systems, electrical energy conversion, current, voltage, and power definitions, circuit types, circuit components, Ohm's Law, Kirchhoff's Law, nodal analysis, mesh analysis, mathematical models of circuits, linearity and superposition, Thevenin and Norton theorem, maximum power transfer, circuit topologies, tree structure analysis, loop analysis, transient response of circuits, unit-step function, RL, RC, and RLC circuit responses.

Material Science (2+0) 2 AKTS 3

Atomic structure, system components, classification of materials, atomic bonds, atomic motion, free electron, hole, electron-hole couple behavior, conductivity and types, crystal structure, crystal defects, diffusion, industrial diffusion examples, electrical conductivity, electron conduction, ionic conduction, electron-hole couple conduction, quantum conduction modeling, semiconductors, intrinsic semi-conduction, doped semi-conduction, n and p type conduction, heat effect on conduction, material type effect on conduction, superconduction, microelectronic circuit components, dielectric properties, dielectric constant, breakdown voltage, piezoelectric materials, dielectric material selection, magnetic properties, magnetic field, magnetic flux, magnetic materials, hard magnetic materials, soft magnetic materials, factors effecting magnetism, optical properties, electromagnetic spectrum, reflection, refraction, absorption, photoconduction, Luminescence, thermal properties, thermal vibration, thermal conduction, thermal insulation, thermal expansion, thermoelectrical interaction, environmental interactions, corrosion and types, and material protection to environmental factors.

Numerical Analysis (3+0) 3 AKTS 5

Numerical errors, one-variable equation solutions, interpolation and polynomial approximations, numerical derivation and integration techniques, basic differential equation and linear equation system numerical solutions, approximation theories, iteration techniques in matrix algebra, and software development based on the methods learned in the class in different programming languages.

Mathematics III (3+2) 4 AKTS 6

Differential equations and general applications, first and higher order differential equations, constant coefficient homogeneous differential equations, introduction to Laplace transformations, linear equation systems and inverse Laplace transformations, differential equation solutions by Laplace transform.

Measurement and Circuit Lab (2+2) 3 AKTS 5

Current and voltage measurement in series and parallel circuits, complicated circuits and several measurements, proof of Norton and Thevenin theorems by experiments, hands on practices with oscilloscope and various measurements, transistor characteristic curves extraction, signal generators, three phase systems, power measurements in three-phase circuits, and Aron connection.

Technical English (Social electives I) (3+0) 3 AKTS 3

Introduction to electrical and electronic engineering English. "Batteries" from "Oxford English for Electronics" & "Polymer Batteries for Electric Vehicles" from "Reader at Work I". "Alarm Systems" from "Oxford English for Electronics" & "The Computer" from "Reader at Work I" "Telecommunications" from "Oxford English for

Electronics" & "Turkish Coffee Goes To Europe" from "Our Book". "Renewable Energy" from "Our Book" & "Wind Power" +"Hydro-Electric Power" +"Tidal Power" from "Reader at Work II". "What is Statistics?" from "Academic Reader" & "Middle East Water: Critical Resources" from "Reader at Work II". Football" from "Our Book" & "Cars of future" + "Using Electricity" from "Reader at Work I". "Earthquake Prediction" + "Smoking" + "The Story of the Telephone" from "Reader at Work II", and students presentations.

Project Management (Social electives I) (3+0) 3 AKTS 3

Introduction to CPM methods, comparison between the CPM and GANNT diagrams and resource leveling, establishment of the project network, cost control of the projects, and PERT technique and application.

Industrial Graphic Design (Social electives I) (3+0) 3 AKTS 3

Software introduction, box design, maquette design, product and package relationship, target market, corporate and brand identity, graphical design, and printing techniques.

Preparing Technical Documentation (Social electives I) (3+0) 3 AKTS 3

Students learn how to prepare technical documentation.

History of Atatürk's Principles and Revolutions I (2+0) 2 AKTS 2

Events, thoughts and principles in the rise and development process of Modern Turkey. (Content determined by YÖK)

IV. YARIYIL (Sophomore Year)

Circuit Theory II (3+2) 4 AKTS 6

Alternative current and voltage, phasors, impedance, admittance, steady-state and forced response complex forcing function, nodal and mesh analysis, superposition, Thevenin and Norton theorem, maximum power transfer, Ac power analysis, effective values, complex power, S, P, Q, bode plots, magnetically coupled circuits.

Logic Design (3+2) 4 AKTS 6

Logic variables, Boolean algebra and theorems, gates, logical functions, Karnaugh map, multi-variable maps, basic combinational circuits, coders, decoders, multiplexers, demultiplexers, flip-flops, registers, counters, logical and arithmetical units, and memories.

Electromagnetic Theory I (3+0) 3 AKTS 5

Static electrical fields: Coulomb Law, electrical field amplitude, point charge electrical field, scalar electrical potential, electrical field of line-surface-volume charge distributions, electrical field line integral, electrical field gradient, electric dipole and dipole moment, electrical flux, flux and Gauss's

Law in closed surfaces, electrical field in insulators, polarization, boundary conditions, capacitors, energy density, Laplace and Poisson equations; Electrical current: Current, current density, resistance and Ohm's Law, Joule's Law, resistance and conductance, divergence of current density, boundary conditions on conductors; Static magnetic fields: Magnetic field of conductor carrying current, Biot-Savart's Law, infinite length linear conductor magnetic field, force between two parallel conductors, ampere definition, magnetic field circular and square loops carrying current, magnetic flux and flux density, magnetic Gauss's law, magnetic flux in closed surfaces, magnetic field equations in vectorial notation, moment effecting loop, magnetic moment, magnetic field of solenoid, inductance, Ampere's Law, magnetic field magnitude, magneto-static potential and magneto-motor force, ferromagnetic materials, permeability, magnetization curves, hysteresis, boundary conditions, magnetic circuits.

Physical Electronics (2+0) 2 AKTS 3

Semiconductors: semiconductor, Si and GaAs intrinsic conduction, conduction in doped semiconductors, p and n type conduction, conduction modeling in semiconductors, mobility, life time, energy band models, conduction; Semiconductor devices: PN type devices, I-V curves, energy band structures, Ic-Vce and Ib- Vbe curves, switching; FET devices: I-V curves, energy band structures, Id-Vds and Id-Vgs curves, JFET, MOSFET, depletion-type MOSFET, enhancement-type MOSFET, switching, CMOS structures, CMOS integrated circuits; PNPN devices: I-V curves, SCR, GTO, SCS, DIAC, TRIAC; IC devices: digital and analog integrated circuits, 78XX, 79XX series, OPAMP, 555, 566, 565 IC's.

Mathematics IV (3+0) 3 AKTS 5

Complex numbers and functions, Cauchy-Riemann equations, integral on complex plane, complex sequences and series, Taylor and Laurent expansion, singularities and residue theorem, conformal mapping, complex analysis applications.

First Aid and Health (Social electives II) (3+0) 3 AKTS 3

First aid and health.

Advanced Technical English (Social electives II) (3+0) 3 AKTS 3

Advanced technical English.

Work Health and Security (Social electives II) (3+0) 3 AKTS 3

Basic labor laws and occupational safety.

Industrial Product Design (Social electives II) (3+0) 3 AKTS 3

Program information, box design, model making, product and packaging relations, target audience, corporate identity and brand identity, graphic design, and printing technique.

Motivation and Efficiency (Social electives II) (3+0) 3 AKTS 3

Factors effecting motivation and job satisfaction, management and organization, delegation of authority and effects of team work on motivation, performance management and evaluation systems, effects of education, communication and corporate learning environment on motivation, stress sources and demotivators. Scope and varieties of efficiency and relation of motivation and efficiency.

History of Atatürk's Principles and Revolutions II (2+0) 2 AKTS 2

Events, thoughts and principles in the rise and development process of Modern Turkey. (Content determined by YÖK

V. YARIYIL (Junior Year)

Electronics I (3+2) 4 AKTS 5

Diode characteristics and circuits, transistor biasing, thermal stability and compensation, FET circuits and modeling, transistor h and r parameters, low frequency amplifiers and design examples, and differential amplifiers.

Electromechanical Energy Conversation I (3+2) 4 AKTS 5

Fundamentals of electromechanical energy conversion; Transformers: Structures, ideal two winding transformers, equivalent circuits, voltage phasor diagrams, approximate equivalent circuit calculation, voltage regulation, run in parallel, three-phase transformers, auto-transformers, measurement transformers, DC machines operating principles and structures, armature reaction and commutation, DC machine types and operating characteristics, and DC generator types and operating characteristics.

Signal and Systems (3+0) 3 AKTS 4

Fundamentals of signals and systems: memory, time variance, stability, linearity and causality; time-domain and discrete-domain systems, impulse response, convolution, Fourier transforms and its applications, Laplace transforms and its applications, discrete-time z-transforms, sampling and modulation.

Electromagnetic Theory II (3+0) 3 AKTS 4

Maxwell's equations, electromagnetic energy and power, waves and plane waves, polarization, reflections, transmission line basics, and antennas and propagation.

Fundamentals of Control Systems (3+0) 3 AKTS 4

Introduction to control systems and definitions. Feedback systems. Mathematical background-Laplace transform-Matrices-Differential equations. State space representations of dynamic systems. Transfer functions, Block diagrams. Signal flow graphs. Mathematical modeling of dynamic systems. Analogous systems, electromechanical systems. Sensors of the control systems. Basic control actions, Industrial automatic controllers. Transient response analysis. Reduction of parameter variations by use of feedback. Increasing loop gains by use of positive feedback.

Advanced Logic Circuits (Technical electives I) (3+0) 3 AKTS 4

Computer aided logic circuit synthesis, programmable logic circuit analysis, very large scale integrated logic circuits, synchronous and sequential circuit analysis and synthesis, counters, memory units, state machines, and synchronous sequential logic circuits.

High Voltage Technique (Technical electives I) (3+0) 3 AKTS 4

Introduction to high voltage systems, generation and measurement of high voltages, analysis of high voltage systems, multilayer insulators, discharge phenomenon in high voltage systems and corona, and dielectric power loss and its measurement.

Practice I (0+0) 0 AKTS

Practice I covers 30 business days experience related to science in public institutions and private organizations. Students successfully completing their internships for the DPU-EEM instructions written in an internship are required to act according to instructions.

VI. YARIYIL (Junior Year)

Microcontrollers (3+0) 3 AKTS 5

Structure of microprocessors and microcontrollers, basics concepts, microprocessor families and introduction, Motorola 6802 pin definitions, instruction sets, M6802 programming in mnemonics, simulators, emulators, compilers, mnemonics and assembly, training set applications and examples, types of memories, memory design, address decoder design, advanced programming in mnemonics for control purposes, I/O flow with basic elements, data transfer with hand shaking such advanced logic units as parallel communication interface, asynchronous serial communication interface, ADC and DAC; Microcontrollers: PIC16F877, structure and instruction set, and microcontroller lab experiences.

Electronics II (3+2) 4 AKTS 6

Feedback amplifiers and stability, operational amplifiers, high frequency amplifiers, bandwidth expansion techniques, narrowband sections, large signal circuits, oscillator circuits, power amplifier, OPAMP applications.

Electromechanical Energy Conversation II (3+2) 4 AKTS 6

Asynchronous machine structures, operating principle, equivalent circuits and analysis, approximate and exact equivalent circuit, asynchronous machine moment speed characteristics, maximum moment and maximum sliding, starting moment and current, effect of rotor resistance on moment, Ossana circle diagram, asynchronous machine drive applications, asynchronous machine speed control; Synchronous machines: Structures, stator windings, MMF wave in stator windings, circular and dislocated pole synchronous machines, EMK in stator windings, synchronous machine equivalent circuit phasor diagrams, synchronous machine no-load (motor and generator), synchronous machine parallel connection to electric network (synchronization), parallel operation and control in infinite long network, and speed control.

Linear Control Systems (3+0) 3 AKTS 5

Mathematical modeling, transfer functions, state-space equations, block diagrams, system response, performance parameters, feedback system stability, Routh-Hurwitz criteria, Nyquist criteria, gain margin, phase margin, dynamic compensator design, forward, backward, forward-backward, design and analysis techniques with Root-Locus method, introduction to state feedback, pole placement, and state predictions.

Probability (3+0) 3 AKTS 4

Introduction to probability, finite sample space, conditional probability and independence, one-dimensional random variables, one-dimensional random variables, functions of random variables, two dimensional random variables, two dimensional random variables, further characterization of random variables, further characterization of random variables, the Poisson and other discrete random variables, some important continuous random variables, some important continuous random variables, the moment- generating function.

Analog Communication (Technical electives II) (3+0) 3 AKTS 4

Time, frequency and phasor demonstration of signals, fundamental concepts of communication systems, DSB-TC and DSB-SC modulation techniques, AM and SSB modulation techniques, VSB and QAM modulation techniques, frequency conversion and heterodyning, frequency division multiplexing, fundamentals of angle modulation, PM and FM modulation techniques, amplitude spectrum of the angle modulated signals, design of AM and FM modulation-demodulation circuits, noise effects in communication systems, phase locked loop (PLL) circuits, fundamentals of television techniques.

PLC Programming (Technical electives II) (3+0) 3 AKTS 4

Fundamentals of automatic control systems and system components, the components used in automatic control systems, fundamentals of PLC, PLC programming and methods for programming, PLC and conventional automatic control systems, realizing logical functions and tasks using PLC, derivation logical function from conventional automatic control system, start-up of three phase asynchronous motor using PLC timers and counters, PLC functions and control of stepper motor using in-built PLC functions to drive DSW and Hkey key pad using in-built PLC functions, speed control with in-built PLC functions, problems, performing I/O functions with function blocks, Industrial PLC applications.

Power Generation Systems (Technical electives II) (3+0) 3 AKTS 4

Primary energy sources for electric power generation, the economics of electrical power, thermal power stations, gas combined power stations, co-generation systems, nuclear power stations, hydraulic power stations, wind

farms and their components, other renewable electrical energy sources, the controls and associated components of power generation systems, bus-bar systems, substation and transformer systems, residential and industrial area distribution transformers, the communication between the substations using power lines.

VII. YARIYIL (Senior Year)

Power Electronics (3+0) 3 AKTS 4

Introduction to Power electronics, Power Electronics equipment (Rectifiers), Rectifier circuits, Converter Operation, Line commutated inverters, DC Line commutation, DC choppers, Commutation Circuits Frequency Conversion, PWM inverters, AC choppers, Some Applications, Harmonics and filtering, DC motor control, AC motor control, Power electronics circuit design.

System Programming (Technical electives III) (3+0) 3 AKTS 4

C-Sharp programming language. Implementation of visual applets using C-Sharp programming language. RS-232, USB, one-wire communication protocols. Controlling electromechanic systems via visual applets.

Power Transmission Systems (Technical electives III) (3+0) 3 AKTS 4

Fundamentals of transmission systems, power in single phase AC circuits, complex power, power triangle, voltage and current in balanced three phase systems, power in balanced three-phase systems, per-unit (pu) system, converting from per-unit values to physical values, change of base, problems; Transmission line constants: resistance, inductance and inductive reactance, capacitance and capacitive reactance, table of line constants; equivalent circuits for transmission lines, short transmission lines, steady-state power limit, voltage regulation, medium-length transmission lines, long transmission lines, equivalent circuit of transmission line, incident and reflected voltages, general circuit constants, determination of A, B, C, D constants, asymmetrical Π and T networks, networks connected in series, networks connected in parallel, power relations using A, B, C, and D line constants, derivation of admittance matrix of a given network and numerical methods for linear algebraic equations, load flow analysis in power systems.

Electrical Driven Systems (Technical electives III) (3+0) 3 AKTS 4

The historical development of driven systems, classification of the characteristics of the electric motor, the dynamics of rotating systems and determination of stable operating point, acceleration, speed change, downtimes on the drive system, characteristics of load machines, intermittent load, 4 region operation, start-up in motor drivers, speed adjustment, electrical driven system modeling, and fault analysis.

Digital Communication (Technical electives V) (3+0) 3 AKTS 4

Fourier transform and amplitude spectrum of digital signals, digital transmission of analog signals, sampling theorem, pulse amplitude, width and position modulations (PAM, PWM, PPM), pulse code modulation (PCM), delta modulation (DM), adaptive DM, adaptive PCM, differential PCM, time division multiplexing (TDM), PCM-TDM multiplex systems, PDH and SDH systems, signaling formats (line codes), pulse shaping and intersymbol interference (ISI), digital carrier modulation systems (ASK,FSK,PSK,QPSK), noise in digital communication systems, noise performance in digital communication systems (SNR, BER), information theory, and coding theory.

Solar Energy (Technical electives V) (3+0) 3 AKTS 4

Introduction To Solar Cells, Design Expressions and Critical Performance Parameters for Solar Cells, Classification of Solar Cells Based on Performance, Design Complexity, and Manufacturing Costs, Techniques to Enhance Conversion Efficiencies of Solar Cells, Advanced Design Configurations for Optimum Performance to solar cells, Solar Cells In Space, Performance Capabilities and Economic Benefits of Potential Alternate

Energy Sources, Thin Films And X-RAY Imager Technologies.

Illumination Techniques (Technical electives V) (3+0) 3 AKTS 4

Lighting projects of buildings, familiarization with Turkish Domestic Lighting Project Code and lighting calculations, familiarization with the symbols used in lighting projects, selection of appropriate conductor size and current check, voltage drop calculations and using tables for voltage drop check, energy distribution summary and loading tables, cost calculations, practice on an architectural domestic project, application of electrical lighting project on an architectural plan, investigation a full lighting project of a hospital, power projects, methods of cable lying in power circuits, voltage drop calculations and conductor size selection in power systems, components of electrical power systems and design, and Project.

Communication Electronics (Technical electives VII) (3+0) 3 AKTS 4

Transmission line circuits, impedance matching using Smith Chart, scattering parameters, filters amplifiers, oscillators, frequency synthesizers, mixers, wide-band amplifiers, and RF receiver/transmitter analysis.

Sensors (Technical electives VII) (3+0) 3 AKTS 4

Measurement systems, sensor signals, operating modes, interference, desired and undesired signals in sensor systems, thermal sensors, thermoresistor, thermodiode, thermotransistor, other thermo sensors and applications, radiation sensors, nuclear sensors, UV, visible, IR, NIR sensors and applications, mechanical sensors, displacement, accelerator, speed, force, pressure, fluid, mass sensors and applications, magnetic sensors, hall effect, magnetic probe, SQUID's and applications, sensor performance, smart sensors, sensor arrays, MAD structure and applications.

Power Distribution Systems (Technical electives VII) (3+0) 3 AKTS 4

Electrical power distribution systems and stages of distribution voltages, the factors affecting the conductor type selection, power cables, overhead lines, insulators and poles, voltage drop calculations, power losses and selection of conductor size, load characteristics, power distribution networks, radial power distribution lines, ring type power distribution networks, power distribution system losses and compensation in power distribution systems, and short-circuit load and symmetrical faults.

Engineering Economy (3+0) 3 AKTS 4

Basic concepts of EE and cash flow diagrams, interest factors and their use, nominal and effective interest rates, uniformly, geometrically and arithmetically increasing and decreasing cash flow analysis, evaluation methods of alternatives, comparing alternatives, rate of return analysis, internal and external rates of return, benefit/cost ratio analysis, replacement analysis, inflation-interest rate relations, depreciation, after-tax economic analysis, breakeven analysis, capital budgeting and risk analysis, sensitivity analysis and statistical evaluation techniques, and project's cost evaluations.

Analysis (5+0) 5 AKTS 6

Students work on theoric topics or applied projects related to electrical-electronics field for one semester.

Practice II (0+0) 0 AKTS 4

Practice II covers 30 business days experience related to science in public institutions and private organizations. Students successfully completing their internships for the DPU-EEM instructions written in an internship are required to act according to instructions.

VIII. YARIYIL (Senior Year)

Digital Signal Processing (3+0) 3 AKTS 5

Fundamental digital signals and systems, Z-transform and its applications in digital signals and systems, Fourier Transform and its applications in digital signals and system, digital filter design techniques, and discrete random signals.

Fiber Optic Communication Systems (Technical electives IV) (3+0) 3 AKTS 5

Fundamentals of fiber optic communication systems, principles of light transmission, fiber types, dispersion and attenuation in optical fibers, LED and laser sources, PIN and APD photodiodes, fiber link characterization using OTDR, design of optical systems, SNR, BER, OTDM, WDM, splicing, OSA.

Process Control and Instrumentation (Technical electives IV) (3+0) 3 AKTS 5

Definition for industrial process control, measurement and instrumentation, a view of stochastic process, square integral error minimization for stochastic inputs, basic definition techniques, sinus-step-impulse inputs, pseudo-random dual sequences and correlation methods, continuous cycling and reaction curve methods to adjust controller parameters, temperature-pressure-level-flow-gas-compression-pH sensor fundamentals, pneumatic and electrical transmitter converter and controller, and select A/D and D/A converter.

Power System Analysis (Technical electives IV) (3+0) 3 AKTS 5

Introduction, phasors, network equations, symmetrical components, sequence networks of impedance loads, sequence networks of series impedance, sequence impedance of rotating machines, power in sequence networks, power transformers, the ideal transformer, equivalent circuits for practical transformers, three-phase transformer connection and phase shift, per-unit sequence models of three-phase two-winding transformers, three-winding transformers, symmetrical faults, series R-L circuit transients, three-phase short circuit, bus impedance matrix, circuit breaker and fuse selection, unsymmetrical faults; system representation, single line-to-ground fault, line to line fault, double line to ground fault, sequence bus impedance matrices, transmission system reliability, basic definitions, basic probability theory, combinational analysis, probability distributions, basic reliability concepts, reliability evaluation of complex systems, and transmission system stability methods.

Power System Protection (Technical electives VI) (3+0) 3 AKTS 5

High voltage circuit breakers, substations, measurement transformers, power system grounding and faults, relay types, characteristics and their structures, protection relays(transformer, generator, transmission line),overvoltage protection, and work safety.

Applied Power Electronics (Technical electives VI) (3+0) 3 AKTS 5

AC-DC, DC-DC, DC-AC power electronics circuit experiments and its applications.

Antenna Theory (Technical electives VI) (3+0) 3 AKTS 5

Antenna parameters, Radiation Integrals, wire antennas, and antenna arrays.

Fundamentals of Biomedical Engineering (Technical electives VIII) (3+0) 3 AKTS 5

Human-instrumentation system, biological signals, determining the cellular membrane potential, electroneurogram, electroencephalogram, electro-oculogram, electrocardiogram, electroretinogram, and electromyogram signals measurement, induced potential signals measurement, pressure, flow speed and blood flow volume measurement, biopotential electrodes, basic transducers, heat transducers, resistive, capacitive, piezoelectric and electromagnetic transducers and their applications, analog biological signals processing, signals classification, and digital biological signals processing.

Special Electrical Machines (Technical electives VIII) (3+0) 3 AKTS 5

Electrical machines' structure, operating principles, applications, understanding of the characteristics of motors and the driver circuits further concepts taught in electromechanical energy conversion course.

Nanotechnology (Technical electives VIII) (3+0) 3 AKTS 5

This course covers the synthesis of nanoscale and nanostructures materials, process, characterization and application of nanomaterials. Understanding nanoscale and nanostructured materials, properties and nanoscale relation as well as nanotechnology, application field of nanotechnology, to be aware of nanotechnology benefits and risks with problems, provide a background regarding to the classification of nanomaterials synthesis, learn application and process of nanotube, nanowires and nan rods, learn application and process of nanocomposites, explain and understand the effect of grain size on mechanical, thermal, electrical, optical and magnetic properties of materials, get an information regarding to instruments that characterize nanostructured materials, obtain the background to follow the development of nanotechnology, understand application of nanotechnology.

Wireless Communications (Technical electives VIII) (3+0) 3 AKTS 5

Cellular wireless communications, GSM network nodes and their working principles, interference, capacity (traffic engineering), path-loss, propagation, fading, receiver antenna diversity. GSM networks nodes, cell types and their structures, GSM frequency band propagation, the digital transmission principles of the GSM (sampling, quantization, coding), logical channels and their physical counterparts, analysis of the location update and handover issues, working principles of the GSM call scenarios, principles of the radio network system configurations, frequency re-use, and the source of the interferences, elimination of the ICC and ACI interferences, and analysis of the effects for the performance of the wireless communication systems, GSM network capacity calculation and traffic engineering, fading, radio propagation models, free space, scattering issues. The cellular configuration can be realized based on the large scale fading, path loss, outdoor/indoor propagation models, small scale fading, Doppler shift, time propagation parameters and fading effects for the system performance, receiver antenna diversity techniques, changes in GSM, towards the next generation communications systems based on the products, standards, capacity limits, and infrastructure evolution.

Design (4+0) 4 AKTS 6

It covers research, development, prototyping, experimental results, and report preparation on faculty and student collaborative project related to the faculty interested fields.

Project (0+2) 1 AKTS 4

It covers report presentation to a commission, on faculty and student collaborative project related to the faculty interested fields.