SULEYMAN DEMIREL UNIVERSITY
FACULTY OF ENGINEERING and NATURAL SCIENCES
Department of Electrical and Electronics Engineering

UNDERGRADUATE COURSE CATALOGUE

SEMERTER I

ATA-160	**Principles of Atatürk and Modern Turkish History I (Compulsory)**	**T=2 P=0 L=0 ECTS=2**

The National Struggle in education, culture, social and economic areas, the life of Atatürk, the strategy of Turkish Revolution, Political, social, cultural, and legal revolutions, and the process of these revolutions. Ataturk s internal and external political events Atatürk s struggle for world peace. To warn youth against Atatürk s principles and internal and external threats to the country and to give information about Turkey s geopolitical position.

ELE-101	**Algorithm and Programming (Compulsory)**	**T=2 P=0 L=2 ECTS=5**

Program development with algorithms and programming logic, flow diagrams, program development environment and MATLAB programming language.

ELE-103	**Chemistry (Compulsory)**	**T=2 P=0 L=0 ECTS=3**

Atomic structure, Chemical Bonding, Lewis Structure, Valence Shell Model, Molecular Orbital Theory, Chemical Compounds: formulas and nomenclature, Mol and calculations, Gas Laws, Equations of State, Thermochemistry, Liquids, Solids, Intermolecular Forces, Solutions: Solution Types and Concentration

ELE-105	**Matrix Theory (Compulsory)**	**T=4 P=0 L=0 ECTS=6**

Linear equation systems, matrices, determinants, vector spaces, linear transformations, eigenvalues, and eigenvectors.

FIZ-145	**Physics I (Compulsory)**	**T=3 P=0 L=0 ECTS=3**

Physics and Measurement, Vectors, Motion and Kinematic Equations (1-D, 2-D), Newton s Laws of Motion, Circular Motion and Other Applications of Newton s Laws, Work and Kinetic Energy, Conservation of Potential Energy and Energy, Linear Momentum and Collisions, A Rigid Body Rotation Around a Fixed Axis, Rolling Motion and Angular Momentum, Static Equilibrium, Vibration Motion.

FIZ-147	**Physics Laboratory I (Compulsory)**	**T=0 P=0 L=2 ECTS=2**

Physics and Measurement, Vectors, Motion and Kinematic Equations (1-D, 2-D), Newton s Laws of Motion, Circular Motion and Other Applications of Newton s Laws, Work and Kinetic Energy, Conservation of Potential Energy and Energy, Linear Momentum and Collisions, A Rigid Body Rotation Around a Fixed Axis, Rolling Motion and Angular Momentum, Static Equilibrium, Vibration Motion.

KRY-001	**Career Planning (Compulsory)**	**T=1 P=0 L=0 ECTS=2**

Career Planning and Introduction to Working Life course has been framed in a single roof to address different departments and programs.

In line with the aim of the course, the concepts of career and career planning will be explained to the students first. CV preparation training will be provided as the key to starting working in institutions and each student s personal CVs will be entered and updated to the Talent Gate (www.yetenekkapisi.org) system. It provides information about national and international exchange programs to add different perspectives to their careers. Entrepreneurship and leadership training as a career path will be transferred

to students within the scope of the course. According to the Professional Committees established within the Isparta Chamber of Commerce and Industry, sector representatives and / or university graduates will be informed about private sectors. These sectors are as follows:

1. Real Estate, Finance, and Insurance Activities
2. Education, Culture, Entertainment Sports Information and Communication
3. Human Health and Other Social Support Service Activities
4. Construction Activities
5. Construction Materials Trade
6. Leather Manufacturing and Exports
7. Agriculture, Fisheries and Livestock
8.Food, Beverage, Tobacco Trade and Manufacturing
9. Chemical, Machinery, Boiler, Marble, Metal Manufacturing, Electricity Generation and Distribution
10. Motor Vehicles Spare Parts Accessory Fuels Trade and Manufacturing
11. Clothing, Home Textile Trade and Manufacturing
12. Trade of Furniture and Electrical Materials
13. Mineral, Chemical, Jewelry, Toy, and Gift Trade
14. Forestry and Packaging Material Manufacturing and Trade
15. Passenger and Freight Transport Transport
16. Accommodation, Consultancy and Tourism
17. Engineering Activities

Awareness level of the students taking the course will be increased by informing them about different sectors by sector representatives. Career opportunities in the public sector and non-profit organizations will also be explained to students within the scope of the course.

MAT-151	**Calculus I (Compulsory)**	**T=3 P=0 L=1 ECTS=5**

Preparation for calculus, functions and graphs, limit, limit rules, continuity, derivative, derivative rules and applications.

TUR-170	**Turkish I (Compulsory)**	**T=2 P=0 L=0 ECTS=2**

What is language? Birth of languages. The relation of language-feeling-thought. Language-Culture relation. Language society relation. Languagest all over the world and the place of Turkish among these languages. Punctuation marks and spelling rules. Fhonoloji-Structure-word-werbs-phrases-sentence.

ING-101	**English I (Compulsory)**	**T=2 P=0 L=0 ECTS=2**

Elementary Level

ING-111	**English I (Compulsory)**	**T=2 P=0 L=0 ECTS=2**

Reading texts fostering reading sub-skills needed for academic reading and writing

SEMESTER II

ATA-260	**Principles of Atatürk and Modern Turkish History II (Compulsory)**	**T=2 P=0 L=0 ECTS=2**

The National Struggle in education, culture, social and economic areas, the life of Atatürk, the strategy of Turkish Revolution, Political, social, cultural, and legal revolutions and the process of these revolutions. Ataturk s internal and external political events Atatürk s struggle for world peace. To warn youth against Atatürk s principles and internal and external threats to the country and to give information about Turkey s geopolitical position.

ELE-102	Electrical - Electronics Engineering Fundamentals (Compulsory)	T=3 P=0 L=0 ECTS=4

Definition of electricity. Conductors and insulators. Effects of electric current. Definitions of current, voltage and resistance. Equivalent resistance calculation. Ohm s Law, Energy, Power, independent and dependent resources. D.a.definition of. Kirchhoff Laws. Electrical work and power. Conversion of electrical energy to heat. Eye and Node analysis, equivalent circuit of voltage source, serial and parallel connection. Maximum power theorem, Thevenin and Norton theorems, superposition theorem. Inductors and capacitors, direct current behavior, series and parallel connections, basic principles of alternating current.

ELE-104	Electric and Magnetism (Compulsory)	T=4 P=0 L=0 ECTS=5

Topics in Electricity and Magnetism: Electric charges and matter, Coulomb s law, electric fields, electric field calculations, motion of a charged particle in electric field. Gauss s law, electric flux and Gauss s law, applications of Gauss s law. Electric potential and electric potential difference, electric potential energy, electric potential due to point charges and charge distributions. Capacitance and dielectrics, definition and calculations of capacitances, energy stored in capacitors, capacitors with dielectrics. Current and resistance, electric current, resistance, electrical conduction. Direct-current circuits, electromotive force, Kirchhoff s rules, applications. Magnetic fields, definition, and properties of Magnetic fields. Magnetic forces on charges and currents, applications of magnetic fields. Sources of magnetic fields, the Biot-Sawart Law, Ampere s law. Faraday s law, Lenz s law, induced electric fields, generators and motors. Inductance, mutual and self inductance, RL circuits, energy in magnetic fields.

ELE-106	Computer and Programming Language 1 (Compulsory)	T=2 P=0 L=2 ECTS=4

Basic Concepts in Programming Languages. Write, compile and merge program source code. Basic data structures. Variables, constants, and expressions. Process sequence. Decision making and looping. Arithmetic, relational, and logical operators. Input-output operations. String operations. Problem solving and designing simple algorithms on a computer. Cycled inside. Series.

ELE-108	Computer Aided Technical Drawing (Compulsory)	T=2 P=0 L=1 ECTS=3

Basic Concepts in Programming Languages. Write, compile and merge program source code. Basic data structures. Variables, constants, and expressions. Process sequence. Decision making and looping. Arithmetic, relational, and logical operators. Input-output operations. String operations. Problem solving and designing simple algorithms on a computer. Cycled inside. Series.

ELE-110	Complex Analysis For Engineers (Compulsory)	T=2 P=0 L=0 ECTS=3

Basic concepts of functions of complex variables, Limit, Continuity, Branching points and Riemann surfaces, Derivative, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Curvilinear integral, Cauchy theorem, Caucy integral formula, Determination of roots of equations, Singular points and isolated Singular points, Cauchy-Goursat theorem, Sequences, Sequences of functions, Power series, Taylor series, Laurent series, Residue theorem and calculation of residues, Computation of integrals with the help of residue theorem, Conform transformations.

MAT-152	Calculus II (Compulsory)	T=3 P=0 L=1 ECTS=5

Indefinite integral: concepts of anti-derivative and indefinite integral, examples of indefinite integral, definite (Riemann) integral and properties, integration techniques, specific integral applications (area, arc length, volume calculation, surface area calculation) , generalized integral and its properties, sequences and series, convergence tests.

TUR-270	Turkish II (Compulsory)	T=2 P=0 L=0 ECTS=2

The main purpose of the Turkish Language course is that every young person who has completed her higher education can comprehend the structure and functioning features of her native language properly and gain the ability to use Turkish correctly and beautifully in terms of language-thought connection.

ING-102	English I (Compulsory)	T=2 P=0 L=0 ECTS=2

Elementary Level

ING-112	English I (Compulsory)	T=2 P=0 L=0 ECTS=2

Reading texts fostering reading sub-skills needed for academic reading and writing

SEMESTER III

ELE-201	Electromagnetic Theory (Compulsory)	T=5 P=0 L=0 ECTS=6

Vector analysis, vector differential operators, orthogonal coordinate systems, static electric fields, electrik potential, electrostatic boundary conditions, static electric currents, static magnetic fields, vector magnetic potential, magnetostatic boundary conditions.

ELE-203	Circuit Theory I (Compulsory)	T=5 P=0 L=0 ECTS=5

Lumped circuits: Kirchoff`s laws, basic lumped elements, circuit graphs, circuit equations, linear and nonlinear resistive circuits, first order dynamic circuits. Introduction to operational amplifier circuits.

ELE-205	Logic Circuits (Compulsory)	T=3 P=0 L=0 ECTS=4

Digital Systems Overview / Number Systems and Transformation / Boolean Algebra / Algebraic Simplification of Boolean Functions / Boolean Algebra Applications, Logic Gates / Karnaugh Maps / Multilevel Logic Gate Circuits, NAND and NOR gates / Multi Output Logic Circuits / Multipliers / Decoders / Encoders / Sequential Circuits / Programmable Logic Gate Arrays (PAL) / Combinational Logic Circuit Design /

ELE-207	Probability and Random Variables (Compulsory)	T=3 P=0 L=0 ECTS=4

Set Probability and Sample Spaces, Permutations and Combinations, Binomial Theorem, Introduction to Probability: Probability of an event and axioms of probability, Some probability rules, Geometric probability, Conditional probability, Split of sample space, Total probability formula, Independent events, Bayes theorem and applications, Problem solving with general approach, Random variables and probability distributions: Random variable concept, Probability distribution of interrupted random variable, Probability function and plot, Distribution function and plot, Distribution of continuous random variable, Probability density function and plot, Two dimensional random variables, common probability function, common probability density function, expected value of a random variable, properties of expected value, variance of a random variable, properties of variance, Chebys Hev theorem, Some Discrete Probability distributions, Bernoulli distribution, Binomial distribution, Multivariate distribution, Geometric distribution, Negative binomial distribution, Hypergeometric distribution, Poisson distribution, Uniform distribution.

ELE-209	Electric Circuit Laboratory (Compulsory)	T=3 P=0 L=0 ECTS=4

Resistance Measurement and Circuit Establish, Direct Current and Voltage Measurement, Alternating Current and Oscilloscope, Diode Rectifying Circuits, RC Circuit Analysis, Series and Parallel Resonant Circuits, Electrical Realization of Logic Gates.

ELE-211	Engineering Mathematics (Compulsory)	T=4 P=0 L=0 ECTS=5

Classification and solution methods of first order and higher order ordinary differential equations / Existence-uniqueness theorems / Differential equation systems / Series method, Laplace transform.

ELE-213	Measurement Information (Compulsory)	T=2 P=0 L=0 ECTS=2

Measurement and error, accuracy and precision, significant figures, types of errors, combination of errors, fundamental prenciples of measurements, loading effect. Units. Standarts. DC Indicating Instruments, torque and deflection of the dc current galvonometer, the permanent magnet moving-coil mechanism,

dynamics of PMMC, definitions of galvonometer sensitivity, ammeter shunt and multirange ammeters, dc voltmeters, voltmeter sensitivity and loading effect, the voltmeter-ammeter method, the series type ohmmeter, the shunt-type ohmmeter, the multimeter. Alternating-current indicating instruments, the electrodynamometer as a wattmeter, the watthour meter. DC-AC Bridges and their application, the wheatstone bridge, sensitivity of the wheatstone bridge. Oscilloscope, C, L, M measurement methods in AC. Inductance measurement definications of inductance, equivalent circuits and inductive element models, measurement methods, capacitance, and capacitance methods. Voltmeter-ammeter-wattmeter method. Measuring transformers. Transducers. Operational amplifiers and their static-dynamic parameters.

SEMESTER IV

ELE-202	Electromagnetic Waves (Compulsory)	T=4 P=0 L=0 ECTS=6

Time-varying electromagnetic fields and Maxwell equations, electromagnetic boundary conditions, wave equations, time harmonic fields, plane electromagnetic waves, transverse electromagnetic waves, polarization of plane waves, plane waves in lossy medium, group velocity, Poynting vector, instantaneous and average power densities, reflection and refraction of plane waves, transmission lines.

ELE-204	Circuit Analysis II (Compulsory)	T=4 P=0 L=0 ECTS=6

Direct current analysis of second-order circuits. Sinusoidal Steady State Analysis. The concept of phasor and investigation of frequency response of electrical circuits. Complex concept of power. Magnetic Coupled Circuit model and analysis of ideal transformers. Analysis of electrical circuits using Laplace transform and obtaining transfer functions.

ELE-206	Electronic Circuits I (Compulsory)	T=4 P=0 L=0 ECTS=6

Atom theory: Introduction classical atom theory (atomic structure) and modern atom theory, Semiconductor materials: Introduction semiconductor materials, energy levels, doping process, p-type and p-type semiconductor materials forward and reverse biased junction, Semiconductor diodes: basic diode structure and characteristics, circuit models for the semiconductor diode (large-signal, small-signal and piecewise linear diode model), specification diode types (zener, varicap, led, pin, photo, tunnel, etc.), Diode applications, (rectifier circuits, clamping circuits...), simplified structure of BJT/MOSFET and models of operation, biasing BJT/MOSFET, dc analysis of basic BJT/MOSFET circuits. The theory of small signal operation and its applications, small signal parameters, small signal models: hybrith pi" model, "T" model, single stage amplifiers: common emitter/common source, common base/common gate, common collector/common drain, high frequency behavior of amplifiers, differential pairs, differential and multistage amplifiers.

ELE-208	Electronic Circuits Laboratory I (Compulsory)	T=0 P=0 L=3 ECTS=4

Diode characteristics, Clippers, clampers, and rectifiers, BJT amplifiers, FET amplifiers, Low frequency power amplifiers, Linear applications of operational amplifiers, Logic circuits, Transistor switch behavior.

ELE-210	Signals and Systems (Compulsory)	T=4 P=0 L=0 ECTS=4

A general view to signals and systems, properties of systems, LTI systems, properties of LTI systems, linear constant coefficient differential and difference equations, continuous time Fourier series, continuous time Fourier transform, discrete-time Fourier transform, sampling, Laplace transform, Z-transform.

ELE-212	Object Oriented Programming (Elective)	T=2 P=0 L=0 ECTS=3

Java Overview, Object Oriented Programming Concept, Class and Object Concept, Class Members, Access Specifiers, Object Creation, Constructor Methods, this operator, Package Concept, Static method

and variables, Encapsulation, Inheritance, Polymorphism, Abstraction, Protected Access Identifier, Interfaces, Generic Concept.

ELE-214	Computers and Programming Languages 2 (Elective)	T=2 P=0 L=0 ECTS=3

Introduction to C ++, Basic Input-Output Operations, Data Types, Selection Structures, Repetition and Looping Expressions, Modular Programming, Classes, Encapsulation, Inheritance, Polymorphism, Construction and Destruction Functions, Vectors, Pointers, Summary.

ELE-216	Computer Aided Design (Elective)	T=2 P=0 L=0 ECTS=3

Loops, function creation, two-dimensional plotting, introduction to Matlab Simulink, system modeling and simulation-based applications, modeling for general engineering, dynamic analysis in Simulink, MATLAB / Simulink / SimpowerSystems applications.

ELE-218	Numerical Methods (Elective)	T=2 P=0 L=0 ECTS=3

Introduction: Errors in numerical computation, error sources, Taylor expansion. Finite differences: Forward, backward, and central difference equations, interpolation, extrapolation and curve fitting. Solution of sets of linear algebraic equations. Finding real and complex roots of nonlinear equations and sets of equations. Numerical integration. Numerical solution of ordinary differential equations.

SEMESTER V

ELE-301	Communication Theory I (Compulsory)	T=4 P=0 L=0 ECTS=4

Fundamentals of communication systems, Amplitude modulation and demodulation types, Double Sideband Suppressed Carrier Amplitude modulation (DSB- AM), Conventional Amplitude Modulation, Single Side Band Modulation (SSB), angle modulations, phase, and frequency modulation (FM), FM demodulation, noise modeling and effects of noise on amplitude and angle modulation systems.

ELE-307	Electronic Circuits II (Compulsory)	T=3 P=0 L=0 ECTS=4

High frequency behavior of amplifiers, differential pairs, differential and multistage amplifiers. The general feedback theory, basic feedback topologies, stability using bode plots, The general structure of operational amplifiers (op- amps), data converters, signal generators and waveform shaping circuits (RC sinusoidal oscillators, Wien oscillators, phase shifting oscillators, LC sinusoidal oscillators, Colpitts oscillator, Hartley oscillator, crystal oscillators), the oscillation criterion, the output stages (Class A, Class B, Class AB, etc.).

ELE-309	Electronic Circuits Laboratory II (Compulsory)	T=0 P=0 L=3 ECTS=3

DC bias of a BJT amplifier, supply and input output characteristics suitable for the load line, Input-output signals of a BJT amplifier, Efficiency of a BJT amplifier, distortion distortion factors and heating / cooling effects, Output when the input is a pulse in amplifiers, Oscillator types, calculations and usage areas, Types and benefits of feedback in electronic circuits, Factors affecting stability, Operation of OPAMP, supplying calculation, stability and sensitivity, All analog circuit blocks, types, uses, Differential amplifier, why it is used, input / output relations, Peak detector, usage, calculations, output factors.

ELE-311	High Voltage Technique I (Compulsory)	T=4 P=0 L=0 ECTS=4

What is high voltage? Why is it needed? Static electric field and basic electrode systems; electrical discharge phenomena in gases, liquids, solids, vacuum; protection against overvoltages and overvoltages; generation of high voltages; measurement of high voltages and high voltage applications.

ELE-313	Power Electronics I (Compulsory)	T=3 P=0 L=0 ECTS=3

Content and Industrial Applications of Power Electronics; The Structure of the Control and Protection System and Linear Power Supply; Signal Description and Signal Generators; Operation Principles and

Properties of Power Devices of Diode and SCR; Operation Principles and Properties of Power Devices of BJT and MOSFET; Operation Principles and Properties of Power Devices of Triac, GTO, MCT and IGBT; AC-DC Converters (Rectifiers); Analysis of Uncontrolled AC-DC Converters; Analysis of Controlled AC-DC Converters; Generalized Analysis of AC-AC Converters and Effects of AC-DC Converters on AC Mains; Introduction to AC-AC Converters (AC Choppers) and Single Phase AC-AC Converters; Three Phase AC-AC Converters; Generalized Analysis of AC-AC Converters and Effects of AC-AC Converters on AC Mains Drive Circuits; Protection Circuits; Operation Principles of DC-DC Converters; Analysis of Chopper Type DC-DC Converters; The converters with inductance and non isolated; The converters with inductance and isolated; Analysis of DC-DC Converter with isolated and inverter interrupter; Design of DC-DC Converters; Introduction to DC_AC Converters(Inverters) and Single Phase Square Wave DC-AC Converters; Analysis of Single Phase, Spaced Square Wave DC-AC Converters; Analysis of Single Phase, PWM DC-AC Converters; Three Phase, Square Wave and PWM DC-AC Converters; Design of DC-AC Converters.

UOS-801	University Common Elective I (Elective)	T=2 P=0 L=0 ECTS=3

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ELE-321	Microwave Engineering (Elective)	T=3 P=0 L=0 ECTS=3

TEM transmission lines and circuit analyses, terminated transmission lines, Smith Chart and applications, impedance transformation and matching in transmission lines, matching with lumped elements, solution of Helmholtz equations, rectangular waveguides.

ELE-323	Biomedical Devices (Elective)	T=3 P=0 L=0 ECTS=3

Medical Imaging Systems, Conventional X-Ray, Computed Tomography, Angiography, Ultrasonography, Magnetic Resonance Imaging, Echocardiography, Gamma Camera, PET and SPECT, Defibrillators, Intensive care devices, Physical therapy devices, Radiotherapy devices.

ELE-325	Introduction of Medicine Electronics (Elective)	T=3 P=0 L=0 ECTS=3

The concept of measurement in biomedical, errors in measurement, Noise in signal measurement, General static characteristics, General Dynamic characteristics, Transducers, Amplifiers, Measurement of biomechanical parameters (force, acceleration, torque), Measurement of Pressure, Catheters, Principles of Flow Measurement, Principles Body Temperature and Body Measurements, Bioelectircal and biomagnetic measurements, Optical Methods in biomedical engineering, Acoustic Methods in biomedical engineering, Spectroscopic methods in medicine, Non-invasive ultrasonic methods and piezoelectric systems, Non-invasive applications of photon radiation, Detectors used in nuclear medicine and measurement of radioactivity.

ELE-327	High Frequency Technics and Systems (Elective)	T=3 P=0 L=0 ECTS=3

Wireless communication systems, resonance circuits, impedance matching, filter design, Smith Chart.

ELE-329	Digital Electronics Circuits (Elective)	T=3 P=0 L=0 ECTS=3

Logic gate characteristics and determination of logic gate characteristics according to production technology.

ELE-331	Artificial Neural Networks (Elective)	T=3 P=0 L=0 ECTS=3

Biological and artificial neural networks, network models, learning in artificial neural networks, current applications.

ELE-333	Microwave Engineering Applications (Elective)	T=3 P=0 L=0 ECTS=3

Introduction to Microwave Engineering, RF/Microwave systems and measurement techniques, transmission line theory, impedance matching (application in simulation tools), introduction of

RF/Microwave simulation programs, design of passive microwave devices, design of active microwave devices, Passive/active microwave measurement techniques.

SEMESTER VI

ELE-300	Internship I (Compulsory)	T=0 P=0 L=0 ECTS=7

To make students apply what they learn in the course.

ELE-304	Microprocessors I (Compulsory)	T=3 P=0 L=0 ECTS=3

Number Systems, Microprocessor Peripheral Components, Memory Addressing, Memory Structures, Microprocessor Internal Structure and Properties Investigation of I / O Elements, I / O operation in the interrupt, microprocessor-based communication, Assembler Command Team, Assembler programming.

ELE-306	Digital Signal Processing (Compulsory)	T=3 P=0 L=0 ECTS=3

Introduction to discrete-time systems, and digital signal processing. Discrete time linear systems, difference equations. Discrete-time Fourier transform, Z- transform, Sampling, Discrete Fourier transform (DFT), Digital filter design and implementation.

ELE-308	Feedback Systems (Compulsory)	T=4 P=0 L=0 ECTS=4

Making mathematical models of linear time-varying systems and establishing electrical analogy, stability analysis in the s-plane (Routh Hurwitz and Root Locus plots) and frequency domain (Nyquist and Bode plots), PID controller design and analysis, Relative stability analysis with gain margin and phase margin.

ELE-310	Electromechanical Energy Conversion I (Compulsory)	T=4 P=0 L=0 ECTS=4

Introduction to mechanical energy conversion / Energy conversion in singly and multiple excited magnetic field systems / Structure and excitation types of DC machines / Equivalent circuits of DC machines and armature reaction / Transient and steady state voltage equations of DC machines / Obtaining instant torque equations for DC machines / Losses and efficiency in DC machines / General aspects of speed control methods in DC machines / Introduction to transformers / No load operation of single phase transformer and referring secondary values to the primary ones / Equivalent circuit and phasor diagrams of single phase transformers / Short circuited operation conditions for single phase transformer and obtaining loss and efficiency equations / Explanation of operation conditions of single phase transformers by drawing Kapp diagram / Parallel operation for two single phase transformer and autotransformers / Course Content Introduction to synchronous machines and equivalent circuit diagrams for single phase and three phase synchronous machines / Polarization in synchronous machines and study of excitation field of cylindrical-rotor synchronous machines / Stator windings in synchronous machines / Obtaining induced voltage of stator windings in synchronous machines / Voltage equations and phasor diagram of cylindrical-rotor synchronous machines / Power and torque equations in cylindrical-rotor synchronous machines / Reactive and active power regulation in cylindrical- rotor synchronous machines / Introduction to induction machines / Power flow chart for induction machines / No load and short circuited operation conditions for induction motors / Obtaining equivalent circuit and phasor diagrams for induction motors / Torque equation and torque-slip characteristics of induction motors / Study of induction machine characteristics with Ossanna diagram / Obtaining circuit parameters for induction motors.

ELE-312	Protection Technique of Electrical Institutions (Compulsory)	T=3 P=0 L=0 ECTS=3

General concepts about protection (Selectivity, speed, reliability ...), Structures and operating principles of protection relays (Electromechanical relays, thermal relays, static (electronics) relays),Instrument transformers (Structures, characteristics and connection diagrams of current and voltage transformers, capacitive voltage transformers),Line protection (instance overcurrent relays and invers time over current

relays, directional over currnet relays, distance relays, pilot protection),Coordination of over current relays, Generator protection, transformer protection, bus protection, motor protection.

UOS-802	University Common Elective II (Elective)	T=2 P=0 L=0 ECTS=3

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ELE-320	Communication Theory II (Elective)	T=3 P=0 L=0 ECTS=3

Sampling theorem, Pulse modulations (PAM, PWM, PPM, PCM), Quantation, Delta modulation, Adaptive Delta Modulation, Baseband data transmission, Digital Coding Techniques, Digital modulation methods (ASK, FSK, PSK, QPSK)

ELE-322	Microwave Technique II (Elective)	T=3 P=0 L=0 ECTS=3

1- Matrix representation of microwave networks (Z, Y, ABCD, S matrices), Directional Coupler theory, Wilkinson power divider theory, 90 degree hybrid theory, microwave power amplifier design.

ELE-324	Biomedical Technology (Elective)	T=3 P=0 L=0 ECTS=3

The concept of measurement in biomedical, errors in measurement, Noise in signal measurement, General static characteristics, General Dynamic characteristics, Transducers, Amplifiers, Measurement of biomechanical parameters (force, acceleration, torque), Measurement of Pressure, Catheters, Principles of Flow Measurement, Principles Body Temperature and Body Measurements, Bioelectircal and biomagnetic measurements, Optical Methods in biomedical engineering, Acoustic Methods in biomedical engineering, Spectroscopic methods in medicine, Non-invasive ultrasonic methods and piezoelectric systems, Non-invasive applications of photon radiation, Detectors used in nuclear medicine and measurement of radioactivity.

ELE-326	Power Electronics II (Elective)	T=3 P=0 L=0 ECTS=3

Operation Principles, Properties and Types of Uninterruptible Power Supplies (UPS) / Analysis of Various Uninterruptible Power Supplies / Design of Uninterruptible Power Supplies / Operation Principles, Properties and Types of Switch Mode Power Supplies (SMPS) / Analysis of Various Switch Mode Power Supplies / Design of Switch Mode Power Supplies / Operation Principles, Properties and Types of Resonant Mode Power Supplies (RMPS) / Analysis of Various Series Resonant Power Supplies / Operation Principles, Properties and Types of Induction Heating (IH) Systems / Analysis of Various Induction Heating Systems / Operation Principles, Properties and Types of Electronic Ballasts (EB) / Analysis of Various Electronic Ballasts / Analysis of Basic Power Factor Correction (PFC) Circuits / Analysis of Basic Active Filter (AF) Circuits.

ELE-328	RF and Microwave Circuits (Elective)	T=3 P=0 L=0 ECTS=3

Matrix representations of microwave circuits, Z, Y, ABCD and S parameters representations, directional couplers, Wilkinson power dividers, 90 degree hybrids, microwave power amplifiers

SEMESTER VII

ELE-401	Senior Project (Compulsory)	T=0 P=0 L=2 ECTS=2

Depending on the topic chosen: To be able to conduct scientific research by designing and executing experiments; Engineering design, data evaluation and interpretation considering a system and component in the field of Electronics and Communication Engineering. Preparing and writing a report.

ELE-403	Electrical Machinery Laboratory I (Compulsory)	T=0 P=0 L=2 ECTS=4

General information about the experiments to be realized during the semester, Introduction to measurement tools and circuit design / DC Machines Theory / Transformers Theory / Induction Motors Starting Methods / Operation characteristics of DC shunt generator under no load condition / Operation characteristics of DC shunt generator under loaded condition / Regulation and efficiency calculation of

single phase transformer by Kapp method / Parallel operation of two single phase transformers / Delta-Star connection for three phase transformers

ELE-407	Antennas and Propagation (Elective)	T=3 P=0 L=0 ECTS=4

Introduction to Antenna Theory, Fundamental Antenna Parameters, Radiation Integrals and Auxiliary Potential Functions, Linear Wire Antennas, Antenna Arrays, Microstrip Antennas, Radiation of Radio Waves

ELE-409	Data Communication (Elective)	T=3 P=0 L=0 ECTS=4

Data transmission process of how to perform data communication principles, network architecture fundamentals, OSI Model, TCP / IP reference model, data communication used in digital coding techniques, networking concepts, network devices, data communications environment, data coding and compression techniques

ELE-415	Pattern Recognition (Elective)	T=3 P=0 L=0 ECTS=4

Introduction, Overview, basic concepts, various Approaches, Statistical Pattern Recognition, Bayes Decision Theory, Supervised Learning: Parametric & Non-parametric approaches, Linear Discriminant Functions, Unsupervised Learning, Non- metric methods Decision trees, Grammars, Parsing, Inference by syntactic methods Graphical models for Structural Pattern Recognition Graph matching, relational and attributed graphs Neural Pattern Recognition Feedforward & non-feedforward networks. Deep Learning Paradigm

ELE-417	Digital Image Processing (Elective)	T=3 P=0 L=0 ECTS=4

Digital images; two-dimensional convolution, Fourier transform, and discrete cosine transform; Image processing fundamentals; Image enhancement; Image restoration; Image encoding and compression.

ELE-419	Discrete Time Control Systems (Elective)	T=3 P=0 L=0 ECTS=4

Transition methods from continuous-time system to discrete-time system, relations between them, controller design for discrete- time systems

ELE-421	Power System Analysis (Elective)	T=3 P=0 L=0 ECTS=4

Single Line Diagrams and Per- Unit Values ??and Impedance / Circuit Equations and Solutions / Bus Admittance and Impedance Matrices / Synchronous Machines Three-Phase Faults / Symmetrical Components / Sequence impedances and Circuits / Generator Asymmetric Faults / Asymmetric Power Systems Faults / Bus Impedance Matrix Using Asymmetric fault Analysis / Power System Stability

ELE-423	Electromechanical Conversion II (Elective)	T=3 P=0 L=0 ECTS=4

Introduction to single phase AC motors / Analysis of single phase AC motors speed and torque characteristics / Obtaining equivalent circuit and power distribution of single phase AC motors / Soft starting methods of single phase AC motors and comparison / Introduction to universal motors / Comparison of serial motors, dc and ac excited / Introduction to synchronous reluctance motors and its dynamics / Introduction to stepper motors / Analysis of variation of position and speed of stepper motors / Classifying stepper motors

ELE-425	Microprocessors II (Elective)	T=3 P=0 L=0 ECTS=4

Microprocessor Interrupt Structures, 8, 16 and 32 bit Microprocessors, Microcomputer Structure, Block Structures of Microcomputers, Processors, Memory, Input Output Circuits. Interface Input/Output Elements, Input Output Working Techniques.

ELE-427	Measurement and Instrumentation (Elective)	T=3 P=0 L=0 ECTS=4

Basic principles of measurement, measurement faults, explaining design terms, calibration concepts, circuit components measurements and measurement methods, Maxwell-Wien Bridge, Wheatstone Bridge,

Hay Bridge, Owen Bridge, Series and Parallel Condenser Bridges, Schering Bridge and their applications, Q- meter, Analog Measurements, Digital Measurements, Analog-Digital converters and transducers, Changing measurement limits, accuracy of devices, ohmmeter, electronic multimeter, counters, flash converters, voltage- frequency converters, Measurement in Trigger circuits

ELE-429	Industrial Electronics (Elective)	T=3 P=0 L=0 ECTS=4

Industrial electronic components, light-sensitive elements, temperature control circuits, remote control methods, timers, transducers, transducer and sensors, relays, electric motors, the semiconductor materials used in industry.

ELE-431	Introduction to Robotics (Elective)	T=3 P=0 L=0 ECTS=4

Basic components of robot systems: Coordinate frame selection, homogeneous transformations, solutions of kinematic equations, velocity and force/moment relations. Manipulator dynamics in Lagrangian formulation, control unit design with calculated torque method, classical control units for manipulators.

ELE-437	Communication Theory (Elective)	T=3 P=0 L=0 ECTS=4

Communication Systems, Communication Channels and Characteristics, Analog Modulation Technics (AM / FM / PM), Analog - Digital Modulation Technics (PCM / Delta Modulation), Digital - Analog Modulation Technics (ASK / FSK / PSK / QPSK / QAM), Digital Coding Technics, Bandwidth Usage at Communication, Multiplexing Technics (FDM / WDM/ TDM), Spread Spectrum Technics (FHSS / DSSS)

ELE-441	Biomedical Sensors and Convertors (Elective)	T=3 P=0 L=0 ECTS=4

Properties of converters, dynamic linearity, hysteresis, and frequency domain. Basics of biosensor design, analysis and selection of physical, optical, electrical, mechanical and thermal adaptation mechanisms. Biological elements, immobilization of biological components. Medical, biological, and chemical sensors and transducers based on electrochemical, optical, and solid-level devices.

ELE-443	High Voltage Technique II (Elective)	T=3 P=0 L=0 ECTS=4

H.V. Laboratories, over voltages / The protective devices for over voltages / Lightning and Lightning arrester, insulators, traveling waves.

ELE-445	Energy Transmission and Distribution Systems (Elective)	T=3 P=0 L=0 ECTS=4

Modeling of Energy Transmission Systems, Types of Energy Distribution Networks, Load Characteristics, Voltage Drop and Power Losses, Branch Networks, Network Systems, Underground Cables and Heat Analysis Criteria.

ELE-447	Optical Communication Systems (Elective)	T=3 P=0 L=0 ECTS=4

Optical communication process, the basic principles of optical communication, the distortions and losses that may occur in the transmission, the multiplexing techniques used in optical communication, PON, SONET and SDH will be discussed.

ELE-481	High Voltage Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

Generation and measurement of high voltages. Experimental and numerical analysis of electrostatic fields. High voltage measurement with sphere gaps. Generation and measurement of HV direct and impulse voltages. Experimental determination of Paschen's Curve. Breakdown strength of insulating oils. Measurement of the relative permittivity and the dissipation factor of solid insulating materials. Determination of breakdown strength for solid insulating materials. Determination of flashover voltage and potential distribution of an insulator string. Corona and partial discharge tests.

ELE-483	Microprocessors Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

Applications with 8, 16 bit Microprocessors, Laboratory Experiments on Input Output Circuits, Assembly Applications

ELE-485	Power Electronics Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

AC-DC Converter (Rectifier) Experiments 1 / AC-DC Converter (Rectifier) Experiments 2 / AC-DC Converter (Rectifier) Experiments 3 / AC-DC Converter (Rectifier) Experiments 4 / AC-AC Converter (AC Chopper) Experiments 1 / AC-AC Converter (AC Chopper) Experiments 2 / For All Experiments: Firstly Oral Exam, Control Circuit Experiments, Ohmic Loaded Main Current Circuit Experiments, Ohmic- Inductive Loaded Main Current Circuit Experiments, Lastly Experiment Report

ELE-487	Digital Signal Processing Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

Introduction to real- time processing hardware and software, Signal types, Fast Fourier Transform, Correlation, Detection of signals in noise, Decimation, Interpolation, Filtering

ELE-489	Microwave and Antenna Laboratory I (Elective)	T=0 P=0 L=2 ECTS=2

Microwave and antennas simulation programs, directional coupler design, rat- race coupler design, branch line coupler design, Wilkinson power divider design, bandpass filter design, antenna parameters and antenna radiation pattern measurement, lambda/2 dipole antenna design and implementation, microstrip patch antenna.

SEMESTER VIII

ELE-400	Internship II (Compulsory)	T=0 P=0 L=0 ECTS=7

To make students apply what they learn in the course.

ELE-402	Design Project (Compulsory)	T=0 P=0 L=2 ECTS=2

Depending on the topic chosen: To be able to conduct scientific research by designing and executing experiments; Engineering design, data evaluation and interpretation considering a system and component in the field of Electronics and Communication Engineering. Preparing and writing a report.

MUH-103	Engineering Faculty Common Elective I (Elective)	T=2 P=0 L=0 ECTS=3

Common elective courses aim to provide students with general knowledge and / or skills in areas such as science and technology, health, arts and sports.

ELE-404	Biomedical Measurement and Instrumentation (Elective)	T=3 P=0 L=0 ECTS=4

A course in biomedical instrumentation, introduction to basic concepts of instrumentation facility. Focused on basic measurement and standard units after given detailed information about biomedical sensors. Amplifier, Biopotential amplifiers and instrumentation amplifiers, analysis and design electronic control is passed to the filter. Regarding filters, low pass, high pass, band pass, notch filters analysis and design of such circuits by teaching focuses on the use of various biomedical devices. Analog-to-digital and digital- to-analog converter

ELE-412	Electromagnetic Compatibility (Elective)	T=3 P=0 L=0 ECTS=4

EMI problem, EMC solution, electromagnetic base to EMI/EMC engineering, engineering aspects of EMC model, standards, limits, and test procedures

ELE-414	Mobile Communication Systems (Elective)	T=3 P=0 L=0 ECTS=4

The basic structures of Mobile Communication Systems, 1st, 2nd, 2.5., 3, and 4 Generation mobile communication systems, error detection and correction processes, multiple access protocols, WLAN, WMAN, WWAN technologies, satellite communications

ELE-416	Communication Networks (Elective)	T=3 P=0 L=0 ECTS=4

Computer Communications, Local Network Structures, Network Technologies, Network Access Protocols, Telephone Communication, Wireless Communication Technologies, Network Architectures

ELE-420	Lighting and Interior Installation (Elective)	T=3 P=0 L=0 ECTS=4

Lighting Subject, Purpose and Types; Light and Visual Effect; The Spectral Sensitivity of the Eye; Photometry; Photometric Laws; Physiological Optical Principles; The General Properties of Light Sources; Magnetic Ballasts and Electronic Ballasts Operating Principles; Examination Of Lighting Equipment and Lighting Systems; Lighting Design Softwares to the Computer Calculations; Scope of the Indoor Electricity Installations; Examination of Electrical Facilities Regulation; Specifications of Indoor Installation Equipments; Examination of Light Sources, Ballasts and Lighting Types. Indoor lighting Design and Indoor Installation Project Applications.

ELE-422	Electromagnetic Applications (Elective)	T=3 P=0 L=0 ECTS=4

Eddi and fuko currents in magnetic materials, magnetic and electromagnetic forces, a basic induction heater circuit, a basic self ossilator and relaxation ossilator, FM and high frequence ossilator and transmitter, basic instrumentation and measurements via digital, analog spectrum analizor

ELE-428	Bioelectromagnetics (Elective)	T=3 P=0 L=0 ECTS=4

To have knowledge about the interaction of electromagnetic fields with biological tissues.

ELE-432	Renewable Energy Systems (Elective)	T=3 P=0 L=0 ECTS=4

The Fundamentals of Renewable Energy Systems, Their Technical and Economic Impacts on Electric Power Systems and Electricity Markets, Other Technical and Economic Issues

ELE-434	Fundamentals of RADAR (Elective)	T=3 P=0 L=0 ECTS=4

Radar systems, Radar types, Radar Equations, Radar signal processing, Doppler radar systems, Sythetic aperture radars, Electronic warfare, some radar and electronic warfare systems used today**.**

ELE-480	Communication Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

Practical Applications about amplitude and frequency modulation techniques; Receiver-Transmitter Unit Design, Noise in the Amplitude and Frequency Modulation, RF applications, Noise in Digital Communication Systems, ASK Modulation / Demodulation, FSK Modulation / Demodulation, PSK Modulation / Demodulation, Generation the QPSK Signals, Generation the PAM Signals, Introduction to Digital Communication Systems Design, Fiber optic communication, Satellite communication, GSM communication

ELE-482	Control Systems Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

Analog and Digital controllers, proportional, integral and derivative (PID) controllers, On/off controllers, Modeling, simulation, analysis of various process control systems (flow, pressure, temperature, liquid level, etc.).

ELE-484	Electromechanical Energy Conversion Laboratory II (Elective)	T=0 P=0 L=2 ECTS=2

Explanation about the experiments to be performed during the term / Introduction of measurement instruments to be used in the experiments and explanation of connection forms to the circuit / General Structure, Types and Working Principles of Induction Machines / Finding Circuit Parameters of Induction Motor and Ossanna Circle Diagram / General Structures, Types and Working Principles of Synchronous Machines / Determination of Equivalent Circuit Parameters of Three Phase Asynchronous Motor / Finding Equivalent Circuit Parameters of a Phase Transformer / Obtaining Ossanna Diagram of Three Phase Induction Motors / No Load Operation and Obtaining No Load Characteristics of Synchronous Generators / Loaded Operation and Obtaining Loaded Characteristics of Synchronous Generators

ELE-488	Power Plants Laboratory (Elective)	T=0 P=0 L=2 ECTS=2

Fuses / Contactors / Instrument transformers / Protection relays / Reactive power compensation / The types of Low Voltage Grids / Short and medium-length transmission lines / Examination of medium voltage switchgear cubicles.

ELE-490	Power Electronics Laboratory II (Elective)	T=0 P=0 L=2 ECTS=2

DC-DC Converter Experiments 1 / DC-DC Converter Experiments 2 / DC-DC Converter Experiments 3 / DC-AC Converter (Inverter) Experiments 1 / DC-AC Converter (Inverter) Experiments 2 / DC-AC Converter (Inverter) Experiments 3 For All Experiments: Firstly Oral Exam, Control Circuit Experiments, Ohmic Loaded Main Current Circuit Experiments, Ohmic-Inductive Loaded Main Current Circuit Experiments, Lastly Experiment Report

ELE-492	Microwave and Antenna Laboratory II (Elective)	T=0 P=0 L=2 ECTS=2

Input impedance and impedance matching in a terminated transmission line, Indent matching in a microstrip antenna, single-stud matching, quarter-wave matching, antenna arrays, broadband antennas, antenna polarization, RF power detection, RF energy harvesting.