

**ASPETE
DEPARTMENT OF ELECTRICAL ENGINEERING
EDUCATORS**

4-Year Degree Programme

**Duration of Studies: 8 Academic Semesters
ECTS: 240**

Course Content

Μετάφραση από την Ελληνική:

Μαρία Μ. Καντωνίδου, Επικ. Καθηγήτρια, Υπεύθυνη Γραφείου Δημοσίων & Διεθνών Σχέσεων ΑΣΠΑΙΤΕ, σε συνεργασία με τους Καθηγητές Ειδικότητας.

Απόφαση Συμβουλίου Τμήματος: 11/18.02.2009

1st SEMESTER

EL101 – Mathematics I (Compulsory - ECTS 6.5)

Linear algebra (matrices, determinants, linear systems, eigenvalues and eigenvectors), complex numbers, vector calculus and analytic geometry, differential and integral calculus of one variable, differential equations (first order and higher order differential equations, first and second order linear equations with constant coefficients), sequences-series (basic concepts, numerical series, convergence, function series, power series, applications in the field).

EL102 – Physics (Compulsory - ECTS 5.0)

Kinematics and dynamics of particles. Work-energy. Dynamics of solid body. Conservation of energy, momentum and angular momentum. Oscillations. Waves-optics.
Lab assignments.

EL103 – Electric Circuits I (Compulsory - ECTS 7.5)

Basic concepts. Elements of electric circuits. Simple linear circuits; circuit elements combination (resistors, capacitors, inductors, voltage and current sources), voltage and current dividers, source transformations, variable resistances, resistance measurement). Circuit analysis (mesh-current method, fundamental loop analysis, node-voltage method). Theorems of linear ohmic circuits (superposition, Thevenin and Norton, maximum power transfer, Millman, reciprocity, symmetrical circuits). Responses of linear circuits of 1st and 2nd order. Operational amplifiers.
Lab assignments.

EL104 – Introduction to Computers (Compulsory - ECTS 2.0)

Number systems (binary, octal, hexadecimal). Hardware (input units – output units, memory, cards). Software (system software, applications software). Networks–communications (computer communications, network architecture, internet (TCP/IP protocol, domain addresses, internet services).
Lab assignments.

EL105 – Introduction to Educational Sciences (Compulsory - ECTS 3.5)

Theoretical background. Interdisciplinary aspects and approaches. Sources of pedagogical knowledge: educational practice, philosophical thinking, bibliographic support, scientific research. Determining factors in educational processes. General aspects of education: goals and objectives, school space and time, relations of school, family and society, etc.
Educational practice: fundamental principles, educational relations, school textbooks, educational material. New trends and forms of education: education for persons with special needs, environmental education, cross-cultural/intercultural education, health education – consumer education, art education, etc. Current pedagogical trends and applications: Children’s rights, voluntary work and social problematics, linking education and work, technological literacy, “flexible zone” in education, etc.

EL106 – General and Developmental Psychology (Compulsory - ECTS 5.5)

Psychology as science. Methods of psychological research. Main theoretical streams. Personality – The role of heredity and environment. Adjustment (problems, disorders, defense mechanisms, etc). Intelligence, emotional intelligence, creativity.
Personal growth and development. Theories of human development (psychodynamics, sociological, and developmental approaches). Lifespan development. Special attributes at different stages. Focus on the emotional problems of adolescents (emotional disorders, depression and suicide, etc). Individual differences.

2nd SEMESTER

EL201 – Mathematics II (Compulsory - ECTS 6.5)

Functions of multiple variables (definitions, partial derivative, total differential, complex and implicit functions, local maxima and minima, multiple integration, transforms). Differential equations. The Laplace transform. Vector analysis (vector functions of one or more variables, limit,

continuity, derivatives, differentials, space and plane curves, integration, line integral, surface integral). Probability and statistics.

Lab assignments.

EL202 – Electric Circuits II (Compulsory - ECTS 6.5)

Signals (definition, categories and properties). Alternating current in steady state condition (definition, production, vector representation, complex representation, circuit elements, Kirchhoff's laws, combination of impedances, voltage and current dividers, capacitance measurement, inductance measurement). Circuit analysis in steady state condition (mesh-current method, fundamental loop analysis, node-voltage method). Power in steady state condition (complex, real, reactive, apparent, power triangle, power factor, compensation). Theorems of linear circuits in steady state condition (superposition, Thevenin and Norton, maximum power transfer, Millman, symmetrical circuits). Circuit resonance (definitions, series, parallel, random circuit). Three-phase circuits (definitions, three-phase symmetrical, three-phase asymmetrical). Mutual inductance – magnetic circuits.

EL203 – Electrical Drawing I (Compulsory - ECTS 2.5)

Electrical drawing for internal electrical installations: electrical drawing symbols. Light points and switches. Water-heater and stove connection. Staircase circuit breaker. One-phase and three-phase electrical distribution boards. Safety circuits.

Industrial electrical drawing: Electrical symbols for industrial installation components. Basic control systems design of asynchronous squirrel cage motor starting: direct starting, star-delta starting, reverse speed control. Control system connection of asynchronous slip-ring motor to direct current motor. Combinations of measuring instruments in one-phase and three-phase systems. Three phase connection (single-line and construction drawing).

Lab assignments

EL204 – Electric Measurements (Compulsory - ECTS 5.5)

Basic concepts. Errors. Basic instruments. Electromagnetic instruments (moving-coil, electrodynamic, crossed coil). Electromagnetic instruments (moving-iron, moving-magnet, inductive, vibrating reed). Thermal instruments – Electrostatic instruments – Electrochemical instruments, etc. Measurement area increase. Resistance measurements (ohmic, inductive, capacitive) – Bridges. Detection of short circuits in underground cables. Electrical equipment delivery checks. Watt meters. Power measurement in one-phase and three-phase systems. Electrical energy measurement – meters. Power coefficient measurement – power factor meter. Compensation. Frequency measurement – frequency meters. Measurement converters for electrical quantities. Electronic and digital instruments. D/A and A/D converters. Sensors. Systems and sensor properties. Meters. Anemometers. Quality assurance systems ISO 9000 and certification procedures. Lab assignments.

EL205 – Philosophy-Sociology of Education (Compulsory - ECTS 4.5)

Philosophy of education: Fundamental concepts. Relationship of philosophy of education and education. Basic methods of philosophical analysis, philosophy of education and teacher education, the philosophical underpinnings of teaching and learning. Problems and antinomies in education, language and philosophical thought, critical thought and philosophy. Major figures in the philosophy of education. Analysis of classical texts. Main philosophical streams. Trends and contemporary issues.

Introduction to Sociology. Leading figures in sociology. Sociology of Education, overview of theoretical streams. Social functions of education, education and economic development, equal opportunities in education, school and social environment, school performance, school failure. The school as a social organization. Ideological-political functions of education. Sociological analysis of Greek educational system.

Sociology of Technical & Vocational Education. Main theoretical streams. Science and technical studies in recent years and in postindustrial society, “technoscience”. Technical & Vocational Education and new technologies.

EL206 – Educational Psychology (Compulsory - ECTS 4.5)

Introduction to educational psychology.

Learning: Concept, object and problems. Learning theories. Overview of main theories. Factors influencing learning outcomes (motivation, maturity, teaching styles, etc). Individual differences and learning. Learning styles and study habits. Perception, learning and memory. Learning difficulties. Interpersonal relationships and mental health. Social skills. Enhancement of interpersonal relationships. Gender relations. Special student groups (intelligent students, mentally retarded, non-privileged students, foreign students, etc). The classroom as group. Peer groups in the classroom. Group types, group function and group dynamics. Drug, alcohol, AIDS and other support services for students and school. The teacher as counsellor.

3rd SEMESTER

EL301 – Foreign Language-LSP (Compulsory - ECTS 4.0)

A learner-centered approach to English for Specific Purposes (ESP) in the context of electrical engineering curriculum. Task-based activities promoting the acquisition of receptive competence and communicative skills in the field (contextualized treatment of specific notions, functions, discourse skills and rhetorical components; specialized/authentic reference materials).

EL302 – Electronics (Compulsory - ECTS 6.0)

Fundamentals of semiconductors. Signal amplification and operational amplifiers. Junction diode: models and basic circuits. Special diodes (Zener, Schottky, Varactor). Rectifiers and clippers. Bipolar junction transistors: equivalent circuit models of weak signal, biasing techniques and basic single-stage amplifiers. Field-effect transistor (MOSFET, JFET). Frequency response and filter theory.

Lab assignments.

EL303 – Electrical Materials and Components (Compulsory - ECTS 4.0)

Basics of electrical materials technology. Measurement of dielectric properties (volume resistivity, surface resistivity, dielectric constant, electrical endurance, surface discharge). Physical, mechanical and chemical properties of dielectrics. Dielectric behaviour (the aging effect, humidity, etc). Liquid dielectrics (oils, synthetic liquids). Tests and trials. Solid dielectrics (fibrous insulating materials, electrical insulating resins). Impregnating and finishing varnishes. Electromagnetic materials, mica. Insulators of station and substation transmission lines. Conductive materials (conductors and cables, properties, regulations, calculations). Power cables (calculations, testing).

EL304 – Basic Electromagnetic Theory (Compulsory - ECTS 6.0)

Electric charges and currents – The principle of electric charge conservation. Electric field strength and magnetic induction. Maxwell's equations (integrated and point form, boundary conditions). Static electric field – Electrostatic potential. Static magnetic field – Vector magnetic potential. Poisson and Laplace equations. Reflection. Electric dipoles. Dielectric materials and capacity. Conductive materials. Magnetic dipoles. Magnetic materials, self-inductance, mutual inductance, permanent magnets, magnetic circuits.

EL305 – Educational Management and Policy (Compulsory - ECTS 5.0)

Basic concepts and principles of educational management and policy. Statutes and Constitution. The issue of pedagogical freedom. Authority and pressure groups and their impact on educational policy. Organizational and management theories and their impact on educational management.

Structure and organization of the educational system: Overview of educational reforms and changes, levels of education, school types, institutions, etc). Central and regional educational management. School environment and school climate.

Human resource management. Staff categories. Staff management (placement, promotion and professional development policies). Human resource management in education. Gender and educational management. School quality and health and safety policy. The teacher as educator; the teacher as public servant or private employee. Performance assessment. Internal evaluation of school unit.

Comparative educational management and policy: European and international educational policy. CEDEFOP's role in Vocational Education and Training.

EL306 – Counselling Psychology and Guidance (Compulsory - ECTS 5.0)

Counselling: Concept, aim, content, and relation with counselling psychology. Theoretical background, methodology and applications. Counselling intervention. Professional ethics and principles of counselling and guidance. Assessment in counselling. School case studies requiring counselling intervention and support.

Career counselling: School, educational and occupational guidance. Career development and personal growth. Career education in the context of career counselling. Career counselling methodology and organization of overall counselling/guidance services and interventions. Assessment in career counselling and guidance. Overall evaluation of career counselling and guidance.

4th SEMESTER

EL401 – Electric Machines I (Compulsory - ECTS 7.5)

Electromechanical conversion of energy. Magnetic circuits. The law of induction. Induced voltage. Rotating frame, constant field. Rotation. DC machines. Basic characteristics. Power flow and power losses in DC machines. Generators (separately excited, parallel-excited, series-excited, complex excited). Parallel operation of DC generators. Properties of DC motors. Equivalent circuit of a DC motor. Motors (separately excited, parallel-excited, series-excited, complex excited, permanent magnet excited). Power flow, power losses and DC motor performance. Speed control of DC motors.

Electric transformers. Types and manufacturing characteristics. One-phase transformers. The ideal transformer. Operation principles of a real one-phase transformer. The equivalent circuit, approximate equivalent circuits, vacuum operation and operation under load. Three-phase transformers. Special combinations, asymmetric operation, high voltage operation, the saturation effect. Insulation, cooling, and temperature control. Transformers protection. Instrument transformers. Transformer design.

Lab assignments.

EL402 – Automatic Control Systems I (Compulsory - ECTS 5.5)

Basic concepts. Description of systems (mathematical models, transfer function, impulse response). Block diagrams– Block diagram algebra (series and parallel connections, sum of signals etc) – Simplification of block diagrams and flow diagrams. Control systems solutions in time and frequency domain (time response of first and second order systems). Steady state errors. Stability of automatic control systems (algebraic criteria). Stability of automatic control systems (geometric criteria: root locus, Nyquist, Bode, harmonic response). Control systems equipment (DC motors, AC motors, hydraulic servo motor, servomechanism, etc). Practices and applications of automatic control systems. Logic control. Introduction to PLCs - principles of operation.

Lab assignments.

EL403 – Digital Systems (Compulsory - ECTS 5.0)

Number systems: Binary numbers, hexadecimal numbers, conversion of numbers, complements, signed binary numbers. Binary codes: decimal, alpha-numeric. Binary logic – Boolean algebra: switching circuits, basic theorems and properties, logic variables, sum of minterms, product of maxterms. Other logic operations. Logic gates. Simplification of logic functions. Combinational circuit design. Combinational logic devices: adders, subtractors, comparators, code converters, parity generators, encoders, decoders, multiplexers, demultiplexers, read-only memory (ROM). Flip-flops: D, T, SR, JK, Master-Slave JK. Basic matrices. Sequential circuit design, applications: Design of counters. Sequential digital systems: registers, shifters, counters, time sequences, random access memory (RAM), etc.

Lab assignments.

EL404 – Techno-Economic Analysis (Compulsory - ECTS 3.5)

The concept of market, market forms, demand and offer, individual consumer behaviour, cost estimation, cost indicators, price determination, cost-effectiveness, production functions, active demand, budget planning, balance of payments, the role of interest rates, inflation, pricing techniques, principles of economic planning. Economic criteria, cost equations and cost optimization, case-studies.

EL405 – Teaching Methodology (Compulsory - ECTS 6.5)

Introduction to the field. Teaching models. Forms and principles of teaching. New ways of teaching, teaching style(s), dilemmas in teaching, curriculum and hidden curriculum. Lesson planning, goals, content, and implementation. Teaching methods: Lecture, guided discussion, Socratic questioning, demonstration, discovery learning, cooperative learning, team teaching, individualized teaching, project-based, problem-based, skill-based, interdisciplinary instruction, developing teaching portfolio, programmed teaching, tele-teaching, etc.

In-class practice: Lesson plans and analysis of teaching.

EL406 – Computer Applications in Education (Compulsory - ECTS 2.0)

Computer Basics: Operating systems basics, office applications software, educational software.

Computer applications in education: Integrating technologies & educational software in course design and teaching. Development of multimedia presentations.

Networks – Internet: The educational potential of internet, internet as an educational tool, internet technologies and services and learning theories. Internet as an information resource (web browsing, searching for information, retrieval of information, information management and evaluation).

Internet as communication and distance learning tool. Development of web-based educational material. Web page concept and design. Introduction to web-base teaching and learning activities.

Multimedia: Designing multimedia applications. Authoring tools.

Lab assignments.

5th SEMESTER

EL501 – Automatic Control Systems II (Compulsory - ECTS 6.0)

System compensation. PID controllers (proportional, proportional and integral, proportional and differential, proportional-integral and differential control). Description, analysis, and design of systems in state space (state equations, transfer function, impulse response, system eigenvalues, SISO systems, MIMO systems, state space configurations of systems). Time response of automatic control systems in the state domain. System observability and controllability. Design of automatic control systems (state vector, output vector, eigenvalues, state observers, optimal control). Analogue computers. Nonlinear automatic control systems (describing function method, phase plane method, Lyapunov stability theory).

Lab assignments: Programmable logic controllers (PLC) - Analogue computers – P, I, D terms.

EL502 – Electric Machines II (Compulsory - ECTS 6.0)

Rotating AC machines. Rotating magnetic field, induced voltage and torque, power flow, losses, performance. Synchronous generator operation. Synchronous generator modeling, equivalent circuit parameters, network-based model. Operation principles of synchronous motors. Equivalent circuit and steady-state operation. Effect of excitation change. Effect of charge change. Compensation. Power factor correction with synchronous motors. Induction motor starting methods, compensation coils, stability, speed control. Operation principles of asynchronous (induction) motors. Structure, induced torque, rotor shift, equivalent circuit, vacuum and under load operation, losses and efficiency. Low-drift operation. Starting and inversion torque. Speed regulation of slip-ring induction motors. Modeling of cage induction motor. Electronic speed regulation in induction motors. Induction motor modeling, parameters estimation, no-load/blocked rotor tests, calculations of mechanical and iron losses. Operation principles and applications of induction generators. Design and specifications of induction motors. One-phase induction motor.

Lab assignments.

EL503 – Electrical Installations I (Compulsory - ECTS 6.0)

Electric power supply. Low-voltage installations. Power supply networks. Connection to the public network. Current-carrying cables (overhead, low-voltage). Internal electrical installations (consumption, nominal power size of connection). Total installed power. Internal installation conductors. Materials and components (fuses, switchgear, etc). Grounding and short circuit protection. Domestic electrical installations. Lighting apparatus and sockets. Guidelines and calculations. Voltage drop calculation. Security lighting. External electrical installations. Special installations. Weak current installations (intercom systems, fire alarm, security systems). Domestic

electrical installations boards. Electrical installation regulations.
Lab assignments.

EL504 – Technical Legislation (Compulsory - ECTS 4.0)

Public works design – project assignment and execution (request for interest and qualifications, consultant selection committee). The project assignment contract (clauses, contractual obligations, liability, contract problems, arbitration). Engineering fees and payments. Public works contract (clauses, project management and supervision, public works auction and tenders, public works construction, contract problems, arbitration). Contract laws. Public works laws. Contract and auction templates.

EL505 – Educational Research Methodology (Compulsory - ECTS 4.0)

Philosophical background of scientific research (positivism, anti-positivism, phenomenology, etc). Fundamentals of empirical research. Empirical research methodology. Empirical research design and methods (formulation of research questions, goals and objectives, variables, hypotheses, funding, etc). Statistical criteria and techniques. Computer data processing. Writing a research paper – steps and instructions. National and European research institutes and programmes. Educational research institutes at national and European level.

EL506 – Educational Evaluation (Compulsory - ECTS 4.0)

Introduction to the field. Theoretical background, contemporary evaluation theory, models, methods, techniques, context and application problems. Purpose and standards. Staff evaluation, school-based evaluation. Organization and presentation of data. Evaluation programmes and evaluation processes. Institutional framework. The role of evaluation in the curriculum.
Student evaluation. Theoretical background, goals and objectives. Methods and assessment techniques. Student performance assessment – test construction and validation. Key elements involved in testing and grading, test anxiety. Higher education entrance exams. Marking and grading of papers and projects. Statistical analysis of test results; score interpretation. Presentation of data; different types of scales.

6th SEMESTER

EL601 – Power Electronics (Compulsory - ECTS 6.5)

Power converters. Power switches. Power diode, BTJ, MOSFET, transistor, TRIAC, GTO, IGBT, etc. Electronic components and circuits, integrated circuits, operational amplifiers. Starting, cutting off, and protection circuits of power switch. AC/DC converters (1-phase, 3-phase, fully controlled, semi-controlled). DC/DC converters (step up and step down). AC/AC converters (fixed frequency, one-phase and three-phase). DC/AC converters. AC/DC/AC frequency to voltage converters.
Lab assignments.

EL602 – Electrical Installations II (Compulsory - ECTS 8.0)

Industrial installations. Motors. Properties of electric motors, power of electric motor. Cross section calculation of a motor power supply line. Electric motor protection. Calculations of industrial installations. Motor automations (inversion switch, automatic star/delta switch, automatic pumping systems). Power factor. Drawbacks of low power factor. Power factor correction with fixed capacitors. Power factor correction with synchronous motors. Economics of power factor correction. Elevators. Elevator machines and materials. Simple elevator circuit. Elevator operation. The elevator motor. High voltage protection. Lightning protection systems. Measuring instruments and electrical installations inspection. Low-voltage specifications.
Lab assignments.

EL603 – Electric Energy Systems I (Compulsory - ECTS 4.0)

Forms of energy (conventional, renewable). Electric energy systems – operational framework. Electric power stations (steam-electric, hydro-electric, thermal wind, nuclear). Electric power production from renewable energy sources (wind, solar, geothermal, etc). Generator models – Properties of synchronous generators – equations and power control. Transformer models. Power switch elements. Electrical energy economics (electric load, load curves, load duration curves, load

variation, demand prediction). Installation cost – Annual cost. Economic operation and station cooperation . Electric energy co-production. Electric energy pricing.

EL604 – Subject Didactics (Compulsory - ECTS 6.5)

Introduction to the field. The concept of job analysis; job analysis in vocational education and training. Professional knowledge and skills. Linking production with vocational education and training. Sample teaching analysis. Curriculum design principles and programmes of subject didactics – current trends. Comparison of vocational education and vocational training programmes. Skill-based teaching. Demonstration and experiment. Individualized practice. Procedural knowledge and the strategy of effective teaching in subject didactics. Declarative knowledge and teaching practices in vocational courses didactics; alternative applications. Development of learning enhancement strategies during teaching. Lab assignments.

EL605 – Educational Technology-Multimedia (Compulsory - ECTS 5.0)

Nature of technology and emergence of educational technology as a discipline. Learning theories as bases for technology integration models. Technology integration planning. Current educational technology systems and emerging trends. Integrating software tutors and tools into teaching and learning: educational software, basic software tools (word processing, spreadsheet and database programs), multimedia and hypermedia tools. The internet as an educational tool: integrating the internet into teaching and learning. Research findings on the use of new technologies in different teaching and learning environments. Lab assignments: Production, presentation and integration of educational material. Current and emerging information and communication technologies. Web-based teaching and learning activities. Teleconference, tele-education, distance learning.

7th SEMESTER

EL701 – Computer Aided Design of Electrical Installations (Compulsory - ECTS 3.0)

Introduction to the field. AUTOFINE (design, calculations, data libraries). Study and design of electrical installations for buildings, industry, substations, etc. Commercial and industrial central heating design, heat insulation, air-conditioning, distribution of costs. Fire protection (fire extinguishment, fire safety). Elevators. Hydraulics (water supply, sewage). Fuel gases. Biological stations. Operation permission. Print-outs.

Lab assignments.

EL702 – Lighting Technology (Compulsory - ECTS 7.5)

Introduction to the field. Luminous intensity graphs (luminous intensity distribution curves, orthogonal coordinates, etc). Luminance, lighting laws. Lighting types, lighting fixtures characteristics, performance indexes. Reflection, transparency and absorption coefficient. Indoor lighting (determination of luminous intensity, point light sources, etc). Local lighting. Outdoor lighting. Lighting fixtures and adjustment mechanisms.

Lab assignments.

EL703 – Electric Car System (Compulsory - ECTS 7.0)

Introduction. Charging and starting system. Conventional and current ignition systems – detection of faults. Electronically controlled systems: KE-Setronic, L-Setronic, Motronic, Mono Setronic, Mono Motronic. Detection and repair of faults. ABS systems, BOSCH/TEVES. Air conditioning systems: Operation principles - detection of faults. Lighting systems and extra equipment: Airbags, anti-theft devices, electromagnetic locks, electric windows, etc. Electrical diagrams: reading and interpreting electrical diagrams, service diagnosis, kinds of diagrams, symbols and abbreviations.

Lab assignments.

EL704 – Electric Energy Systems II (Compulsory - ECTS 7.5)

Basics of transmission lines. Properties of three-phase transmission lines (calculation of ohmic resistance, self-inductance, mutual inductance, and capacitance; ground influence on self-inductance and capacitance). Equations and equivalent circuits for short, medium and long transmission lines

(wave parameters of two-port circuits, transmission line compensation). Operational properties of transmission lines (transmission line power and losses, pie charts). Mechanical properties of transmission lines and cable cross-section calculations (mechanical properties of overhead lines, cable sag calculation, wind and frost influence, conductors built on sloping ground, overhead line charging ability, economic cross-section of conductors). Low and medium voltage substations. Development of steady state operation model (admittance and busbar resistance matrices, system variables, charge flow equations, the Gauss-Seidel and Newton-Raphson methods).

Lab assignments.

EL705 – General Technology (Compulsory - ECTS 5.0)

Introduction to the field. The educational value of rational object design. Theory and practice in one-to-one development. Philosophical and scientific background of technology: Philosophical, sociological, educational, pedagogical, and historic approach.

Education and production technology programmes and curricula (elementary school, high school, lyceum, technical & vocational schools, and institutes of vocational training).

Lab assignments.

8th SEMESTER

EL801 – Teaching Practice (Compulsory - ECTS 6.0)

EL802 – Practical Work Experience (Compulsory - ECTS ---)

EL803 – Graduation Thesis (Compulsory - ECTS 24)