



SCHOOL OF PEDAGOGICAL AND TECHNOLOGICAL EDUCATION
DEPARTMENT OF MECHANICAL ENGINEERING EDUCATORS

4-Year Degree Programme

Duration of Studies: 8 Academic Semesters
ECTS: 240

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1st SEMESTER**M101 - Mathematics I****ECTS 7.0**

Linear algebra: Matrices, determinants, linear systems, eigenvalues and eigenvectors, complex numbers. Differential and integral calculus of a real variable. Sequences-Series: sequences, numerical series, convergence, function series, power series (Taylor and Maclaurin series). Differential equations: first order and higher order differential equations, first and second order linear equations with constant coefficients, homogeneous equations. Vector calculus and analytic geometry. In-class practice: Problem solving exercises.

M102 - Physics I**ECTS 5.0**

Kinematics and dynamics of material point. Conservation of momentum, conservation of energy. Kinematics and dynamics of solid body. Conservation of angular momentum, conservation of energy. Fluid mechanics, ideal fluids, laws. Heat, thermodynamics. In-class practice: Problem solving exercises.

M103 - Chemistry & Technology of Materials**ECTS 5.5**

Basics of chemistry: the structure of atom, the periodic system, chemical bonds, states and structure of matter, chemical kinetics and equilibrium, micro-heterogeneous systems, oxidation-reduction, electrochemistry. Chemical technology, fuels, lubricants. Science and technology of materials: structure and properties of materials, structure formation in cast materials, effects on the equilibrium structure of alloys, structure formation in deformed metals and alloys, properties of material surface. In-class practice and Lab assignments.

M104 - Computer Programming**(ECTS 3.0)**

Number systems, arithmetic operations and conversions. The concept of algorithm. Algorithm structures. Flowcharts. Introduction to programming. Types and sizes

of data. Control commands. Relational and logic operators. Do loops. One- and two-dimensional matrices. Functions and programme block structure. Other data structures (indicators, stacks, queues). Files. File access. Search techniques. Classification techniques. Lab assignments.

M105 - Introduction to Educational Sciences**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 problematic, linking education and work, technological literacy, "flexible zone" in education, etc.

M106 - General and Developmental Psychology**ECTS 6.0**

Psychology as science. Methods of psychological research. Main theoretical streams. Personality – The role of heredity and environment. Adjustment (problems, disorders, defence 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**M201 - Mathematics II****ECTS 6.5**

Functions of several variables: Definitions, functions of two and three variables, partial derivatives, total

differential, homogeneous functions, implicit functions, coordinates transformation, mean value theorem. Differential equations: First order and higher order differential equations, first and second order linear equations with constant and variable coefficients. Vector analysis; introduction to tensors. Probability and

statistics.

In-class practice: Problem solving exercises.

Lab assignments: Numerical calculations, functions of one variable, Taylor series, graphs, solutions of equations, inequalities and systems, functions of several variables, multiple integrals, solutions of differential equations and direction fields, matrices and systems, eigenvalues and eigenvectors, statistical data processing.

M202 - Physics II

ECTS 5.5

Oscillations: linear harmonic oscillation, angular, damped, forced, resonance, composition. Waves: harmonic wave equation, wave intensity, superposition of waves, standing waves. Acoustics: subjective and objective characteristics of sound, noise measurement (decibel scale) – the Doppler phenomenon, ultrasounds. Electromagnetism: electrostatic field (Gauss law), magnetic field (Biot Savart's law, Ampere's law), electromagnetic induction (Faraday's law), Maxwell's equations.

In-class practice: Problem solving exercises.

Lab assignments: Error and graph theory, simple pendulum study, Young's modulus, measuring the viscosity coefficient, oscillation frequency of a diapason, boiler performance index, the c_p/c_v ratio, measuring the capacitance of a capacitor, measuring resistance and capacitance with a Wheatstone bridge, thermal dependence of resistance, etc.

M203 - Manufacturing Processes I

ECTS 5.5

Classification of materials. Structure and mechanical properties of metals. Engineering alloys (phase diagrams, ferrous and non-ferrous alloys). Classification of manufacturing processes - Thermal treatments of metals and alloys. Casting processes for metals (casting methods, thermal, mechanical and macro/microscopic phenomena, casting defects, casting equipment, design for casting). Powder-metallurgy (compaction and sintering, economics of powder metallurgy, design considerations). (Basic concepts of plasticity theory applied to manufacturing. Metal forming processes (rolling, extrusion, forging, drawing, bending, deep-drawing). Metal forming equipment. Welding processes (oxyfuel gas welding, arc welding processes, micro-structure and defects of fusion welded zone, testing welded joints, resistance welding).

Lab assignments: Basic engineering metrology. Elementary metallography and microscopic observations. Thermal treatments of steels (quench, recovery & annealing). Hardness testing. Welding workshop

M204 - Philosophy-Sociology of Education

ECTS 5.0

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.

M205 - Educational Psychology

ECTS 5.0

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.

M216 - Mechanical Engineering Drawing

ECTS 2.5

Basic concepts (drawing instruments, paper sizes, title block, scales, line types, lettering). Descriptive geometry (cylindrical cross-sections, development (pattern) drawing, layers' crosscuts). Mechanical engineering drawing (views, cross-sections). Dimensions, symbols. Model design. Lab assignment and homework.

M217 - Computer Aided Mechanical Engineering Drawing

ECTS 2.5

Title blocks, scales, lines. Mechanical Engineering Drawing: views, cross-sections. Regulations, dimensions, symbols. Design Standards. Drafting of machine parts and machine elements (rivets, bolts, axes, bearings, gear, wheels, springs, piping, μειωτήρες, welding, clutches). Special installation designs.

Lab assignment and homework. The course is conducted on PCs.

3rd SEMESTER**M301 - Applied Mechanics****ECTS 4.0**

Statics: Introduction. Equivalent systems of forces, Forces, Moments, Equivalence, Addition of forces, solid body, free body diagram, types of supports of Structures. Equilibrium of a point, 2D-Equilibrium of the rigid body, bars, 3D-Equilibrium of the rigid body, Equilibrium of a mechanical system. Plane trusses, Method of Nodes, Method of sections or Ritter's method. Center of Gravity and Centroids. Full-length structures, beams, axial forces, shear forces, bending moments, beams with concentrated loads, beams with distributed loads, Gerber beams, three-hinged structures.

Dynamics: Basic concepts and Principles of Mechanics, Momentum and angular momentum. Central motion, central force. Power, Work, Energy, energy and conservation theorems. Momentum and angular momentum of a rigid body. Thrust and Impact. Kinematics of the rigid body, Relative motion. Dynamics of the rigid body.

In-class practice: Problem solving exercises.

M302 - Applied Thermodynamics**ECTS 5.0**

Basic concepts and definitions. Forms of energy. First law of thermodynamics. Ideal gas. Cyclic processes. Carnot cycle of an ideal gas. Reversible and non reversible phenomena. Second law of thermodynamics. Carnot cycle of any working fluid. Thermodynamic temperature scale. Entropy. T-S and H-S diagrams (Mollier). Thermodynamic probability. Theoretical entropy of mixing. Entropy of irreversible processes. Two - stage thermodynamic processes. Vaporization, diagrams. Vaporization tables, real gases. Thermodynamic representation of reversible processes. The Joule-Thomson expansion. Equations of state (VDW equation). Thermal capacity of gases. Thermodynamic cycles. One-dimensional flow. Nozzles and Diffusers. Mixture and combustion thermodynamic analysis.

In-class practice: Calculations of thermodynamic properties, states, processes using Mollier diagrams, vaporization tables or software.

M303 - Electrotechnics - Electronics**ECTS 5.5**

Definitions: Electric field, magnetic field, capacitor, coil, ohm resistor, electric current, Ohm's law, Kirchhoff's laws, direct and alternating current, impedance and admittance. Mesh and node analysis, theorems (superposition, Thevenin, Norton, Millman, maximum power transfer). Three-phase networks, generator

connections, simple electrical installations, semiconductors, diodes, transistors, amplifiers, rectification, logic gates, simple digital circuits, vibrators, registers, counters.

Lab assignments: Ohm resistor, resistor connections, voltage divider, current divider, theorems (superposition, Thevenin, maximum power transfer), electric and electronic instruments, power measurement, grounding, wiring, oscilloscope, weak-signal amplifier, operational amplifier, bridge rectifier, logic gates.

M304 - Educational Management and Policy**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.

M305 - Counselling Psychology and Guidance**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.

M316 - Manufacturing Processes II**ECTS 5.5**

Engineering metrology and instrumentation. Dimensional Tolerances and Fits. Material removal processes (Mechanics of Chip Formation - Tool Wear & Tool life - Surface Finish & Surface Integrity - Machinability - Cutting-Tool Materials). Machine-Tool Structures. Basic conventional machining processes (turning, drilling milling) Process planning. Economics of Machining and Optimization. Finishing processes (grinding & lapping). Non conventional processes (EDM, ECM, AWJM).

Lab assignments: Conventional machining workshop (process planning of metal specimen – fabrication by turning drilling & milling, dimensional measurements & inspection).

M317 - Applied Mathematics**ECTS 5.5**

Approaches and methods (polynomial approach, Legendre, Laquerre, Hermitte and Chebyshev polynomials, splines methods and least squares). Numerical integration. Numerical derivation. Solutions of equations (Graeefee, Bernoulli, Ward, Newton, Regula Falsi). Eigenvalues-eigenvectors. Solutions of equation systems (Gauss and Gauss-Jordan elimination, Jacobi methods, Gauss-Seidel, Newton-Rahson). Solutions of ordinary differential equations and systems (Taylor, Euler, Runge-Kutta).

Lab assignments: Development of codes (Fortran and/or Pascal and/or C++). Use of software for the solution of problems in the field of mechanical engineering.

4th SEMESTER**M401 - Fluid Mechanics I****ECTS 7.5**

Properties of fluids, Hydrostatics – Aerostatics, Kinematics of fluid flow. Fluid dynamics: Conservation laws, Differential and integral equations, Non-dimensional numbers, Dimensional Analysis and Similitude. Forces acting on ducts and bodies, Lift and drag. Incompressible laminar boundary layers: Boundary layer concept and boundary layer equations, Blasius, Falkner-Skan and Pohlhausen solutions. Types and classification of incompressible turbomachines (pumps, fans, blowers), Performance curves. Analysis of pipe networks. Introduction to experimental fluid dynamics: Pressure, speed and temperature measurements.

In-class practice: Problem solving exercises.

Lab assignments: Measurement of the properties of fluids (viscometers, density meters, manometers), hydrostatic forces on plane surfaces, volumetric flow rate (Venturi, orifice plate, weirs, rota meter), pressure drop in pipelines (major and minor losses), velocity distribution in ducts of circular and rectangular cross-section. Measurement of velocity profiles across a boundary layer of a flat plate. Computer simulation of fluid flows.

M402 - Strength of Materials**ECTS 5.5**

Theory: Introduction. Basic concepts and Principles, σ - ϵ diagrams. Tension-compression of bars, indeterminate problems. Shear. Moment of Inertia. Bending, elastic deflection of beams. Torsion, Buckling, composite load conditions. Failure criteria. Energy methods. Indeterminate problems of beams.

Lab assignments: Experimental determination of materials data and stresses and strains in tension, compression, torsion, bending, buckling, creep, Impact,

Fatigue, and other experiments. Interpretation of results.

In-class practice: Problem solving exercises.

M403 - Electric Machines**ECTS 4.5**

Basics of electromagnetism, electromagnetic induction. Transformers and autotransformers: operation, performance, applications. DC machines (generators, motors): operation, inductive voltage, internal torque, excitation, speed control, switching, applications. AC machines. Static and rotating fields, multiple pole machines, windings. Synchronous machines (synchronous generators, synchronous motors) and synchronous capacitors: operation, applications. Asynchronous machines (induction motor, variable frequency generator): advantages, operation, speed control, applications. Single-phase motors: construction, operation, applications.

Lab assignments: Transformer tests. DC machines: excitation (series, parallel, compound), Ward–Leonard speed control. Synchronous machines: connections, characteristic curves, power factor correction, starting, torque and performance measurements. Asynchronous motors (squirrel cage): starting and operation, characteristic curves, sliding and performance. Asynchronous slip-ring motors: installation, operation, performance. Single-phase motors with starting capacitor.

M404 - Foreign Language – ESP**ECTS 4.0**

A learner-centered approach to English for Specific Purposes (ESP) in the context of mechanical 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).

M405 - Teaching Methodology

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.

M406 - Computer Applications in Education

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-based teaching and learning activities. Multimedia: Designing multimedia applications. Authoring tools. Lab assignments.

5th SEMESTER

M501 - Heat Transfer

ECTS 4.0

Steady state heat conduction in simple and complex bodies. Transient phenomena. Graphic and numerical methods. Optimum insulation thickness. Convection. Theory of similitude. Dimensionless numbers (Nusselt, Prandtl, Grashoff). Forced convection inside pipes, across cylinders and over flat plates. Free convection over flat plates and across cylindrical bodies. Phase change (vaporization, condensation). Heat exchangers - types, operation, logarithmic mean temperature difference. Parallel, counter and cross flow heat exchangers with or without mixing, NTU method, efficiency. Principles of radiation. Max Planck, Stefan-Boltzmann, Kirchhoff, and Wien laws.

In-class practice: Heat transfer calculation in simple or complex bodies of various materials, by means of tables and software. Calculation of optimum insulation thickness and optimum heat exchanger geometry.

M502 - Machine Elements I

ECTS 6.5

Theory: Joints, screws, welding, rivets, springs, pins, keys, rolling and sliding bearings. Axes – shafts. Stress and strain calculations Clutches. Belt drives. Trapezoid and flat belts. Belt drives.

In-class practice: Calculation and design of a variable diameter shaft. Shaft deflection. Belt drives. Stress calculation of above mentioned machine elements.

M503 - General Technology

ECTS 5.5

The concept of technology. Technology and society.

Linking technology with production. Primary, secondary, and tertiary production. Technological development and professions. The economy. Production organization and management. Study of technology (individual work). Study of production (collective work). The production line method in industry. Method, research and experimentation. General Technology didactics in secondary education. Educational processes (seminars and lectures, presentations of projects, manufactures).

Lab assignments: Tools, instruments, appliances, machinery, materials, technical drawing. Individual research and team work projects. The method of production line.

M504 - Educational Evaluation

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.

M505 - Educational Research Methodology

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.

M517 - Turbomachines

ECTS 6.0

Types and classification of turbomachines. Flow in a turbomachine, Euler equation, velocity triangles. Incompressible flow turbomachines (water pumps, water turbines, fans): Non-dimensional characteristic numbers and performances, Pumping station operation, Water

turbines (Pelton, Francis and Kaplan turbines). Compressible flow turbomachines: Industrial gas turbines (types and applications, gas turbine power plants, combined cycle steam turbine, open and closed cycle gas turbines, ideal cycle analysis, real cycle analysis). Aircraft gas turbines: Jet engines and principles of operation, theory of propulsion, propulsion efficiency. Major components of gas turbines (compressors, combustion chambers, turbines).

In-class practice: Problem solving exercises.

Lab assignments: Measurements and calculations of performance curves in a) a centrifugal pump test rig, pumps operating in series and parallel, b) Pelton water turbine test rig and c) axial and centrifugal fan test rigs. Hydraulic network analysis. Design of radial pumps. Cycle simulations and performance calculations of gas turbine plants.

6th SEMESTER

M601 - Internal Combustion Engines

ECTS 7.0

Principles and Classification of Internal Combustion Engines (ICE). General working principles for Diesel and Otto IC engines. Theoretical and actual operating cycles of Otto and Diesel engines. General working principles for the principal ICE sub-systems i.e. fuel metering (carburetion and Fuel Injection), mixture preparation, ignition in Otto engines, Fuel injection in Diesel engines, cooling, lubrication, supercharging and exhaust gas after-treatment. Combustion in Otto and Diesel engines. Heavy-duty diesel engines. Alternative fuels. Basic performance characteristics of ICE. Selection criteria, malfunctions and maintenance mode of ICE. Modern IC engines.

Lab assignments: Disassembly and assembly of engine specific components. Measurements on engine specific parts, Measurements on engine test bench, Malfunction detection and engine adjustments.

M602 - Refrigeration and Air Conditioning Technology

ECTS 6.0

Theory: Introduction – Definition of cooling, vapor compression cooling cycle, refrigerants, absorption and adsorption cooling, heat pumps, equipment and processes. Psychrometry. Meteorology. Heating and cooling loads. Insolation – shading. Condensers. Air ducts – piping. Air conditioning devices. Heat pumps. Combustion, steam boilers, superheaters – steam reheaters, feeding water and combustion air preheaters. Air stream's velocity and mass measurement inside experimental air duct. Psychrometric processes. Energy

balance between conditioned air and refrigeration unit inside experimental air duct. Energy balance of refrigeration upon experimental air conditioning unit. Types of central heating systems. Regulations. Systems. Boiler types, selection and methodology. Exhaust gas analysis, boiler draught. Exhaust fumes quality. Heating value. Boiler's burner test. Heat exchangers.

Lab assignments: Exercises upon copper tubing. Equipment and processes Identification upon vapor compression experimental unit. Elaboration and usage of manometer gauge. Operation, functionality and necessity of refrigerant circuit's service valves. Secure connection of manometer gauge. Refrigerant charging and recovery, purging and evacuation of experimental refrigeration unit.

M603 - Subject Didactics

ECTS 6.0

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.

M604 - Educational Technology - Multimedia**ECTS 4.5**

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.

M615 - Automatic Control Systems – Industrial Automations**ECTS 6.5**

Introduction to dynamic systems, analysis of industrial linear discrete/continuous time processes in time and frequency domain, the principles of simulation. Continuous system discretization. Design of industrial controllers, discrete-time and continuous time SISO systems. Pole placement and model matching, three-term controllers, identification processes, adaptive control.

Introduction to multivariable processes, input-output uncoupling. Properties of sensors, temperature sensors, pressure sensors, speed sensors, etc. Properties of actuators, hydraulic and pneumatic actuators, electric actuators, electromechanical actuators. Industrial controller manufacturing, microcontrollers, programmable logic controllers, computer system control. Controllers architecture, ergonomics, reliability. Controllers tuning. Industrial applications of automatic control systems: Automatic control systems for metal cutting systems, water supply systems, robot motors, respirators, greenhouses. Analysis and simulation of car brake systems, design of a hydraulic motor control system, lathe analysis, connected vehicle systems analysis and simulation, etc.

Lab assignments: Hydraulic and pneumatic control systems (PID controllers for pneumatic suspension systems, hydraulic system conversion), binary control applications.

M616 - Hydraulic – Pneumatic Systems**ECTS 6.5**

Hydraulic fluid flow. Positive-displacement pumps. Tank, filters. Piping. Valves (pressure control, flow control, direction control, one way). Hydraulic cylinders. Hydraulic motors. Applications of hydraulic circuits. Installation, commissioning, maintenance of hydraulic circuits. Applications of pneumatic systems.

Lab assignments: Hydraulic circuit design. Pneumatic circuit design.

7th SEMESTER**M701 - Environmental Protection Technologies****ECTS 5.0**

Introduction to the field. Main ecosystems. The problem of pollution. Global pollution. Bio-diversity reduction. Socio-economic cost of pollution. Cost of anti-pollution measures. Types of pollution/pollutants: Impacts and risk levels. Pollution of atmosphere. Industrial atmospheric pollution. Acid rain. Reduction of atmospheric ozone. The greenhouse effect. Climate change. Concrete carbonization. Metal, concrete and stone corrosion. Sea pollution/water pollution. Soil pollution. Other forms of pollution. Liquid and solid waste. Toxic waste. Radioactive pollution – nuclear accidents. Anti-pollution technologies and systems. Biological treatment of liquid waste. Primary, secondary and tertiary treatment processes. Silt treatment. Biogas production. Industrial wastewater treatment. Solid waste disposal, recovery and management system. Toxic and nuclear waste management. Other anti-pollution measures. Large-scale pollution, self-purification and technical purification processes. Spread of pollutants, simulation of the spread-

mathematical models. Regulations and legislation in Greece and Europe.

M702 - Basics of Economics – Operational Research**ECTS 6.5**

Fundamentals of political economy. Fundamentals of financial management. Investment plans. Pre-investment plans. Information collection for techno-economic studies. Studies, guidelines, options/alternative solutions. Computer applications. Examples of techno-economic studies. Feasibility studies of investment plans. Parameters of feasibility studies. Evaluation of investment plans. Mathematical programming. Linear programming – Linear models. Graphs. The Simplex method. Dynamic programming.

M703 - Technical Legislation**ECTS 6.5**

Work safety regulations and legislation. Legislation relating to the environment, electromechanical projects and processes, project assignments, and technical

companies. Management of workplace safety. Safety of buildings. Safety of transportation and transfer. Safety regulations relating to electrical installations, fire protection, welding processes, mechanical engineering equipment. Working conditions and hygiene. Hazardous substances control. Noise level control. Lighting. Radiation(s). Ventilation. Hazardous materials and substances. Management of materials-storing. Personal protection and first aids.

M704 - Quality Control – Quality Assurance

ECTS 5.5

Definitions of quality. Dimensions of quality. Cost of quality. Statistics for Quality Control. Quality tools. SPC: control chart for variables, control charts for attributes. Acceptance sampling. Design of experiments – Taguchi approach. Quality improvement & Total quality management. ISO 9000 series of standards. Accreditation and certification. Reliability. Food safety: The HAACP system and ISO 22000.

Lab assignments: Dimensional inspection & Quality control. Working examples in SPC. Working examples in Design of Experiments. Computerized data sampling and SPC.

M715 - Automobile Technology

ECTS 7.5

Drivetrain: Clutches dry friction, hydraulic, solenoid, torque converter, calculation of transferred torque, power, flat dry clutch friction limit slipping. Mechanical gearboxes, planetary systems, overdrive, automatic transmissions, CVT etc. Drive shafts, articulated joints, several simple, block-wheel drive systems. Calculating resistance movement, required torque to the wheels, power motion, motion diagrams, car power measurements. Steering: Dynamic of motion, understeer and oversteer, steering methods, kinematic chain, stub shaft arrangement, compasses steering assist systems, steering geometry, alignment, 4 wheel steering. Suspension system: Suspension springs, dependent and

independent suspensions, dampers, electronically controlled suspensions, dynamics of suspension. Braking system: Mechanical, hydraulic, pneumatic, electric and mixed braking systems, ABS, ESP, ASR, etc. Calculation of braking force and torque, braking time interval, brake system calculations, weight transfer during braking. Wheels - Tyres: Offset of wheels, wheels and rims types and characteristics. Limit driving: Slip in turn, overturning. Car aerodynamics: Drag, lift, side forces, airfoils, spoiler, improvement of aerodynamic characteristics.

Lab assignments: Disassembly and assembly car systems, car power measurements, simulation of driving a car, measurement of pulling power, acceleration, motion diagrams, alignment.

M716 - CNC Machine Tools

ECTS 7.5

Introduction to CNC (Computer Numerical Control): fundamentals & programming technology. Types of CNC machine tools (turning and machining centres, grinding machine tools, laser cutting machines and Coordinate Measuring Machines (CMMs). CNC hardware (positioning accuracy systems, sensors, kinematics and servo control). Direct Numerical Control (DNC), Computer-aided Numerical Control, Asynchronous serial communication (CNC-RS 232), Tooling and Fixturing devices - tool offsets. Conventional CNC programming (ISO) and Computer aided manufacturing (CNC - CAM). Process planning and machining parameters determination, CNC metrology (machine tool axes errors, interferometers, autocollimators, special devices)

Lab assignments: Manual and Computer aided NC programming of Turning and Machining centres, CNC code generation and Verification, Machining parameters determination regarding machine tool configurations, cutting tools and material properties.

8th SEMESTER

M801 – Teaching Practice

ECTS 4.0

M802 – Practical Work Experience

ECTS 6.0

M803 – Graduation Thesis

ECTS 20.0