APPROVED by the DEPARTMENT's ASSEMBLY
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INTERNATIONAL HELLENIC UNIVERSITY

SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE OUTLINE

DEPARTMENT OF MECHANICAL ENGINEERING

SERRES, 2023

EDITING GROUP (in alphabetical order)

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I.H.U. 2023

COURSES OUTLINE

1. COURSES OUTLINE

The courses are presented by Semester and Sector of Studies, briefly for each course, with the course description and syllabus.

1.1 1st Semester Courses

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0101	**SEMESTER**	1st
COURSE TITLE	**Mathematics I – Calculus of One Variable**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	5	7.5
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Functions: Definitions. Domain, range, even and odd function, composite and inverse function, types of functions - polynomial, exponential, logarithmic, trigonometric, hyperbolic, and their inverses. Graphical representation of a function. Parametric representation of a curve. Limits: Limit and continuity of a function. Derivatives: Definition of derivative. Geometric interpretation of derivative. Rate of change. Derivatives of basic functions, derivation of composite, implicit and inverse function, logarithmic derivation. Differential of a function. Applications of derivatives: Rolle's theorem and mean value theorem, function study - extreme values, monotonicity intervals, inflection points, curvature intervals, asymptotes of curve. Solving limits with de l' Hospital's rule. Taylor-Mc Laurin expansions. Indefinite integrals: Basic methods of integration - integration by substitution, integration by parts, Other methods of integration. Definite integrals: Definitions. Fundamental theorem of integral calculus. Mean value theorem of integral calculus. Applications of definite integrals - arc length of curve, area of plane region, work of force, work of reversible change. Generalized integrals: 1st, 2nd, and 3rd kind. Methods of solution. Cauchy's principal value.

Linear Algebra: Polynomials: Basic concepts, division of polynomials, finding roots - real and complex roots. Complex Numbers: Basic concepts. The complex plane. Representations of complex numbers. Operations with complex numbers. Vectors: Basic concepts and rules for handling vectors, operations

between vectors, the inner product of vectors, the outer product of vectors, applications. Matrices: Basic definitions, types of matrices and applications, operations between matrices, matrix multiplication, identity matrix, inverse matrix, unitary matrix, similarity of matrices, finding inverse matrix by row operations. Eigenvalues and eigenvectors of a matrix. Diagonalization of matrices. Determinants: Basic properties, calculation of determinant of invertible matrix. Linear systems: Solving linear systems - by Kramer's method, by the method of the inverse matrix.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0102	**SEMESTER**	1st
COURSE TITLE	**Physics I – Dynamics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction: Rules for handling vectors, derivatives and integrals.

Kinematics and Dynamics of the material point: Newton's laws, simple motions, work, energy, power, momentum, conservation principles of energy - momentum.

Dynamics of Rigid Body: translational and rotational motion around a fixed axis and a fixed point, general spatial motion, inertia tensor, angular momentum, conservation principles.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0103	**SEMESTER**	1st
COURSE TITLE	**Mechanical Drawing**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course,*		**WEEKLY TEACHING HOURS**	**CREDITS**

give the weekly teaching hours and the total credits		
Tutorials (Theory)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

1. Introduction to Mechanical Design, Drawing tools and paper, Drawing legend, Scales, Types of lines, Writing letters and numbers, Folding drawing papers, Parts list.

2. Drawing geometric shapes. Regular polygons inscribed or circumscribed in a circle. Ellipse, Archimedean spiral, helix. Drawing geometric constructions.

3. Drawing basic, partial, auxiliary, special views. Representation of object in views. Drawing views of reduction, limit positions, small slopes.

4. Rules for placing dimensions on symmetrical and non-symmetrical shapes. Observations and examples for the placement of dimensions

5. Full sections, half-sections, compound and partial section, inclination. Details and general observations for the drawing of the sections. Drawing from axonometric drawings and templates of the necessary views, sections, etc. Placement of dimensions and machining symbols.

6. Surface qualities and machining symbols. Tolerances of form and position. Examples of assemblies.

7. Intersections and developments. Developments of sheet metal, prismatic, cylindrical, conical, pyramidal, spherical pieces. Drawing developments of sheet metal constructions.

8. Representations of threads, screws, nuts - Representations of springs, gear wheels, standardized components. Assembled mechanical devices.

Execution of exercises, on an individual level or small groups, in the individual sections, delivery and evaluation of them.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0104	**SEMESTER**	1st
COURSE TITLE	**Introduction to Materials Science**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

i. Nature, structure and properties of materials.

ii. Crystal structure of Metals.

iii. Mechanical behavior of Metals.

iv. Phase equilibrium diagrams of Alloys.

v. Plastics and Ceramic materials.

vi. Nature of Materials (structure of matter, chemical compounds, chemical bonds).

vii. Structure of solids (crystalline solids, crystal systems, planes, axes, points and directions).

viii. Metals (crystalline structure, crystallization of metals, defects of their structure).

ix. Mechanical properties of materials (deformations, strength, creep, brittleness, wear and hardness).

x. Mechanical behavior of metals (stress and strain, tensile test, necking, recrystallization, fatigue).

xi. Electrical properties of metals.

xii. Thermal properties of metals.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0105	**SEMESTER**	1st
COURSE TITLE	**Technical Terminology – English**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Teaching in English and Greek language Exams in English language		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		

COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

1. Words and phrases in English that relate to the science of Mechanical Engineering.

2. Vocabulary enrichment: Use of words that match each other (collocation), compound words, opposites, synonyms, derivatives, etc.

3. Academic writing: The appropriate use of connectors for writing an academic text such as a scientific paper or an essay related to Mechanical Engineering, summarizing and drawing conclusions, the difference in style between a formal letter and a reply to an email message etc.

4. Structure of oral and written speech on topics of specialization. Practice using foreign texts and concepts of relevant terminology with the aim of correct use of corresponding bibliography.

1.2 2nd Semester Courses

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0201	**SEMESTER**	2nd
COURSE TITLE	**Mathematics II– Calculus of Several Variables**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Functions of several variables: Domain and geometric interpretation. The concept of curvature. Systems of curvilinear coordinates. Sphere, ellipsoid, cone, paraboloid, hyperbolic surfaces. Partial derivatives: First and second order - mixed derivative. Geometric interpretation. Physical interpretation. Partial derivatives of simple, composite, and implicit functions. The concept of the Jacobian. The total differential. Extreme values of functions of several variables - maxima, minima and "saddle" points. Extrema under conditions. Lagrange multipliers. Vector Analysis: Scalar and vector fields. Directional derivative. Gradient, divergence and curl. Physical interpretation. Conservative fields. Double integrals: Domain of integration. Solution of double integral in Cartesian and polar coordinates. Applications of double integrals - volume of solid body, moment of inertia. Triple integrals: Domain of integration. Solution of triple integral in Cartesian, cylindrical, and spherical coordinates. Curvilinear integrals: Methods of calculation and applications. Circulation of field - Work of force. Surface integrals: Methods of calculation. Gauss - Ostrogradsky theorem. Stokes theorem.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT
LEVEL OF STUDIES	UNDERGRADUATE

COURSE CODE	ΓΥ0202	**SEMESTER**	2nd
COURSE TITLE	**Physics II –Electromagnetism**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I, Dynamics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction: elements of vector analysis, complex numbers. Electrostatics (Coulomb's, Gauss's Laws): electric field, potential, analytical calculation of potential and intensity of electric field of simple geometric charge distributions, capacitance, dipoles, energy of charge distribution, electric field as carrier of electric energy. Dielectrics: electric displacement, dielectric polarization, energy density within dielectrics, piezoelectricity. Thermoelectric Phenomena. Study of Direct Current Circuits (Ohm's Law, Kirchhoff's Rules). Mechanisms of Conductivity of Solids & Fluids: conductors, insulators, semiconductors, dependence of conductivity on temperature - superconductivity, dependence of conductivity on factors.

Electrodynamics (Ampère's, Biot-Savart's, Faraday's Laws): magnetic field, analytical calculation of magnetic field intensity from simple arrangements of current-carrying conductors, Lorentz force, induction, magnetic materials, alternating currents, study of alternating current circuits with complex numbers. Electromagnetic waves.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0203	**SEMESTER**	2nd
COURSE TITLE	**Computer Aided Design (CAD) I**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Mechanical Drawing		
LANGUAGE OF INSTRUCTION	GREEK		

and EXAMINATIONS:	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/course/view.php?id=45

SYLLABUS

Introduction to Mechanical Design with the Aid of Computer: Types of coordinates (Cartesian, Polar coordinates, with relative or absolute declaration). Definition of edges (Straight, circle, ellipse, Bezier & B-Splines curves). Definition of surfaces (Flat, Linear, Rotational, Bezier & B-Splines). Definition of solids.

Two-dimensional design: Definition of coordinate system and design planes. Definition and creation of geometric entities. Additional design capabilities. Editing and modifying commands of the characteristics of geometric entities. Dimensioning. Management of drawings and printing of them.

Three-dimensional design: Basic principles of geometry of three-dimensional space. Coordinate systems. Techniques for creating solid models. Additional design capabilities. Parameterization of geometric features. Creation of assembly from individual components. Automatic creation of construction drawings from the three-dimensional model. Management of three-dimensional model for communication with CAE systems. Preparation of mechanical drawings with the aid of Computer in two-dimensional and three-dimensional design environment.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0204	**SEMESTER**	2nd
COURSE TITLE	**Mechanics I–Statics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Dynamics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to vector calculus / Coplanar forces / Center of gravity of a body / Beams - Diagrams [N], [Q], [M] / Moments of inertia of section / Frames / Networks / Arches / Flexible carriers - cables / Friction / Composite carriers / Carriers in Space

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0205	**SEMESTER**	2nd
COURSE TITLE	**Computer Programming, I**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to Matlab environment, Description of the environment, Basic mathematical operations, Variables Functions of the command window (Command Window), Number formatting (format), Help options, Creation of simple and special types of matrices, Operations with matrices (Addition - Subtraction - Multiplication - Division of matrices and elements, Deletion of columns and rows). Special functions: Inverse and Transpose matrix, Raising matrix to power, Creating a unit matrix of order n, matrix of order n consisting only of zeros and only of units, magic matrix of order n, Euler angles. Graphical representations of simple functions. Graphical representations of trigonometric, logarithmic functions. More settings (editing graphical representations). Saving graphical representations. Polynomials: Roots of polynomials, Calculation of polynomial values, Multiplication / Division between polynomials. Derivation of polynomials. Polynomial approximation. Interpolation with third-order sp-lines, Third-order interpolation, Symbolic representation of variables. Limits. Derivatives and Integrals Graphical representations of symbolic functions.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0206	**SEMESTER**	2nd
COURSE TITLE	**Labour Safety – Ergonomics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**

	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	OXI		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Organization of occupational safety / Hazardous working conditions.

Electrical installation safety / Fire safety / Transport and storage safety.

Special topics of various machines and installations.

Accident management / Laws, statistics and organizations related to occupational safety and accidents.

Concept of environment and its protection / Ecological - socio-economic burden from pollution and private-economic cost of decontamination.

Determination of acceptable level of pollution. Regulations and legislation.

Aerosols and other gaseous industrial pollutants.

Mechanical equipment for decontamination.

Liquid waste.

General about biological treatment (BOD, COD, biochemical reactors).

Primary cleaning, secondary cleaning / Tertiary cleaning.

Sludge disposal - Energy utilization (biogas production).

Material recovery / Treatment of waste from special industries / Solid waste / Methods of disposal, energy utilization and material recovery.

Other forms of pollution.

Pollution of large systems.

Natural self-cleaning and artificial cleaning / Simulation and models.

1.3 3rd Semester Courses

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0301	**SEMESTER**	3rd
COURSE TITLE	**Mathematics III – Differential Equations**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I, Mathematics II		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Differential equations (DE) of 1st order: General solution, partial solutions, orthogonal trajectories. Existence theorem of Cauchy's solution. Types: Separable variables. DE reducible to separable variables. Homogeneous DE of 1st order. DE reducible to homogeneous. Linear DE - The method of Lagrange's variable coefficients. The DE of Bernoulli. The DE of Riccati. Complete DE of 1st order. The Euler integral factor. Solutions with tricks.

Differential equations (DE) of 2nd order: General solution, partial solutions. Solution of linear DE of 2nd order with variable coefficients. The Wronski determinant. Transformations of the dependent and independent variable. Reduction of the order of a DE of 2nd order. Solution of linear DE of 2nd order with constant coefficients. The general solution of the homogeneous. The general solution of the complete.

Linear systems of DE of 1st order: The method of elimination. The method of eigenvalues. Models in matrix form. Normal form and the transition matrix.

Introduction to DE with partial derivatives. Applications for Engineers.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΕΥ0302	**SEMESTER**	3rd

COURSE TITLE	**Thermodynamics I**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Dynamics, Mathematics II		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Basic Concepts: Thermodynamic state variables and process variables, state equation of ideal gases, absolute temperature. 1st Law of Thermodynamics: formulation for closed and open systems of steady flow, calculation of work and heat. 2nd Law of Thermodynamics: cyclic processes, Carnot cycle, entropy, dissipation work. Applications of the 1st and 2nd Law: ideal gases, gas engines: compressors, gas turbines (Joule and Ericson cycles), piston engines of internal combustion (Otto, Diesel and Seiliger cycles). Vapors: characteristic quantities of steam, tables and diagrams of steam - Mollier h-s diagram, cycles of power generation plants with steam (Clausius-Rankine), refrigeration cycles (compression and absorption).

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0303	**SEMESTER**	3rd
COURSE TITLE	**Computer Aided Design (CAD) II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	CAD I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Includes the teaching of the principles and techniques of representation of mechanical connections, e.g., screw connections, welds, etc., as well as their symbols. The teaching of the principles, techniques of representation and symbols of the various methods of welding, the representation of gear wheels, as well as pulleys and sprockets. The way of using tables of standardized elements (rolling bearings, sealing elements, screws, nuts, washers, etc.) is presented.

Within the framework of the course's lectures, two-dimensional and three-dimensional design of a series of tests and mechanical components takes place, as well as a complex exercise of developing a mechanical device using standardized components and mechanical connections, such as, for example, a single-gear reducer. At the same time, the construction drawings of the involved components are developed in detail, the summary drawing of the whole device, the list of parts, etc.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0304	**SEMESTER**	3rd
COURSE TITLE	**Mechanics II – Material Strength**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Mechanics I - Statics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

1. Basic concepts of materials mechanics. Stress-strain diagrams
2. Axial tension - compression
3. Biaxial tension - compression
4. Plane stress and plane strain
5. Moments of inertia of arbitrary section
6. Bending of beam
7. Elastic line
8. Torsion of beam

9. Buckling
10. Double and asymmetric bending
11. Composite stress
12. Energy methods
13. Solution of hyperstatic carriers

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0305	**SEMESTER**	3rd
COURSE TITLE	**Computer Programming II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I, Mathematics II, Computer Programming I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Programming in Matlab environment: Symbolic representation of variables. Algorithms - Commands. Special functions: Roots of algebraic equations, Series, Limits, Derivatives and Integrals. Special topics in Matlab: Finding roots of polynomial and nonlinear equations (analytical and graphical method). Numerical interpolation. Numerical differentiation and integration of functions. Solving integrals in power series form. Numerical solution of first order differential equations. Applications in Dynamics and E/M.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0306	**SEMESTER**	3rd
COURSE TITLE	**Production Management**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**

	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Product Design,

Production capacity design,

Work Study,

Site selection,

Spatial planning,

Forecasting methods,

Inventory planning and control,

Production planning.

1.4 4th Semester Courses

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0401	**SEMESTER**	4th
COURSE TITLE	**Numerical Analysis**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I, Mathematics II, Mathematics III		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Computational errors: Basic concepts, types of errors, error propagation in numerical calculations. Approximate expressions of functions: The coincident polynomial and the polynomials of Taylor and Mc Laurin. Applications to numerical methods of solving problems - integration of functions in non-closed form. Numerical solution of algebraic equations: Finding roots - method of regula falsi, method of Newton-Raphson. Numerical interpolation: Linear interpolation, complete interpolation with Newton's method. Double linear interpolation. Numerical differentiation: Linear differentiation, complete differentiation with the help of Newton's coincident polynomial. Numerical integration: Trapezoidal method, Newton-Cotes method. Numerical solution of first order differential equations: Euler's method, Taylor's method, Runge-Kutta method of 2nd and 4th order.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0402	**SEMESTER**	4th
COURSE TITLE	**Fluid Mechanics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**

Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background	
PREREQUISITE COURSES:	Mathematics II, Mathematics III, Thermodynamics I	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/	

SYLLABUS

Fluid Mechanics: Basic properties of fluids. Systems of units and dependence between units. Basic equations of Fluid Mechanics: Conservation of Mass (continuity equation), Conservation of Linear and Angular Momentum (2nd law of motion of Newton), Conservation of Energy (1st thermodynamic axiom), State Equations. Hydrostatics: Point pressure and distribution with fluid depth, pressure measurement & manometers, absolute, relative and atmospheric pressure, static & dynamic pressure, forces on flat (vertical, horizontal & inclined) and curved surfaces, buoyancy. Basic Fluid Mechanics: Acceleration of fluid element - 2nd Law of Newton, Bernoulli equation, static, dynamic & total pressure, velocity measurement with Pitot-Static tube, applications of Bernoulli equation, energy line & piezometric line, deviations from Bernoulli equation. Kinematics of Fluids: Velocity Field (flow description by Euler or Lagrange, 1D, 2D & 3D flow, steady & unsteady flow, streamlines, streaklines & pathlines), Acceleration Field (the material derivative, unsteady phenomena, convection phenomena), Control Volume, Reynolds Transport Theorem (steady & unsteady phenomena, the theorem for moving control volumes, selection of control volume). Dimensional Analysis and Similarity, Buckingham Theorem. Definition and physical interpretation of the Dimensionless Numbers of Fluid Mechanics (Reynolds, Mach, Froude, Weber, etc.). Analysis of forces and flow of elementary fluid particle and derivation of the differential equations of fluid motion (Navier-Stokes). Analysis and interpretation of the various terms of this equation. Flow in Closed Conduits: Laminar & turbulent flow, flow at the entrance of the conduit, pressure & shear stress, fully developed laminar flow, fully developed turbulent flow, transition from laminar to turbulent flow, turbulent shear stress, velocity distribution in turbulent flow, dimensional analysis of flow in closed conduits, linear losses, local losses.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0403	**SEMESTER**	4th
COURSE TITLE	**Engineering Materials Technology**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		3	4.5
COURSE TYPE *general background, special background, specialised general*	Special background		

knowledge, skills development	
PREREQUISITE COURSES:	Introduction to Materials Science
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

i. Characteristics of the most important Mechanical Materials.

ii. Properties of the most important Mechanical Materials.

iii. Applications of the most important Mechanical Materials.

iv. Methods of preparation or production of Mechanical Materials.

v. Phase equilibrium diagrams of the most important Mechanical Materials.

vi. Methods of determination and control-characterization of Mechanical Materials.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0404	**SEMESTER**	4th
COURSE TITLE	**Machining Technology I**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Mechanical Drawing		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Measurements: General elements about measurements. Basic approach to the measurement system (basic parts). Measuring instruments - definitions (accuracy, correctness, fidelity, range, repeatability, reproducibility, resolution, sensitivity, reliability). Specifications of measuring instruments, operating principles. Measurement standards (basic and productive units of SI). Measurement errors (absolute, relative). Causes of errors. Classification of errors (systematic, random, composite). Tolerances, fittings,

length standards, dimension and angle control. High precision measurements (hierarchy of standards, certified reference materials, traceability). Basic concepts around verification.

Workshop: Raw materials, specifications, order. Phase diagram of construction works. Technical specifications, tool order, standardization. Modern tools - equipment.

Foundry: Raw materials, specifications, order. Models of castings. Tools and basic casting operations. Molding and various casting methods. Mechanical molding. Processing of cast objects, control of castings.

Welding: Electric welding, oxy-fuel welding, TIG, MIG, MAG welding. Oxy-fuel cutting. Soft soldering.

Pipe work: Raw materials, specifications, order. Tools, machines. Pipe networks, network control. Pipe colors-Symbols.

Elasturgy: Raw materials, specifications, order. Machines tools and measuring instruments. Technical characteristics, operating principles, maintenance. Shaping and cutting of elastics.

Workshop Safety: About accidents. Regulation for the smooth operation in the laboratory. Obligations of employers and employees. Machine safety and safe use of tools and devices. Safety signage according to National Legislation and Community Directives.

Laboratory Exercises (every 3 weeks of classes):

Exercise in length measurements with high-resolution measuring instruments. Checking dimensions and surfaces of ready-made mass-produced mechanical products.

Construction of a two-piece assembly with a tolerance of ±0.1 mm.

Mechanical molding and metal casting.

Construction of a typical pipe network with steel pipe and copper pipe.

Welding of three pieces with arc welding and TIG.

Welding of elastics with oxy-fuel welding.

Oxy-fuel cutting of metals.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0405	**SEMESTER**	4th
COURSE TITLE	**Machine Elements I**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Mechanical Drawing		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		

COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Standardization of components: Dimensional tolerances, fits. Dynamic loading. Safety factor. Materials: failures, basic properties, selection criteria.

Fusion welds: advantages-disadvantages, seam shapes, gap shapes, seam thickness, strength test, examples of correct welded constructions. Pressure welds: connection shape, strength test, examples of correct constructions.

Elements of the technique of rivets and their mechanical behavior. Connections with pins.

Screws: General description, relation of tightening torque - axial force and its applications. Tightening screws: pre-tension and operating forces, cold settling, adjustment of the tightening torque, specifications of good operation of the screw connection, strength test. Applied screws, elastic washers. Motion screws.

Axles - spindles: Shape, function, dimensioning. Strength test of spindles: Dynamic loading, equivalent stress, size factor, surface factor, shape factor, support factor, safety against dynamic fracture and against plastic deformation. Deformations and vibrations of spindles. Wedges, polyspines. Fixed and movable spindle joints, clutches.

Rolling bearings: Types of bearings and properties of each type. Fixed-mobile bearing action, floating bearing action, bearing action with pre-tensioning, bearing failures, static strength test, calculation of life duration, examples of bearing assemblies.

Laboratory Exercises (every 3 weeks of classes):

Application of the theory both in the strength test of components and in their dimensioning. Disassembly of simple mechanical constructions, free body diagrams of the components, power flow in the schematic design of the construction.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0406	**SEMESTER**	4th
COURSE TITLE	**Production Units Administration**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	3	4.5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Mathematics I, Production Management		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		

COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Introduction: Economic unit - Businesses - Distinctions between them. Production system and business environment. Wealth, cost, depreciation, break-even point, efficiency, productivity. Cost standards.

Basic principles of Operations Research: Maximization of profit and minimization of cost (Linear Programming - the graphical method and the Simplex method). Product distribution and inventory management (Transportation models). Personnel management (The Hungarian method).

Industrial Business: The characteristic elements of modern industrial businesses, basic functions of the industrial business, productivity - efficiency, forms and systems of industrial production, industrial buildings, spatial planning of production systems. Production design. Organization and control of production and distribution of products. Quantitative methods of decision making.

1.5 5th Semester Courses

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΥ0501	**SEMESTER**	5th
COURSE TITLE	**Statistics & Probability Theory**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	Mathematics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Combinatorial Analysis (Permutations, Repeated Permutations, Combinations, Arrangements, Repeated Arrangements, Repeated Combinations). The principle of Enumeration. Examples.

Basic concepts of Statistics (Random Variable, Population, Sample). Methods and Organization of Sampling. Descriptive Statistics. Classes - Frequencies - Cumulative and Relative Frequency. Statistical Tables and Graphs.

Parameters of Central Tendency (Arithmetic - Geometric - Harmonic mean, Mode and Median. Properties. Parameters of Dispersion (Variance and Standard Deviation). The same parameters in data given in Classes. Transformations and their properties. The Z transformation.

Probabilities (Experiment of chance, Sample space, Simple Event, Event). Reminders from Set Theory, Venn diagrams, proofs of properties. The concept of Probability and its properties. Probability Exercises. Conditional Probabilities. Properties. Bayes' Theorem.

Probability Distribution Functions in Discrete Random Variables (Definitions, Symbols, Mathematical Expectation - Variance and their properties, Cumulative Probability). Binomial Distribution. Poisson Distribution. Examples.

Probability Distribution Functions in Continuous Random Variables (Definitions, Symbols, Mathematical Expectation - Variance and their properties). The Uniform Distribution.

Polynomial and Exponential Probability Distribution Functions. The Normal Distribution and the Standard Normal Distribution. Examples.

The Student Distribution (t-Distribution). Estimation (Sampling Distributions for the Mean, for Differences of Means and for Ratios. Central Limit Theorem (C.L.T.). Confidence Intervals for the Mean. Confidence Intervals for the Difference of the Means. Regression (Linear, Exponential and Logarithmic) and Correlation.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0502	**SEMESTER**	5th
COURSE TITLE	**Thermodynamics II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Mathematics I, Thermodynamics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Gas mixtures: mass, mole, volume percentages. Ideal gas mixtures: calculation of internal energy, enthalpy, entropy, mixing entropy. Gas and vapor mixtures, moist air: absolute and relative humidity, specific enthalpy, applications in air conditioning: h-x diagram of Mollier. Combustion: combustion equations, calculation of required air, composition, quantity and volume of flue gases, as well as combustion temperature, solid, liquid and gaseous fuels. Calculation of air ratio based on the composition of flue gases. Calculation of combustion efficiency. Flows: continuity equation, momentum theorem, dependence of flow velocity on pressure and cross-section of the duct, nozzles and diffusers, applications in propulsion systems.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0503	**SEMESTER**	5th
COURSE TITLE	**Electrical Technology & Electronics**		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY**	**CREDITS**

if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits	**TEACHING HOURS**	
Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background	
PREREQUISITE COURSES:	Physics II - Electromagnetism	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/	

SYLLABUS

- Introduction - Electric Circuits. Basic electrical quantities. Active and passive elements.
- Ohm's law, Kirchhoff's laws.
- Basic electric circuits with series or parallel connection of elements. Voltage divider and current divider.
- Methods of analysis of electric circuits, principle of superposition.
- Thevenin and Norton theorems, Source Transformation - Theorems of Millman and Kenelly.
- Alternating currents. Representation of sinusoidal quantities with vectors.
- Power of alternating current in a dipole with resistive, inductive or capacitive resistance.
- Three-phase systems, three-phase power, Compensation of electrical installations

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0504	**SEMESTER**	5th
COURSE TITLE	**Machine Elements II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Machine Elements I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

TRANSMISSION SYSTEMS OF MOTION

1. Motion transmission system with toothed wheels. General. Geometry of gear drives, materials of construction of toothed wheels, methods of construction of toothed wheels, machining of toothed wheels, construction errors. Displacement of pitch, loads of toothed wheels. Methods of calculation of toothed wheels. Spur gears with straight teeth. Geometry, stresses, methods of calculation and dimensioning.

Spur gears with helical teeth. Geometry, stresses, methods of calculation and dimensioning.

Bevel gears with straight teeth. Geometry, stresses, methods of calculation and dimensioning.

Bevel gears with helical teeth. Geometry, stresses, methods of calculation and dimensioning.

Worm gear pair. Geometry, stresses, methods of calculation and dimensioning.

2. Motion transmission system with belts. General. Geometry of belt drives, materials of construction of belts and their pulleys, construction errors. Slippage of belts, tension of belts. Methods of calculation of belt drives. Motion transmission with flat belts. Geometry, stresses, methods of calculation and dimensioning.

Motion transmission with trapezoidal belts. Geometry, stresses, methods of calculation and dimensioning. Motion transmission with toothed belts. Geometry, stresses, methods of calculation and dimensioning. High torque toothed belts HTD.

3. Motion transmission system with chains. General. Geometry of chain drives, materials of construction of the toothed wheels of the chains, materials of construction of the chains, types of chains. Construction errors. Loads of chains. Methods of calculation of chain drives

Motion transmission with chains. Geometry, stresses, methods of calculation and dimensioning.

SLIDING BEARINGS

Description of sliding bearings. Geometry in general. Mode of operation. Calculation of velocities, hydrodynamic wedge. Lubricants used. Methods of calculation and dimensioning.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0505	**SEMESTER**	5th
COURSE TITLE	**Machine Dynamics & Vibrations**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Dynamics, Mathematics I, Mathematics III		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		

COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Theoretical part: (a) Vibration of dynamic systems with one degree of freedom. Analysis of Mechanical Systems: introduction, means of elastic deformations. Free vibration without damping: translational vibration, rotational vibration. Free vibration with damping: translational vibration, rotational vibration, categories of damping. Forced Vibration: equation of motion, forced vibration with negligible damping, response to harmonic excitation. Applications: selection of machine foundation characteristics, operating principles of instruments for measuring oscillatory quantities. (b) Vibration of dynamic systems with multiple degrees of freedom. Systems without damping: formulation and solution of eigenvalue problem, determination of response. Systems with damping: the Caughey method, the Duncan method, systems under harmonic excitation. Practice Exercises: Computational exploration of the oscillatory behavior of mechanical systems through simulation in Matlab environment, as well as using suitable experimental setups. Measurement and estimation of the basic quantities of vibration, experimental verification of laws, derivation of relations between quantities using experimental data.

1.6 6th Semester Courses

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0601	**SEMESTER**	6th
COURSE TITLE	**Heat Transfer**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Thermodynamics I, Thermodynamics II, Fluid Mechanics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to the basic concepts and mechanisms of Heat Transfer.

- Heat transfer by conduction: Fourier's law, Thermal conductivity of solids, liquids and gases, Steady one-dimensional heat transfer in a plane wall, cylindrical wall, spherical wall, composite walls in series and parallel connection.
- Heat transfer by convection: Newton's law, Flow of viscous fluid, Introduction to the concept of thermal boundary layer, Methodology of solving convection problems, Use of dimensionless numbers, Forced convection over flat plates and inside - outside ducts of cylindrical or other cross-section, Free convection in infinite - finite space.
- Heat transfer by radiation: Stefan-Boltzmann law, Planck distribution, Absorption and emission of electromagnetic radiation, Methods of calculating heat fluxes exchanged by radiation, Wien's law, View factors, symmetry rules, superposition, reciprocity.
- Heat exchangers: Types of heat exchangers, Types of flows in heat exchangers, Heat transfer coefficient, Calculation of required heat exchange area in exchangers, Calculation of mean logarithmic temperature difference, Number of transfer units (NTU), Heat transfer during phase change: boiling - condensation.
- Combined heat transfer problems in complex geometries.
- Finned surfaces and fins, Transient thermal conduction
- Applied examples of Heat Transfer in industrial applications and buildings.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0602	**SEMESTER**	6th
COURSE TITLE	**Electric Engines**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	Physics II - Electromagnetism, Electrical Technology & Electronics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Basic concepts and phenomena of electromagnetism. Direct current machines, generators and motors: operating principle, constructional elements, voltage, internal torque, behavior for different types of excitation, under load. Alternating current machines, synchronous and asynchronous. Sinusoidal distributed vacuum magnetic fields, magnetic fields in machines with multiple magnetic poles, internal constructional elements. Synchronous machines: constructional and operational characteristics, synchronization and start-up for generator and motor. Asynchronous machines: advantages, operating principle and characteristics of induction machine, start-up and speed control of asynchronous motors.

Generators & direct current motors: Connections, conversion, characteristics, selection, faults, speed regulation of direct current motors, WARD-LEONARD system. Synchronous generator & motor: Connections, conversion, characteristics, selection, faults, power factor correction. Asynchronous short-circuited rotor motor: Start-up methods. Asynchronous ring motor: Characteristics, measurement of losses and efficiency. Installation and connection of motor. Asynchronous single-phase motors (with resistance - with capacitor): Start-up methods - Change of direction of rotation. Operation of three-phase motors as single-phase - Change of direction of rotation

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0603	**SEMESTER**	6th
COURSE TITLE	**Internal Combustion Engines**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	WEEKLY TEACHING HOURS	CREDITS
Tutorials (Theory)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Operating principles, classification and description of ICE elements. Structure, composition and materials of ICE. Thermodynamic cycles of operation, gasoline engines, diesel engines and accessories. Constructional and operational parameters: torque, mean pressure, work, power, various degrees of efficiency, consumption. Conventional fuel supply systems for gasoline and diesel engines. Thermochemistry of air-fuel mixtures. Study of theoretical cycles of operation with air and with air-fuel mixture. Conventional and alternative fuels. Lubricants. Gas exchange process: volumetric efficiency, flow through valves, residual exhaust gas, scavenging, flow through ports, supercharging. Fuel delivery regulation: mixture requirements, mixture formation, carburetor, injection systems in Otto and Diesel engines. Combustion in Otto and Diesel engines: normal and knock combustion, fuel quality, octane number, cetane number. Operational characteristics of Otto and Diesel engines, naturally aspirated and supercharged. Pollutant formation and pollution control technologies. Measurement techniques in ICE. Energy behavior of ICE, heat transfer, thermal calculation of engine, supercharging. Selection criteria of ICE, faults, maintenance. Special types of ICE. Vehicle systems that carry ICE.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0604	**SEMESTER**	6th
COURSE TITLE	**Metrology – Quality Control**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	WEEKLY TEACHING HOURS	CREDITS
Tutorials (Theory)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	CAD II
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Introduction to the concept of Quality. Presentation of modern quality control methods with special emphasis on statistical quality control techniques, acceptance quality control, production process control and quality improvement in the design phase. Analysis of the ISO 9000:2008 series of standards, ISO 17025 and ISO 22000.

Physical quantities and measurements (Distinction of quantities, systems of units, error theory, measurement uncertainty, instrument calibration). Dimensional Metrology. Geometric characteristics of technological surfaces. Symbolism. Measurement of straightness, flatness, perpendicularity. Measurement systems of sphericity, circularity, cylindricity. Angle measurement. Thread measurement. Dimension and tolerance control using CMM measuring machines.

Fundamental concepts of measurement systems, Sensor characteristics, Position and displacement measurements, Level measurements, Temperature measurements, Density and pressure measurements, Flow measurements, Speed and acceleration measurements, Force and torque measurements, Magnetic field measurements, Weak and high current measurements, Touch sensors, Optical quantity measurements, Acoustic quantity measurements.

Multiplexing and sampling arrangements in measurement systems using sensors, ADC and DAC converters, Signal adaptation techniques and arrangements, Basic concepts of signal processing, Data collection, display and recording systems.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EY0605	**SEMESTER**	6th
COURSE TITLE	**Management & Implementation of Technical Projects**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

The course is implemented through lectures and active participation in solving practice problems, as well as by writing a relevant topic with a practical dimension.

Principles of team management, the characteristics of the leader, team member relations, team spirit/individual effort, methodologies for evaluating human resources, team member selection, skills and weaknesses. Economic management of the project, vouchers, cash, inflows / outflows, accounting systems, legislation, methodologies for economic monitoring of the project. Safety during the implementation of technical work, description of accidents, prevention methodologies, legislation, plan & health and safety sheet of the project. Time scheduling of the project diagrams PERT & GANT, critical path, project completion time, probabilities, project phases, resources for the implementation of the project, application in Microsoft Project.

The course is examined through the elaboration of a work, in which each student must shape the framework of implementation of a technical project, applying what he learned.

1.7 7th Semester Courses

MANUFACTURING SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)			
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT			
LEVEL OF STUDIES	UNDERGRADUATE			
COURSE CODE	KK0701	**SEMESTER**	7th	
COURSE TITLE	**Machining Technology II**			
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*			**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)			
PREREQUISITE COURSES:	Machining Technology I			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/			

SYLLABUS

Theoretical Part:

A) MECHANICAL PROCESSES WITH MATERIAL REMOVAL: Metal cutting, cutting conditions, cutting tool materials, cutting forces and power, quality of machined surfaces by cutting.

B) LATHES: Basic parts of a parallel lathe, holding objects on the lathe, tools and cutting conditions on the lathe, types of turning, hydraulic copiers.

C) MILLING MACHINES: General, UNIVERSAL milling machines, cutting tools, cutting tool materials, cutting conditions, gear cutting (divider)

D) DRILLING MACHINES: General, types of drills, drill cutting tools, cutting conditions.

E) DRILLS:. General, types of drills, drill cutting tools, cutting conditions.

F) PLANERS: General, basic parts and operation of transverse planer, cutting conditions, work performed on the planer.

Laboratory Exercises (every 3 weeks of classes):

Training in the handling and operation of conventional machine tools (lathe, milling machine, drilling machine, drill, planer), performing a set of different exercises. Training in theoretical subjects related to the technology of machining with material removal. The selection of the exercises is such that, in order to be

implemented, each student must make use of almost all the possibilities of the conventional machine tools, not only getting a taste of the process of making a piece, but also with the questions that arise during his effort, to give answers, to fully understand the difficulties of the machining sequence, and to form an opinion on the machining flow. Thus, in the end, he is ready as an Engineer to guide the respective machine tool operator.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0702	**SEMESTER**	7th
COURSE TITLE	**Electrical & Mechanical Installations**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Description of the installation of mechanical elevator in buildings. Requirements of the regulations, new regulation ELOT 81.20. Development of the issue of calculations, technical description and required drawings in a complete study of the installation.

Description of the installation of hydraulic elevator in buildings. Requirements of the regulations, new regulation ELOT 81.50, usual practice and peculiarities. Development of the issue of calculations, technical description and required drawings in a complete study of the installation.

Description of the water supply and sewerage installation in buildings. Requirements of the regulations, usual practice and peculiarities. Development of the issue of calculations, technical description and required drawings in a complete study of the hydraulic installation.

Description of the natural gas installation in residential buildings and industries. Requirements of the regulations, usual practice and peculiarities. Development of the issue of calculations, technical description and required drawings in a complete study of the installation.

Description of the electrical installation in buildings. Requirements of the regulations, usual practice and peculiarities. Grounding installation. Development of the issue of calculations, technical description and required drawings in a complete study of the electrical installation.

Description of the installation of electric substation in buildings. Requirements of the regulations, usual practice and peculiarities. Development of the issue of calculations, technical description and required drawings in a complete study of the installation.

Description of the fire safety installation in all types of buildings. Requirements of the regulations, usual practice and peculiarities. Development of the issue of calculations, technical description and required drawings in a complete study of the installation.

Description of the lightning protection installation in buildings. Requirements of the regulations, usual practice and peculiarities. Development of the issue of calculations, technical description and required drawings in a complete study of the installation.

Description of the environmental impact studies for various installations. Requirements of the regulations. Development of the issue of calculations, technical description and required drawings in a complete environmental impact study.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0703	**SEMESTER**	7th
COURSE TITLE	**Finite Elements I**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		
PREREQUISITE COURSES:	Computer Programming, I & II, Statics, Strength of Materials		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Theoretical Part:

1. Introduction. The Rayleigh - Ritz method. The Galerkin method.
2. One-dimensional problems. Axial tension. Rod in torsion. Development of stiffness matrices.
3. Networks. Development of the stiffness matrix.
4. Beams and frames. Calculation of stiffness matrices. Equivalent nodal loads of the element.
5. Two-dimensional problems. Triangle with constant strain
6. Quadrilateral and triangular elements of higher order. Numerical integration.
7. Symmetric bodies of revolution with symmetric loads of revolution.

8. Solids in space. Isoparametric elements.

9. The dynamics of mechanical structures.

10. Field problems. The Galerkin method. Heat transfer.

11. Problems with constraints on the boundary conditions.

Laboratory Exercises (every 3 weeks of classes):

Applications of computational stress - strain analysis of mechanical structures with the finite element method (FEA) using suitable software PC, ANSYS classic.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0704	**SEMESTER**	7th
COURSE TITLE	**Casting & Welding**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		
PREREQUISITE COURSES:	Materials Technology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Casting of materials. Phenomena during solidification and crystallization of the material. Castability of materials. Casting methods. Feeding systems of molten metal. Metallographic and non-destructive testing of castings. Types of connections. Thermal source of welds. Heat flow density. Thermally affected zone. Advantages and disadvantages of welds. Weldability of materials. Fusion welds. Pressure welds. Heterogeneous welds.

Symbolism of welds. Preparation of the ends of the pieces to be welded. Quality control of welds. Criteria for selecting the welding method. Safety measures during welding.

ENERGY SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0701	**SEMESTER**	7th
COURSE TITLE	**Automation Control**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Concept of Automation - introduction to SAE - Examples from the practice of technology. Mathematical models of SAE calculation - use of Laplace transform & transfer functions - Boole algebra and matrices. Application of structural diagrams and signal flow diagrams in the analysis of automations. Constituent units of electrical automations. Design and synthesis of electrical automations. Constituent units of pneumatic - hydraulic automations. Design and synthesis of pneumatic - hydraulic automations. Constituent units of electronic automations.

Areas of interest and applications of sensors. Types and characteristics of sensors (Proximity detection, linear and angular displacement sensors, acceleration, deformation, force, pressure, flow, temperature, distance sensors). Data acquisition devices. A/D converters. Analog sensor interface with PC. Signal reception. Data processing of measurements. Measurement errors.

Microcontrollers (micro-controller). Programmable logic controllers (PLC). Industrial networks and SCADA systems. PC connection with measuring devices for the collection and processing of signals in real time and then control device based on the continuously measured quantities. Supervision and monitoring in real time the operation of industrial units-installations. Integrated solutions for industrial automation.

Laboratory Exercises (every 3 weeks of classes):

Design, synthesis and application of automations with:

- Hydraulic systems
- Pneumatic systems

- Electrical systems
- Combinations thereof using PLC.

Laboratory applications using sensors for receiving and processing measurement signals in the control of simple mechanical applications:

- Measurements and temperature control.
- Measurements and pressure control.
- Measurements and control of linear - angular displacement of axis.
- Applications for proximity detection of inductive, capacitive sensors.
- Programming microprocessors and PLCs as parts of industrial automations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0702	**SEMESTER**	7th
COURSE TITLE	**Vehicle Motion Systems**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	Internal Combustion Engines		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Types and structure of vehicles, engine and power transmission systems. Suspension and wheels. Steering system. Braking system. Formation and control of pollutants: nitrogen oxides, carbon monoxide, unburned hydrocarbons, particles, exhaust gas treatment. Catalytic converters and emission control systems. Dynamometers and simulation of operation in laboratory conditions. Measurement and assessment of environmental performance of vehicles. Vehicle diagnosis and monitoring systems. Energy behavior of vehicles. Vehicle operation support systems. Safety systems. Autonomous Driving Systems. Hybrid vehicle technology. Electric vehicle technology. Hydrogen and fuel cell technology. Autonomous driving.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)

ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0703	**SEMESTER**	7th
COURSE TITLE	**Renewable Energy Sources**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	Thermodynamics I, Heat Transfer, Fluid Mechanics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Course objective: The ability to understand the phenomena related to renewable energy sources and their conversion into useful work. The calculation of the potential of renewable energy sources. The calculation of the environmental impacts from the use of RES.

Course description:

The course is implemented through lectures and active participation in solving problems of practice on laboratory devices. General for RES, possibilities and limits of use of RES, coverage of energy needs with RES, problems and current efforts for their exploitation. Fundamentals of wind energy, wind characteristics, boundary layer, wind energy, anemological measurements, Betz limit, types of wind turbines (W/T), W/T efficiency, main parts of W/T, wind farms, analysis of forces on W/T blades, airfoils, calculation of annual generated energy, economic component of wind energy, fundamentals of solar energy, solar radiation, solar constant, characteristics of solar radiation outside and inside the earth's atmosphere, position and motion of the sun in relation to an observer on the surface of the Earth, direct and diffuse solar radiation, methods and instruments of measurement, calculation of solar radiation, flat solar collectors, operating principles, energy balance, performance characteristics, selective surfaces, concentrating solar collectors, efficiency degrees, photovoltaic elements (P/V), performance characteristics P/V, ways of connecting P/V, efficiency degrees, hydroelectric power plants, types of hydroelectric power plants, calculation of generated energy from hydroelectric power plants, biomass, combustion, pyrolysis, gasification, biofuels, small hydroelectric projects, types of turbines, calculation of generated energy from hydroelectric power plants, economic data on RES investments.

Laboratory Exercises (every 3 weeks of classes):

Measurement of wind power potential, operation characteristics of a small laboratory W/T and calculation of its efficiency, effect of the angle of attack of the blades on the characteristics of the W/T, measurement of operating characteristics P/V in the laboratory and outdoors, measurement of the effect of connection P/V, energy balance in solar collectors, visit to a facility producing energy from RES.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0704	**SEMESTER**	7th
COURSE TITLE	**Advances in Fluid Mechanics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Boundary layer theory in laminar and turbulent state. Transition of laminar boundary layer to turbulent. Boundary layer and pressure gradient (limited and non-limited flows). Separation and reattachment of boundary layer. Exact equations of boundary layer. Approximate equations of boundary layer.
- Hydraulic shock theory. Conditions for the formation of hydraulic shock and its approximate equations for finding the variation of pressure and velocity in closed conduits. Protection from hydraulic shock.
- Compressible flow theory and basic thermodynamic relations governing it. Compressibility conditions and Navier-Stokes equations for compressible flow.
- Flow in open straight conduits with constant slope. Flow equations for subcritical state. Reference for critical and supercritical flow and hydraulic jump. Application to channels of simple and complex cross-section. Conservation equations of mass and momentum for steady flow in open conduits.
- Deepening in turbulent flow. Reynolds analysis and formulation of time-averaged Navier-Stokes equations for mean flow. Reynolds stresses and their significance depending on the type of flow. Energy balance of turbulent kinetic energy as a function of distance from the wall. Production and dispersion of turbulence for various basic flows. Reference to turbulence modeling along mixing length Prandtl and turbulent viscosity Boussinesq.

1.8 8th Semester Courses

MANUFACTURING SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0801	**SEMESTER**	8th
COURSE TITLE	**Elevating & Conveying Machines**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Intermittent operation load handling facilities (overhead cranes).

Description of the lifting system of the facility. Wire ropes, pulleys, drums, motors, brakes.

Description of the travel system of the facility of the carrier and the overhead crane. Rolling wheels, motors, brakes, links. Description of the steel structure of the facility, which is either shaped as a solid or a lattice structure. Detailed calculation of all the above elements based on the applicable regulations (correspondingly DIN and Eurocode 3).

Description of the safety measures of a facility as well as the measures that ensure the continuity of the operation of the facility until the next scheduled maintenance.

Description of special Lifting Machines, such as winches, jacks, etc.

Continuous operation load handling facilities (conveyor belts).

Description of the installation of a conveyor belt. Support rollers, drive and return drums, cleaners, material guides, motors. Types and types of conveyor belts. Belt tensioning system. Metal construction supporting the conveyor belt.

Development of the calculation method of the installation according to the applicable regulations.

Processing of design study of load handling installation with the corresponding calculations and drawings.

Calculations of structures with dynamic loading based on load groups and Palmgren - Miner principle. Grouping of loads with Markov tables.

Description of the installation of a tower crane.

Calculation of a tower crane based on the applicable regulations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0802	**SEMESTER**	8th
COURSE TITLE	**Metal Forming**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Theoretical part: Mechanical properties of metals. Plasticity theory. Yield criteria. Standard mechanical tests for determining characteristic properties of bulk metals. Effect of temperature and anisotropy of materials on plastic deformation. Forming tools. Classification of forming processes. Technological elements of the processes: forging, rolling, drawing, extrusion, stamping, shearing, deep drawing, and bending. Basic knowledge of operation and technological elements of hydraulic and mechanical presses. Defects of processed pieces, Residual stresses. Friction, wear and lubrication of tools in forming processes. Numerical methods for simulating forming processes of solid material and alloy with plastic deformation. Design and construction of cutting and forming molds.

Laboratory Exercises (every 3 weeks of classes): Calculation of the basic parameters of the above forming processes of mechanical pieces with plastic deformation of material.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0803	**SEMESTER**	8th

COURSE TITLE	**Industrial Robotics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Historical overview. Areas of interest and applications of Robotics. Robot structure. Robot categories. Degrees of freedom. Kinematic analysis of spatial mechanisms. Homogeneous transformation matrices. Denavit-Hartenberg method. Solution of forward and inverse kinematics problem of serial robotic mechanisms. Dynamic analysis of spatial mechanisms.

The mechanical part: Degrees of freedom. Geometric shapes of robotic arms. Workspace of industrial robots. Euler and RPY orientation angles. Wrist, Gripper. Gripping mechanisms. Driving mechanisms of robotic systems: Pneumatic, Hydraulic, Electric actuators. DC motors, stepper motors, servo motors: Types, drive-control. Sensors suitable for robotic systems. Coordinated control of joints. Trajectory control of the end-effector. Optimization algorithms (deterministic, stochastic, evolutionary-genetic) of end-effector trajectory, with obstacle avoidance and collision control of intermediate members, optimization of placement position of piece.

Performing laboratory exercises using an industrial robotic arm. Motion control using a controller, offline control in a graphical environment using code, in various coordinate systems (joints, base, end-effector).

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KK0804	**SEMESTER**	8th
COURSE TITLE	**Machine Tools - CIM**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Constructions Sector)		

PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Overview of machine tools, Static, dynamic and thermal analysis of machine tools, Constructional elements of machine tools, Motors, Shafts, Controllers- position encoders, Electrical and electronic devices of machine tools, Automatic control systems - Numerical control of machine tools, Systems for holding and loading the pieces to be processed, Diagnostic control of machine tools, Action of machine tools to avoid transmission of oscillatory excitations from and to the environment, Accuracy of CNC machine tools, Accuracy measurements of machine tools according to ISO 230, Standardized tests for acceptance control of digitally guided machine tools.

Production systems with digitally guided machine tools. CIM production systems. Standardized ways of interconnecting components of CIM systems. Placement of machine tools. Cutting tool handling.

Custom-made clamping devices. Transport devices. Principles of assembly systems. Digitally guided measuring machines (CMM). Non-conventional technologies of production systems. Reverse Engineering, Rapid prototyping, Rapid tooling.

Laboratory Exercises (every 3 weeks of classes):

Practice with the use of PC and suitable CAM software in the shaping of mechanical objects with the help of digitally guided machine tools. Automatic creation of machine code from the CAD geometric model. Post-processors. Communication between PC and CNC-Machine tool.

ENERGY SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0801	**SEMESTER**	8th
COURSE TITLE	**Heat – Ventilation – Air Conditioning**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics, Heat Transfer		

LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

- Building insulation elements, Calculation and verification of thermal insulation adequacy of structural elements, Insulation materials and their construction applications, Calculation of heat losses and ways to reduce them, Thermal bridges and their calculation, Equipment and devices of heating systems, Energy balance of buildings.
- Description, study and calculations of the basic heating systems. Reference to the modern advanced systems of the above installations with examples of their application.
- Insulation - heating applications and preparation of integrated studies.
- Basic refrigeration cycle with vapor compression, Building air conditioning, air quality elements, thermal comfort and well-being, introduction to air conditioning systems, Psychrometry (states and changes of air), Cooling Load Calculation, Duct Networks, fan selection, Description, study and calculations of the basic air conditioning systems (Central units, semi-central units, split systems, cooling with Fan Coils), Reference to the modern systems of air conditioning installations.
- Solution of numerical problems of a part or whole of small real installations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0802	**SEMESTER**	8th
COURSE TITLE	**Steam Boilers - Steam Turbines & Energy Systems**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	Thermodynamics I, Heat Transfer, Fluid Mechanics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Course objective: The ability to understand the phenomena related to the production and use of

thermal energy and its conversion to work. The energy calculation of the elements that make up the units of production, use and conversion of thermal energy to work. The calculation of the environmental impacts from the production and use of energy.

Course description: The course is implemented through lectures and active participation in solving problems of practice in the laboratory. The topics covered are:

Fundamentals of Engineering Thermodynamics, state variables, states of water and steam, combustion, basic combustion equations, calculations of air supply for combustion, composition of flue gases, carbon dioxide production, environmental impacts from the production and use of energy, fuels, types of burners, description and operation of steam generators, energy balances in heat exchangers and boilers, heat transfer in basic parts of the steam generator, chimney, calculation of dew point of flue gases, steam pipe networks, elements of steam networks, calculation of pressure losses, heat losses, steam traps, condensate networks, constructional elements of networks, water treatment for use in boilers, safety regulations for boiler operation, basic principles of operation of steam turbines, flow calculation in blades, velocity triangles, thermodynamic calculation, action and reaction turbines, calculation of turbine efficiency, power generation cycles RANKINE cycle, energy balances in power generation cycles, calculation of efficiency, methods of improving efficiency, cogeneration of electricity and heat, Brayton cycle, combined cycles, alternative methods of electricity generation, future directions.

In the laboratory the following experiments are carried out on the laboratory device for producing superheated steam up to 400 kg / h and electric power up to 15 kW:

Energy balance boiler, flue gas analysis, heat loss from insulated pipe, energy balance in steam turbine, energy balance in condenser exchanger, calculation of RANKINE cycle efficiency. At the same time the experimental results are compared with the results of the theoretical calculations in order to acquire by the students the perception of the correlation of the physical phenomena with the methodologies of the calculations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0803	**SEMESTER**	8th
COURSE TITLE	**Turbomachinery**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		

COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

- Introduction & Categories of Turbomachines and their use according to their type.
- Reference and analysis of basic parameters of Turbomachines (flow, head, power, efficiency) and their connection with dimensionless numbers. Creation and functionality of characteristic curves of Turbomachines.
- Dimensional Analysis of Turbomachines and use of the laws of similarity in the reduction of the characteristic curves to different number of revolutions and / or machine diameter.
- Presentation and analysis of the special form of the equations of Fluid Mechanics, as they are applied to Turbomachines. Calculation of the various degrees of efficiency of Turbomachines (hydraulic, mechanical, total, etc.).
- Characteristic operating curves of Turbomachines and characteristic curve of network operation and calculation (graphical and mathematical) of their intersection point (operating point).
- Connection of Turbomachines in parallel & in series.
- Theory of Two-Dimensional Blades and velocity triangles of axial and centrifugal Turbomachines.
- Design, operation and use elements of pumps.
- Design, operation and use elements of fans and propellers.
- Design, operation and use elements of compressors.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EK0804	**SEMESTER**	8th
COURSE TITLE	**Techniques & Measurements of Natural Processes**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	6
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Sector background (Energy Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Definition and examples of processes. Elements of heat transfer (conduction, convection in steady state) and thermodynamic aids of heat exchangers without phase change. Mass and energy balances. Description, classification, general calculation algorithm of exchanger - regulations and standardization. General description of steam generation boilers - main units. Fuels and their preparation, burners for large steam generation boilers. Radiation heat exchangers - calculation and dimensioning. Energy losses of large boilers and efficiency degrees. Calculation of resistance of closed vessels and their components. Regulations. Mechanical separation processes. Types of filters. Measurement methods in processes and mechanical devices. Handling and calibration of instruments. Pollution measurement.

1.9 9th Semester Courses

MANUFACTURING SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA09E1	**SEMESTER**	9th
COURSE TITLE	**Structures Failure Analysis**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to failure analysis, Life cycle of a component / machine, Operating time of a component / machine, Definition and objective, Failure investigation process, Categories of failure mechanisms, Basic causes of failures, Techniques and tools for failure analysis, Failure diagnosis tools, Non-destructive tests, Destructive tests, Elements of Fracture Mechanics, Fractography, Microscopic structure analysis with optical and electron microscopy, Macro- and micro-fractography of fracture surfaces- fatigue, Mechanical tests, Chemical analysis, Tests in simulated operating conditions, Corrosion, Interaction of corrosion-fatigue, Hydrogen embrittlement. Liquid Metal Embrittlement, Interpretation of results and terminology, Recommendations, Report of the failure analysis.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA09E2	**SEMESTER**	9th
COURSE TITLE	**Mechanical Design – Optimization**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures,*		**WEEKLY TEACHING**	**CREDITS**

laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits	**HOURS**	
Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)	
PREREQUISITE COURSES:	Mathematics II, CAD I, CAD II, Numerical analysis	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/	

SYLLABUS

MECHANICAL DESIGN

Methods of development and design of products. The criteria of selection and control. Basic principles of calculation. From the initial idea to the construction of a mechanical product.

OPTIMIZATION

Structural optimization. Topological optimization. Schematic optimization.

Objective function and constraints. Mathematical formulation of optimization problems of constructions.

Simple techniques of optimization for functions of one and many variables. Method of direct substitution, method of constrained variations, method of Lagrange multipliers.

Linear optimization problems. The Simplex method. First and second phase. Revised Simplex method. Dual Simplex method.

Nonlinear systems. Methods of optimization of one dimension.

Methods of direct and indirect search. Transformation techniques.

Geometric programming. Dynamic programming. Stochastic programming. Modern methods of optimization.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA09E3	**SEMESTER**	9th
COURSE TITLE	**Electric, Hydraulic & Pneumatic Motion Systems**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		

LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

- Analysis of basic principles and elements of Electrical, Hydraulic and Pneumatic motion systems.
- Design and analysis of the basic Electrical, Hydraulic and Pneumatic motion systems and their respective circuits and examples of them.
- Description and presentation of technologies based on energy transfer through Electrical, Hydraulic and Pneumatic motion systems, comparison of motion and control technologies
- Static and dynamic description of a mechanical motion, characteristics and curves of torque and performance of driving devices,
- Load-motor coupling, description of the concept of transmission, gearbox,
- Motion systems and applications,
- Driving engines, description of structure and functional characteristics of electric, hydraulic and pneumatic motors.
- Regulation and supply devices, power supply circuits of electric motors, rectifying devices and power management devices,
- Pneumatic structural elements. Control of pneumatic systems,
- Basic hydraulic structural elements and circuits,
- Electropneumatic advanced circuits and applications in industry,
- Methods of control of motion systems.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA09E4	**SEMESTER**	9th
COURSE TITLE	**Materials & Environment**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Introduction to Materials Science		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		

COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

i. Environmental impacts from the use of materials in the atmosphere, soil and subsurface of the Earth and in the aquatic world (oceans, seas, lakes, rivers, etc.).

ii. The various types of pollutants and how they can be significantly reduced by using new techniques of material production and modern materials such as nanomaterials, polymers, etc.

iii. Methods of recycling materials and their applications in the various types of materials.

iv. Studies of environmental impacts of the use of various kinds of materials in the various production processes and applications.

v. Use of materials for reduction and immobilization of environmental pollutants.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA09E1	**SEMESTER**	9th
COURSE TITLE	**Nanotechnology**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Various techniques of Lithography (Optical, Nanoimprint, Electron Beam, X-rays, etc.).
- Processes of fabrication of high-frequency transistors and their applications.
- Methods of fabrication of semi-transparent silicon solar cells with high efficiency.
- Methods of fabrication of various types of sensors and their applications.
- Techniques of deposition of thin nanofilms and coatings and their applications.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA09E6	**SEMESTER**	9th
COURSE TITLE	**Materials & Mechanical Design**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	CAD I, CAD II, Electrical & Mechanical Installations		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

i. The various modern software (Software) design, e.g., SolidWorks and simulation (simulation) for the preparation of the required E/M design studies, the advantages and disadvantages in relation to the materials used and their applications.

ii. Techno-economic methods of design of mechanical products & devices and optimization of the whole production process with emphasis on the quality of production, the safety of work and use of the products produced, with reference to the technical materials used, their properties and their applications.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB09E1	**SEMESTER**	9th
COURSE TITLE	**Computerized Numerical Control (CNC) Machining**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	CAD I, CAD II, Machine Tools - CIM		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		

IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

Theoretical part: Introduction to the programming of machine tools with digital guidance (numerical control), Numerical control systems, Coordinate systems, Interpolation methods of coordinates for the digital guidance of machine tools, Programming language EIA/ISO (G-code), Automatic machining cycles, Tool management and compensation, CLDATA file structure, Post-processors, Communication between PC and digitally guided Machine Tool. Practical Exercises: Learning programming EIA/ISO (G-code) for conducting machining operations of mechanical parts on digitally guided machine tools, performing laboratory applications of turning and milling operations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB09E2	**SEMESTER**	9th
COURSE TITLE	**Mechatronics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Mechatronics: subject matter, content, purpose

Mechatronic System: model, information and energy flow, the interfaces.

Functional Subsystem: systems architecture, task management, time and ports

Communication: general structure, serial communication (asynchronous, SPI, I2C), examples of serial communication

Sensors: general structure, digital sensors, analog sensors, examples of sensors

Actuators: general structure, binary actuators, analog actuators, examples of actuators (AC/DC motors, stepper motors, servo motors, BLDC, PMSM, linear motors, hydraulic systems)

Programming: program structure, processing (code, comments), library element management, in programming languages C++ and Python (Arduino and Raspberry).

Applications of mechatronics of mechanical interest (production, quality control, vehicles and automotive industry), Intelligent control of mechatronic systems (hierarchical, hybrid, fuzzy and neural control).

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB09E3	**SEMESTER**	9th
COURSE TITLE	**Finite Elements II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Mechanics II, Finite Elements I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Methods of exchanging geometric and technological data between CAD and CAE systems. Checking and creating topology of geometric data in CAE systems. Types of finite elements. Creation of 3D finite element mesh and mesh quality control. Definition of boundary conditions and loads. Forms of analysis with the finite element method (static, dynamic, thermal, combined, linear & non-linear). Applications of finite element systems for stress and strain analysis. Analysis of results, optimization of model geometry. Practical Exercises: Application of the modules of the theoretical part through examples and applications of design and optimization of mechanical parts and constructions using CAE systems. (Software ANSYS WORKBENCH).

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB09E4	**SEMESTER**	9th
COURSE TITLE	**Experimental Strength of Materials**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures,*		**WEEKLY TEACHING**	**CREDITS**

laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits	**HOURS**	
Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)	
PREREQUISITE COURSES:	Mechanics II	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/	

SYLLABUS

Theoretical part:

Analysis of the behavior of materials in the elastic region, in the plastic region and in fracture. Distinction of the behavior of materials between ductile and brittle. Mathematical formulation of the behavior of materials both for the linear/elastic region and for the non-linear region.

Tensile test: Description of tensile device - execution of experiment. Types of tensile diagrams. Determination of characteristic points of diagram and related properties of material for ductile and brittle fracture. Compression test: Description of device, Drawing of diagram, Evaluation of results. Bending test: Critical bending load, evaluation of results. Torsion test: Description of device, Drawing of torsion diagram. Bending test: Measurement of deflections due to bending, evaluation of results. Strain measurement: Measurement of strains and maximum stresses using strain gauges, Hardness measurement test: The Brinell method. The Rockwell hardness test method. Charpy impact test, Fatigue test: Description of methods - execution of experiment and evaluation of results. Non-destructive testing of materials: Description of methods and devices and analysis of results.

Study of the mechanical behavior according to the theory of plasticity (non-linear behavior) of metallic materials/constructions. Calculation of stresses, strains and residual stresses (residual stresses) due to complex loads.

Practical Exercise:

Description of experimental device and procedure for the following tests. Use of experimental data from students, plotting experimental results and evaluation of mechanical properties of materials of respective specimens.

- Tensile test
- Compression test
- Bending test
- Torsion test
- Bending test
- Hardness measurement test
- Charpy impact test
- Fatigue test
- Non-destructive testing of materials

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB09E5	**SEMESTER**	9th
COURSE TITLE	**Mechanics of Composite Materials**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Mechanics II		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Definition of composite materials, phase components, classification, Ashby diagrams, application areas, SWOT analysis, Matrix materials with emphasis on thermoplastic and thermosetting matrices, Reinforcement - role, important types of reinforcement - construction, modification, characterization, Interface - Interphase: Definition, role, impregnation, adhesion mechanisms, modification methods, Manufacturing technologies with emphasis on composites with polymer matrix (continuous and short fibers, particulate and nanocomposites). Selected other methods for the manufacture of composite materials, Non-conventional composites, Biological composites, Micromechanics of composites (density, mechanical properties, thermal properties, load transfer), Macromechanics of composite materials (elastic deformation, elastic analysis of tensors - layer - multilayer). Nanoporous and lamellar materials. Nanocomposite materials of clays / polymers. Other lamellar materials: graphite, MoS2. Fullerenes. Carbon nanotubes. Inorganic nanotubes.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB09E6	**SEMESTER**	9th
COURSE TITLE	**Reverse Engineering & Rapid Prototyping**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**

Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)	
PREREQUISITE COURSES:	-	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/	

SYLLABUS

Definition and historical evolution of Reverse Engineering. Analysis of technologies: Differences - Advantages - Disadvantages. Management of scanned geometry data: Point-cloud, Meshing. Process of reconstructing CAD model based on the physical model using three-dimensional scanning of its geometry. Creation of three-dimensional geometry files with meshing of surfaces, stereolithography format (STL), using optical scanners, laser beam scanners, digital tomography and digitally guided measuring machine (CMM). Methods of reconstructing three-dimensional CAD model and comparing them. Uses of reverse engineering in industrial production and research. Case studies.

Necessity of prototype construction and methods of construction. Advantages of Rapid Prototyping (RP) Methods and their applications. Rapid Prototyping Technologies: Stereolithography (Stereolithography, SLA), Sintering of powders with the help of focused laser beam (Selective Laser Sintering, SLS), Sintering of metallic powders by Laser (Direct Metal Laser Sintering DMLS or Selective Laser Melting SLM), Sintering of powders by spraying resin (3D Inkjet Printing or 3D Printing or Binder Jetting), Sintering of photosensitive resins (Solid Ground Curing, SGC), Deposition of molten thermoplastic filament (Fused Deposition Modeling, FDM), Prototype construction with successive layers of sheets (Laminated Object Manufacturing, LOM). Rapid Tooling Construction (molds and dies) with direct and indirect technologies of Rapid Tooling Construction (Rapid Tooling, Investment Casting). Rapid prototyping machines. Case studies.

ENERGY SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)			
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT			
LEVEL OF STUDIES	UNDERGRADUATE			
COURSE CODE	EA09E1	**SEMESTER**	9th	
COURSE TITLE	**Environmental Technology**			
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*			**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)			4	5

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

The impacts of human activity on the environment, environmental balance, the concept of sustainable development. Measurement of gaseous pollutants, systems for capturing gaseous pollutants, systems for chemical treatment of gaseous pollutants, applications. Filters, cyclones, absorbers, design of gas purification systems. Methodologies for calculating emissions of gaseous pollutants. Emission factors. Emissions of pollutants from stationary combustion sources: Electricity generation, industry, small combustion sources (crafts, central heating). Emissions of pollutants from road transport: Road transport emissions and related vehicle technologies, application of COPERT 4 software, scenarios for reducing carbon dioxide emissions from transport, electric, hybrid vehicles, use of biofuels. Emissions of pollutants from other transport: air transport, trains, shipping, machinery and vehicles "off-road". Liquid waste and main causes of production. Treatment of liquid waste, biological treatments, aerobic and anaerobic treatment systems. Solid waste and main causes of production. Measurement of solid waste, systems for retention and cleaning of solid waste, systems for chemical treatment of solid waste, applications. Landfills, thermal treatment of waste. Recycling. Principles of recycling, waste management systems.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA09E2	**SEMESTER**	9th
COURSE TITLE	**Industrial Refrigeration and Cooling**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Thermodynamics I, Heat-Cooling-Climate		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to the basic concepts and arrangements of Industrial Refrigeration.

• Refrigeration theory, Refrigeration cycles and arrangements, Basic calculations in theoretical and real cycle,

• Refrigeration units with mechanical compression of saturated vapor, Effect of evaporation and condensation temperature and pressure, Calculation of refrigeration cycle efficiency coefficient, COP, Calculation of refrigeration power and compressor power.

• Description of the operation of refrigeration cycle arrangements, Evaporators, Compressors, Condensers, Heat exchangers.

• Optimized refrigeration cycle with mechanical compression of vapors, Use of heat exchangers for subcooling - superheating of saturated vapors.

• Refrigerants and Refrigerant Mixtures, Assessment of their thermodynamic and environmental behavior, Presentation of properties and characteristics of CFCs, HCFCs, HFCs, zeotropic and azeotropic mixtures, inorganic refrigerants, Coding of refrigerant nomenclature

• Direct and indirect cooling systems, Secondary refrigerants.

• Cooling with two working media, Absorption and steam injection refrigeration units.

• Description of the operation of combined refrigeration cycles, Refrigeration devices of two-stage and multi-stage compression. • Solution of numerical problems of a part or whole of small real installations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA09E3	**SEMESTER**	9th
COURSE TITLE	**Flow Networks**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Course objective: To acquire the basic knowledge and skills to study and calculate flow networks with applications in industry and the domestic sector.

Course description: The course is implemented through lectures, active participation in solving practical problems, and implementation of projects with practical dimension.

The subjects covered are:

Description of flow networks, materials and components, pressure losses, Reynolds number, Moody diagram, approximate relations, pressure losses in incompressible flow, application to fire-fighting networks, gas networks, pressure losses in compressible flow, application to natural gas networks, regulation of internal installations of natural gas distribution, thermal loading, duct networks, hydraulic diameter of conduit, fans, application to air conditioning duct networks.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA09E4	**SEMESTER**	9th
COURSE TITLE	**Computational Methods in Fluid Dynamics & Heat Transfer**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Numerical Analysis, Fluid Mechanics, Heat Transfer		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Course objective: To acquire the basic knowledge and skills to study and calculate flow networks with applications in industry and the domestic sector.

Course description: The course is implemented through lectures, active participation in solving practical problems, and implementation of projects with practical dimension.

The subjects covered are:

Description of flow networks, materials and components, pressure losses, Reynolds number, Moody diagram, approximate relations, pressure losses in incompressible flow, application to fire-fighting networks, gas networks, pressure losses in compressible flow, application to natural gas networks, regulation of internal installations of natural gas distribution, thermal loading, duct networks, hydraulic diameter of conduit, fans, application to air conditioning duct networks.

• Transport equation: reference to the mechanisms of conduction, diffusion and source. Presentation of Navier-Stokes equations (continuity and momentum) and energy and explanation of the different terms.

• Brief presentation of Numerical Analysis. Solution of algebraic systems. Linearization of algebraic equations. Numerical error.

• Approximation of derivative with Taylor series. Forward, backward and central differentiation. Truncation error.

• Discretization, computational grid and boundary conditions.

• Industrial application of Computational Fluid Dynamics with demonstration of real implemented projects.

• Examples of flow cases with solution in excel or in commercial package of Computational Fluid Dynamics:

• One-dimensional, steady heat transfer in a rod (solution with calculations and in Excel):

• One-dimensional, unsteady cooling/heating (point) body (solution with calculations and in Excel).

• Solution in Excel with trial-and-error of the combustion equation of hydrocarbons of type $C\alpha H\beta O\gamma$ with air. The calculations will take into account a given over-stoichiometric ratio λ, the temperature of the oxidizing air and the variation of the heat capacity of the gases with temperature to calculate the content of the combustion gases and the adiabatic combustion temperature.

• Solution of two-dimensional boundary layer, laminar and turbulent flow, with negative and positive pressure gradient, detachment and reattachment.

• Solution by Runge-Kutta method of a suitable problem (e.g., particle trajectory within a given fluid flow) with excel.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA09E5	**SEMESTER**	9th
COURSE TITLE	**Transport Phenomena**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics, Heat Transfer, Thermodynamics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

• Definition of the phenomena of mass, heat and momentum transfer.

• Molecular transport and transport coefficients as physical properties of fluids.

• Generalized balance and the concepts of production/destruction, accumulation/removal.

• Transport by conduction. Reference to turbulent flow and its effect on transport, compared to laminar flow.

• Integral analysis of balance with examples. Methods of analysis, dimensionless numbers and their significance.

• Application of transport analysis to mixing.

• Application of transport analysis to steady flow in conduits.

• Application of transport analysis to bodies within the flow.

• Application of transport analysis to unsteady flow in conduits.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB09E1	**SEMESTER**	9th
COURSE TITLE	**Gas Turbines & Aero-engines**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics, Heat Transfer, Thermodynamics I		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction, basic concepts and operation elements of gas turbines and aircraft engines.

• Description, operation analysis and thermodynamic cycle analysis of gas turbines and aircraft engines.

• Theoretical cycles, Efficiency degrees, Real cycles.

• Description of industrial gas turbines and aircraft engines, Types, uses and operating principles.

• Description of basic arrangements of aircraft engines (turbojet, turbofan, turboprop) and thermodynamic cycles for various applications. Design and development of modern propulsion engines.

• Analysis of the design and use of the various elements of the turbomachines.

• Presentation of the operation of gas turbine and aircraft engine elements, Compressors (types and their basic characteristics), Combustion Chambers, Turbines (types and their basic characteristics), Gas turbine blades.

• Presentation of technological limits of the various types of engines. Assessment of the thermomechanical resistance of aircraft engines, Cooling of turbine blades.

• Optimization of thermodynamic cycles of gas turbines and aircraft engines, Cycles with reheating, intercooling, regeneration, Use of heat exchangers in gas turbines and aircraft engines.

• Study of design interventions that optimize the construction and operation of gas turbines and aircraft engines.

• Presentation and analysis of future design innovations and interventions.

• Variations and complex-combined installations and arrangements.

• Presentation of construction materials for gas turbines and aircraft engines.

• Presentation of fuels for industrial and aviation gas turbines, Pollution production from gas turbines and aircraft engines,

• Solution of numerical problems of a part or whole of small real installations.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB09E2	**SEMESTER**	9th
COURSE TITLE	**Electric Systems in Industry**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Electric Engines, Electrical Technology & Electronics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction - Basic principles of design and operation of electrical installations

Regulations & Standards of electrical installations

Safety of electrical installations and accident prevention

Characterization of installations and operating environment

Insulated conductors and cables

Determination of the cables/lines supplying loads based on thermal loading and allowable voltage drop

Switches and means of coupling and protection of LV

Connection of electric motors to the network and operation (coupling, starting, protection, etc.)

LV installations in industry

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB09E3	**SEMESTER**	9th
COURSE TITLE	**Electric Systems in Renewable Energy Sources**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Electrical Technology & Electronics, Renewable Energy Sources		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction - Basic principles of design and operation of electrical power generation systems from RES

PV technology (semiconductors, photovoltaic effect, PV element)

Devices and components of PV installations

Configuration of PV installation (number of collectors, arrangement, connection of PV collectors, compatibility check with inverter, Single-line and Polyline diagram of PV)

Calculations of PV installation (energy efficiency, wiring, voltage drop check, etc.)

Connection to the Network (coupling means, protection devices, MT substation, etc.)

Grounding and lightning protection

Economic data and evaluation of RES investments.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB09E4	**SEMESTER**	9th
COURSE TITLE	**Advances in Wind Energy**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Thermodynamics, Heat Transfer, Fluid Mechanics, Renewable Energy Sources		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Course objective: The ability to exploit the phenomena related to wind energy, in order to achieve efficient conversion of it into useful work and electricity production. The knowledge of the main parts of the wind energy utilization projects, as well as the basic calculations that concern them.

Course description: The course is implemented through lectures and active participation in solving practical problems. The subjects covered are:

Climatic parameters and their impact on wind energy, density, temperature, barometric pressure, wind measurements, turbulence, wind turbine categories according to standards, e.g., IEC61400, calculation of annual generated energy, shading models of wind turbines, shading loss calculations, offshore wind farms, offshore wind potential.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB09E5	**SEMESTER**	9th
COURSE TITLE	**Advances in Solar Power**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		

PREREQUISITE COURSES:	Heat Transfer, Heat-Cooling-Climate
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

• Basic Principles of Solar Radiation and Geometry. Introduction to the characteristics of the solar radiation spectrum. Effect of the relative position of Sun - Earth on the intensity of solar radiation. Types of solar radiation (direct, diffuse, background). Methods for calculating the different forms of solar energy. Main gases of the atmosphere and their significance. Instruments for measuring solar radiation and its spectral distribution.

• Optimal inclination and orientation of surfaces for the exploitation of solar radiation. Techniques for maximizing - minimizing solar energy on surfaces of different orientations for instantaneous, seasonal or annual use.

• Conversion of Solar Energy directly into thermal - Solar Collectors of low and medium temperatures. Solar Ponds. Solar Flat Collectors. Solar Vacuum Collectors. Materials for collector construction. Calculation of instantaneous efficiency of solar thermal collectors (ISO9806-1). Concentrating Collectors

• Systems of Solar Thermal Systems of Low and Medium Temperatures. Solar Systems for Domestic Hot Water Production. Solar Systems for Space Heating and Domestic Hot Water (Combi). Solar Air Conditioning Systems (Combi+). Heat Storage

• Sizing of Solar Thermal Systems of Low and Medium Temperatures. The method of f curves. Introduction to dynamic sizing of solar thermal systems (TRSNYS - SAM)

• Conversion of Solar Thermal Energy into electrical - Solar Collectors of high temperatures. Introduction to concentrating systems. Trough systems - troughs. Fresnel systems. Central Tower systems. Solar Furnaces. Stirling systems. Rankine systems.

• Solar Thermal Systems for industrial/chemical processes. Conversion of Solar Energy into electrical - Photovoltaic Conversion. Introduction to semiconductor physics. p-n diode. Current-voltage characteristic curve of a p-n junction. Photovoltaic phenomenon. Electrical characteristics of photovoltaic element. Materials. • Technologies of photovoltaic cells. Effect of temperature on the electrical characteristics of the photovoltaic element. Ways of connecting photovoltaic elements. Photovoltaic frames - nominal power, - standard operating conditions - efficiency and factors affecting it

• Photovoltaic Systems. Photovoltaic systems, characteristics, categories and composition. Stand-alone systems - coverage of daily energy requirements. Array efficiency - utilization factor. Types of Inverters. Storage and management of electric power from photovoltaic systems

• Electric accumulators and their characteristics. Determination of stand-alone system and energy cost. Sun tracking systems

• Sizing of Photovoltaic Systems. Dynamic simulation of pv systems (TRNSYS - SAM - PVSOL)

• Economic Analysis of Solar Systems - Net Present Value

• Environmental Analysis of Solar Systems - Life Cycle Analysis

• Integration of Solar Energy Conversion Systems into Buildings

1.10 10th Semester Courses

MANUFACTURING SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA10E1	**SEMESTER**	10th
COURSE TITLE	**Advanced Materials**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Introduction to Materials Science, Materials Technology		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

i. Modern advanced processes for the production or preparation of advanced materials, e.g. powder metallurgy, sintering, foams, etc., their advantages and disadvantages and their applications.

ii. The different types of advanced materials (biomaterials, porous materials, composite materials, etc.) and how they can significantly contribute to the improvement of the mechanical strength of engineering structures, as well as other important properties, e.g., resistance to oxidation and corrosion, heat, etc. Applications in surgery, prosthetics and general modern medicine, in reducing emissions of various harmful environmental pollutants and other applications.

iii. Composition and structure of advanced materials and how they affect their properties.

iv. Modern methods of dealing with the defects that various advanced materials present, e.g. cracks, discontinuities, inclusions, pores, heterogeneities, lack of repeatability and isotropy, etc.

v. Modern methods of optimizing the properties of advanced materials, such as, e.g., in terms of surface and thermal treatments.

vi. Modern methods of testing the properties of various advanced materials, e.g., repeated impact method (impact testing), nanoindentation methods, X RAY Tomography, etc.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA10E2	**SEMESTER**	10th
COURSE TITLE	**Tribology – Lubricants**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

• Description of surface techniques and their tribological properties.

• Contact of bodies, Stribeck pressure, Hertz pressure, elastic deformation, developing stress field below the surface.

• Phenomena during the relative motion of cooperating surfaces, theories of dry friction, developing temperature field. Wear.

• Tribological properties of materials.

• Liquid lubricants, viscosity, grease.

• Failures of tribological systems.

• Hydrodynamic, elasto-hydrodynamic and thermo-elasto-hydrodynamic lubrication. Application to sliding, rolling, gear bearings. Lubrication systems.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA10E1	**SEMESTER**	10th
COURSE TITLE	**Modern Welding Technologies**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)
PREREQUISITE COURSES:	Casting - Welding
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

i. Modern advanced processes for the manufacture of welded materials, their advantages and disadvantages and their applications.

ii. Energy sources, e.g., electric, chemical (combustion of gas mixture), mechanical, etc., used in modern advanced processes for the manufacture of welded materials, their advantages and disadvantages and their applications.

iii. Modern methods of dealing with the residual stresses that remain inside the welded materials after the completion of the welding process.

iv. Modern methods of dealing with the defects that occur in the welds, e.g., cracks, discontinuities, inclusions, pores, etc.

v. Modern methods of non-destructive testing of the defects that occur in the welds, e.g., by ultrasound, electromagnetic fields, etc.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA10E4	**SEMESTER**	10th
COURSE TITLE	**Thermal & Surface Metal Treatment**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Materials Technology, Casting - Welding		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

i. Results of thermal and surface treatments of metallic materials.

ii. Mechanical surface treatments - Methods of application - Uses.

iii. Thermal surface treatments - Types - Applications.

iv. Coatings - Coatings: types, methods of application, uses.

v. Quality control of the results of thermal and surface treatments.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KA10E5	**SEMESTER**	10th
COURSE TITLE	**Dynamics of Systems**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Mathematics I, Mathematics II, Mathematics III,		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

i. Fundamental concepts of Dynamic Systems. Review of basic mathematical tools. Principles of mathematical modeling. Macroscopic models of processes. Dynamic behavior of typical processes. First-order systems. Connections of first-order systems. Second-order and higher-order systems. Systems with time delay. Mathematical methods of analysis of dynamic systems. Analysis of linear systems in the state space. State description of linear systems and calculation of the response with the method of the exponential matrix. State variable transformations. Input/output behavior in the time domain. Serial and parallel connection of linear systems under state description. State feedback and output feedback. State description of the closed-loop system. Controllability and Observability of Dynamic Systems. Analog state feedback, selection of gains for prescribed closed-loop eigenvalues. State estimation and state observers. Asymptotic stability of linear systems. Solution of linear differential equations with the method of Laplace transform. Transfer function. Poles and zeros. Input/output stability. Calculation of frequency response. Bode diagrams. Linearization of nonlinear dynamic systems. Local asymptotic stability. Lyapunov method. Control systems with feedback. Block diagram of control system. Block diagram reduction. Transfer functions of closed-loop systems. State description of closed-loop system. Analysis and design of control systems. Steady-state error - significance of

integral action. Sensitivity function. Stability analysis of closed-loop system. Algebraic stability criteria. Routh-Hurwitz stability criterion. Graphical Stability Criteria. Nyquist diagram. Nyquist stability criterion. Bode Stability Criterion. Gain and phase margins. Root locus diagram. Calculation of performance criteria for control systems and optimization.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB10E1	**SEMESTER**	10th
COURSE TITLE	**Analysis & Synthesis of Mechanisms**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to mechanisms: kinematic pairs, mechanism members, degree of freedom of mechanism.

Kinematic analysis of planar mechanisms: graphical and analytical methods for determining position-velocity-acceleration of mechanism members. Determination of forces and moments of planar mechanisms, calculation of frame stresses.

Mechanisms with four members, Mechanisms with toothed wheels, Mechanisms with guide curves, Mechanisms of periodic discontinuous transmission.

Computational analysis of mechanisms and simulation of their kinematic behavior, Design of mechanisms using CAD software, kinematic modeling of mechanism, analysis of kinematics and calculation of position-velocity-acceleration, optimization of geometry and orbital position, applications to classical and special mechanisms.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB10E2	**SEMESTER**	10th

COURSE TITLE	**Optimum Product Development**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	CAD I, CAD II, Industrial Robotics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Data collection for products under development. Market research. Product design requirements (functionality, cost, durability, ergonomics, aesthetics). Determination of alternative design solutions and their evaluation. Impact of processes and production methods on design and selection of the optimal design solution. Product modeling using solid and surface geometries, implementation of design requirements and design constraints. Support of the design, analysis and construction phases by CAD, CAE, CAM systems and experimental evaluation. Product life cycle and production cost. Intellectual property protection. Product and production methods optimization with criteria of cost, safety, strength, weight, life cycle using multicriteria objective function.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB10E3	**SEMESTER**	10th
COURSE TITLE	**Industrial Measurements – Machine Diagnostics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	Electromagnetism, Control Automation		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

The theoretical part of the course includes:

- Introduction to sensors and measurement and control systems, measurement systems, open and closed loop control systems.

- Characteristics of sensors and measurement systems (accuracy, errors, calibration, dead zone, slip, hysteresis, time, operating range, linearity, reliability, response, resolution, sensitivity).

- Signal adjustment and adaptation with passive circuit techniques: signal adjustment and adaptation, signal adjustment with potentiometer, signal adjustment with Wheatstone bridge, adaptation for maximum voltage transfer, adaptation for maximum power transfer with or without transformer.

- Signal adjustment and adaptation with active circuit techniques I: active circuits, operational amplifier, inverting and non-inverting amplifier, isolator, summing and difference amplifier, instrumentation amplifier.

- Signal adjustment and adaptation with active circuit techniques II: integrator, differentiator, current-to-voltage and voltage-to-current converter, voltage comparator, digital-to-analog converter, analog-to-digital converter.

- Temperature measurement: liquid and metal expansion thermometers, bimetallic thermometer, bimetallic thermostat, resistance thermometer (RTD), thermistor, thermoelectric phenomenon and thermocouple, radiation thermometers, optical filament pyrometer, infrared pyrometer.

- Motion measurement I: Introduction to the measurement of motion parameters (displacement, proximity, speed, acceleration, mechanical stress, weight), linear displacement measurement (clock micrometer, linear potentiometer, linear variable differential transformer - LVDT, variable area capacitor), angular displacement measurement (rotary potentiometer, incremental and absolute optical encoder).

- Motion measurement II: Tachometric generators, proximity measurement (microswitches, variable magnetic resistance sensor, Hall effect sensor, optical proximity sensors), acceleration measurement (seismic mass accelerometer, piezoelectric accelerometer), mechanical stress gauge, weight measurement (load cell, balance scale, spring scale with linear potentiometer).

- Level measurement: level measurement, observation tank, sounding rod, mechanical and electrical float meter, needle of variable capacity and conductivity, ultrasonic meter, bubble meter, level measurement with pressure sensors.

- Display and recording of measurement data: analog display devices, moving coil meter (instrument), resistance meter, moving armature meter, oscilloscope, digital display devices with light emitting diodes (LED) and liquid crystals (LCD).

- Data collection and processing systems I: basic concepts of data collection and processing systems for measurements, transmission systems for measurements, sampling, sampling and holding circuits, multiplexing and multiplexers.

- Data collection and processing systems II: serial and parallel connection of measurement systems with computer, direct connection, IEEE standards and RS232, analog and digital input-output cards, data collection in computer, software tools for data collection in industrial environment of processing and production control.

The laboratory part of the course (every 3 weeks) includes the following exercises:

Study of moving coil instrument (measurement of characteristic elements, extension of measuring scale, implementation of homometer, etc.), Study of temperature sensor characteristics (thermocouple, thermistor, RTD), Study of linear variable differential transformer (LVDT) and strain gauge (mechanical stress gauge), Study of analog-to-digital converters and vice versa (A/D converters), Practical exercises aiming at familiarizing with the Lab-View software tool programming in graphical environment and virtual instruments (virtual instruments), data acquisition cards for measurements (DAQ).

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB10E4	**SEMESTER**	10th
COURSE TITLE	**Computational Metal Forming**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	FEM I, FEM II		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Introduction to the theory of plasticity. Theory and criteria of yielding, maximum shear stress criterion (Tresca), equivalent stress criterion (von Mises). Concepts of forming and limit strain diagrams. Analysis of forming operations, ideal work method, limit analysis, upper and lower bound methods, slip-line method. Finite element method (FEM), Nonlinearities, geometric nonlinearity, material nonlinearity, Quasi-static analysis, Stereoplastic analysis, Formulation of the Updated Lagrangian method, Calculus of variations in boundary value problems of continuum mechanics, Boundary conditions, friction and contact of surfaces, Heat transfer analysis, Coupled thermomechanical analysis, Finite elements and discretization (Mesh and re-meshing), Solution of systems of nonlinear equations. Development and application of the FEM method in industrial forming applications.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	KB10E5	**SEMESTER**	10th

COURSE TITLE	**Bioengineering**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Manufacturing Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Human body - Geometry and materials: Head, Spinal column, Upper and lower limbs, Bones and musculoskeletal system, Joints and muscles, Respiratory system.

Main mechanisms - kinematics: Motions and displacements of the human body, Kinematics of the joints, Kinematics of the individual elements, Body balance during motion.

Simulation: Kinematic and dynamic analysis of upper and lower limb, Mechanical properties, Determination of the mechanical properties of the elements of the human body.

Deformable body mechanisms: Stresses - strains. Simulation of human body stresses using the finite element method. Simulation of members: upper limbs, spinal column, lower limbs, flow in the respiratory system.

Artificial materials and organs. Medical mechanical constructions. Imaging machines and biomedical machines.

Measurements of biomedical machines: Measurement methods, CT, MRI, Results, File formats, Visualization of measurements, Processing of measurements, Exploitation.

ENERGY SECTOR

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA10E1	**SEMESTER**	10th
COURSE TITLE	**Aerodynamics**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**

Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)	
PREREQUISITE COURSES:	Fluid Mechanics	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK	
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES	
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/	

SYLLABUS

- Basic elements of aerodynamics (forces, moments, pressure distribution around airfoil, types of drag).
- Basic characteristics of airfoils.
- Two-dimensional flow around airfoil. Stream function and vorticity. Vortical and irrotational flow, circulation around wing. Derivation of the Navier-Stokes equations and relation between flow deformation and viscous forces (friction).
- Inviscid flow theory and two-dimensional wing theory. The Kutta condition, circulation and vorticity. The thin airfoil theory. NACA 4-digit type airfoils.
- Viscous flow and boundary layer. Laminar flow, transition and turbulent flow.
- Aerodynamics during flight.
- Elements of vehicle aerodynamics.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA10E2	**SEMESTER**	10th
COURSE TITLE	**Multiphase Flows**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Tutorials (Theory)		4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Fluid Mechanics, Advances in Fluid Mechanics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Types of multiphase flows, continuous and dispersed multiphase flows.
- Interphase forces in continuous phases.
- Interphase forces in dispersed phases.
- Particle size (diameter) distribution.
- Liquid-gas flows in closed conduits.
- Fluid and solid particle flows in closed conduits.
- Flows with immiscible phases.
- Multiphase flows due to phase change (evaporation, boiling, condensation, melting, solidification).
- Applications of multiphase flows:
- Fluidized beds.
- Porous media and filters.
- Spraying and aerosol systems.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA10E3	**SEMESTER**	10th
COURSE TITLE	**Advances in Heat Transfer**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Heat Transfer		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Use of numerical methods of finite differences and finite elements in combined heat transfer problems for steady and unsteady conduction.
- Analytical and semi-analytical solutions of problems in specialized cases of heat transfer.
- Extraction of specialized correlations of heat transfer by conduction in special heat exchanger arrangements. • Heat transfer in liquid metals and secondary working fluids in energy systems with increased operating requirements.

- Analysis of innovative devices and elements of heat transfer optimization.
- Thermo-fluid mechanical analysis of heat transfer systems, evaluation of their performance and optimization in modern industrial applications of Mechanical Engineer and combined problems.
- Development of computational tools for the calculation of heat transfer in special applications of Mechanical Engineer.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EA10E4	**SEMESTER**	10th
COURSE TITLE	**Combustion**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Thermodynamics I, Thermodynamics II		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Combustion thermodynamics: Mass conservation and stoichiometry of mixtures, energy conservation in chemical reactions, Gibbs free energy, chemical potential and chemical equilibrium, combustion temperature. Chemical kinetics: Elementary reactions, propagation and branching, reaction rate, reaction rate constant, partial equilibrium and steady state, reversible and chain reactions, explosive limits, combustion mechanisms of various fuels, kinetics of pollutant formation. Transport phenomena: Kinetic theory of gases, flow quantity, dimensionless numbers, conservation equations, diffusion. Reactors: Constant volume, constant pressure, perfect mixing, plug flow. Premixed laminar flame: Laminar flame structure, flame propagation speed (Mallard and Le Chatelier), factors affecting the speed and thickness of the flame, extinction and ignition phenomena, stability limits. Diffusion flames: Damkoehler number, equivalent ratios, diffusion laminar flame structure, characteristic quantities.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT
LEVEL OF STUDIES	UNDERGRADUATE

COURSE CODE	EA10E5	**SEMESTER**	10th
COURSE TITLE	**Design of Elements for Thermal Turbomachines**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Energy transfer in thermal turbomachines with emphasis on gas turbines
- Aerodynamic-Thermodynamic interaction
- Three-dimensional velocity triangles with emphasis on axial turbomachines
- Design and performance prediction of axial flow turbines
- Design and performance prediction of axial flow compressors
- Design methods of radial flow thermal turbomachines
- Heat transfer by conduction in the cooling of thermal turbomachine blades
- Design of gas turbine blade cooling systems
- Heat exchanger design for thermal turbomachines
- Gas turbine start-up and control system principles
- Combustion systems

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB10E1	**SEMESTER**	10th
COURSE TITLE	**Buildings Energy Assessment**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Heat – Ventilation – Air Conditioning		

LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/

SYLLABUS

- Analysis of basic principles governing the energy behavior of buildings.
- Thermal energy losses in buildings. Thermal insulation.
- Use of computational tools with the aim of designing low-energy buildings for heating, cooling and lighting.
- Adaptation of the building to the built and natural environment.
- Thermal protection of the shell and utilization of the shell's thermal capacity.
- Dimensioning of openings
- Solar gains.
- Natural and artificial lighting.
- Ventilation.
- Optimization of ventilation, natural cooling and solar protection as means of reducing cooling requirements.
- Alternative heating and cooling options, with integration of RES systems into the building envelope.
- Updated legislation with analysis and interpretation for new and existing buildings.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB10E2	SEMESTER	10th
COURSE TITLE	**Processing & Management of Solid Waste**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

Specifications of environmentally friendly and economically sustainable solid waste management systems and the role of mechanical engineering in them. Solid waste: Origin and production, qualitative and quantitative characteristics, prevention, reduction, reuse. Treatment technologies and management practices: Waste transport, collection, transfer. Recycling, sorting methods, mechanical systems for separation and transport, examples of processes. Mechanical-biological treatment, anaerobic digestion and co-production of energy and secondary resources. Sanitary landfill, specifications, recovery and energy utilization of biogas. Thermal treatment: Furnace and process technologies, energy utilization, flue gas cleaning, residue management. Treatment of toxic waste. Decision making tools and their applications for solid waste: Life cycle analysis, multi-criteria analysis, geographic information systems, carbon footprint, material flow analysis.

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB10E3	**SEMESTER**	10th
COURSE TITLE	**Medium & High-Power Electrical Substations**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Electric Engines, Electrical Technology & Electronics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Introduction - Electric Power Systems
- MV Networks / Equipment for Coupling and Protection of the MV Network
- Time-current characteristics of the protection means
- Standardized MV supplies
- The Power Transformer (M/S)
- Materials and Devices of M/S MV
- Grounding in consumer substations MV
- Protection of M/S MV against overvoltages
- MV invoices, Calculation of Electric Energy Cost of Industrial Consumer

- Power Factor Correction
- Economic comparison of technical solutions

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	EB10E4	**SEMESTER**	10th
COURSE TITLE	**Electric Energy Storage & Demand Management**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Renewable Energy Sources, Electrical Technology & Electronics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Transformation of Electric Power Systems
- The need for electric energy storage
- Classification of electric energy storage methods
- Pumped storage, Flywheels, Compressed Air Systems
- Supercapacitors and Superconducting Magnetic Systems
- Batteries
- Hydrogen / Synthetic fuels
- Storage and electricity markets
- Economic evaluation of investment in energy storage systems
- The need for Demand Management
- Programs & Applications of Demand Management - Economic evaluation
- Smart Meters - Electric Vehicles - Smart Homes - Smart Grids

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT
LEVEL OF STUDIES	UNDERGRADUATE

COURSE CODE	EB10E5	**SEMESTER**	10th
COURSE TITLE	**Power Electronics & Applications**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Tutorials (Theory)	4	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized knowledge (Energy Sector)		
PREREQUISITE COURSES:	Electric Engines, Electrical Technology & Electronics		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://elearning.cm.ihu.gr/		

SYLLABUS

- Introduction to Power Electronics: Power electronics technology, relation with other scientific fields
- Structure, characteristics and basic operating principles of the main semiconductor switching power devices (Power diodes, Thyristor, BJT, MOSFET, GTO, IGBT,...).
- Classification and basic operating principles of power electronic converters
- Circuits of uncontrolled rectifier devices (using power diodes): Topologies of single-phase and three-phase rectification.
- Controlled converters (using Thyristor): Topologies of single-phase and three-phase fully controlled converters, voltage and current waveforms, calculation of active and reactive power.
- Alternating current to alternating current converters: AC regulators with anti-parallel thyristors, cycloconverters.
- Direct current to direct current converters: Basic topologies of direct current to direct current converters (buck, boost).
- Direct current to alternating current converters: Topologies of single-phase (half-full bridge) and three-phase switching type inverter.
- Principles of Fourier analysis and calculation of harmonic components. Spectrum design. Calculation of active/reactive power, RMS value, total harmonic distortion and application to alternating current converters.

1.11 Diploma Thesis

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	0901 & 1001	**SEMESTER**	9th & 10th
COURSE TITLE	**DIPLOMA THESIS I & II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Average Individual weekly employment		30	15 + 15 = 30
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Annual (9th & 10th semester), Compulsory Course		
PREREQUISITE COURSES:	Depend on the Sector selected		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://mech.ihu.gr/courses/diplomatiki		

SYLLABUS

The Diploma Thesis is a compulsory course of the 5-year Study Program of the IHU Department of Mechanical Engineering, with a total duration of two (2) semesters, that is, it is carried out during the 9th AND 10th semester of studies. It is an original work, which is the product of bibliographic research and / or field research and concerns the application of the knowledge acquired in each Direction - Specialization.

The purpose of the Diploma Thesis is to familiarize students with the research process and to deepen the cognitive subjects of each Direction - Specialization, it is carried out under the supervision of the teaching staff of the Department. The Diploma Thesis is a basic obligation for obtaining the Diploma of the 5-year Study Program of the IHU Department of Mechanical Engineering. It is awarded 15 (during the 9th Semester) + 15 (during the corresponding 10th) = 30 (total) ECTS credits, that is, it requires a total workload of 390 + 390 = 780 hours. It is reminded that 1 DM = 26 hours of workload. The preparation of a Diploma Thesis is expected to help each student to develop the skills required to deal with complex studies and applications. More specifically, through the Diploma Thesis, the students are trained in order to:

- Design, plan, monitor, and control the progress of theoretical work or / and field work.
- Identify and use effectively information resources (Greek and international - electronic and not - bibliography).
- To use in combination the knowledge, tools, and techniques that he has been taught in each Direction - Specialization.
- To formulate his views and ideas with completeness and clarity.
- To present and support his findings and achievements in a purely scientific way.

1.12 Internship

GENERAL

SCHOOL	ENGINEERING of IHU (Serres Campus)		
ACADEMIC UNIT	MECHANICAL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	0905 & 1005	**SEMESTER**	9th or/and 10th
COURSE TITLE	**INTERSHIP I & II**		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Average Individual weekly employment	40:2 = 20	5 + 5 = 10
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Optional, it concerns Field Exercise that can be carried out during the 9th or / and the 10th Semester		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK - ENGLISH, No Exams are applied		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://mech.ihu.gr/courses/praktiki		

SYLLABUS

The students of the Department of Mechanical Engineering of the International Hellenic University, during their studies, can carry out Fieldwork, as defined by the relevant Undergraduate Program (FEK 2657 B / 01-07-2019). The preparation of the Internship is OPTIONAL and aims at:

The substantial contact of the students with the potential places of employment, with the aim of informing them about the structure and operation of the production or / and service units, for the social, economic & technological factors that affect the working conditions, as well as the active participation of trainees in the processes and methods of production or / and service provision.

The correlation of the theoretical scientific knowledge acquired during their studies with the problems of production.

The creation of a stable bond between the Department of Mechanical Engineering of the International Hellenic University and the relevant Student Potential with domestic and foreign Production, with the aim of creating a two-way relationship.

Specifically, as far as the students of the IHU Department of Mechanical Engineering are concerned, the purpose of their (optional) Internship is field work in the study, calculation, design, development, construction, operation and maintenance of machines, devices and mechanical installations, as well as energy production and management systems. Through the Internship, the students of our Department are expected to become familiar with the work environment, so that they are able to deal with real problems that concern businesses.