

ECTS Information Package: Degree Programme

Bachelor's degree in

MECHANICAL ENGINEERING

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A - General Description

Programme Title - Engenharia Mecânica

Qualification awarded - Bachelor's degree in Mechanical Engineering

Level of qualification - First-Cycle degree, ISCED Level 5, EQF Level 6

Specific admission requirements

General

In order to be eligible to this bachelor's degree, students must hold the high-school diploma or legally equivalent qualification. Application can also be made through the following special entry routes:

- Students coming from the Portuguese education system through re-admission, degree change and transfer schemes;
- Holders of a Foundation Course Diploma (CET);
- Adults aged more than 23 who have passed tailor-made examinations intended to assess their ability to pursue higher education studies;
- Holders of Intermediary or Graduate degree diplomas;
- Students coming from foreign higher education.

Specific

To be accepted for entry in the bachelor's degree in Mechanical Engineering one of the following national access examinations is required: 07 Physics and Chemistry and 16 Mathematics with a minimum score of 95 points out of 200. The same minimum score is required for the application grade (in which 65% of the mark corresponds to secondary education and 35% to access examinations).

Without prejudice to the general admission requirements and based on IPT's internal regulations, the following candidates may be admitted to the Mechanical Engineering degree, but subject to admission quotas:

- candidates coming from the following regions: Castelo Branco, Leiria, Portalegre and Santarém (50%);
- candidates who have completed level-4 Vocational Programs (20%).

Specific arrangements for recognition of prior learning (formal, non-formal and informal)General

Procedures on the recognition of credits gained in previous learning are established in the regulations for the Recognition and Validation of Qualifications and Skills of ESTA-IPT available at <http://webmanager.ipt.pt/mgallery/default.asp?obj=4226>

Specific

Not applicable

Qualification requirements and regulations:

180 ECTS credits distributed throughout 6 curricular semesters (3 years). Each academic year is made up of 40 weeks of full-time study (20 weeks per semester) a total of 1620 study hours (1 ECTS credit is equivalent to 27 study hours).

Profile of the program:

The study program is made up of 6 semesters. The first four semesters are common to all students. The last two semesters include several optional course units that allow the students to select a specific training profile. They can choose advanced training courses in Project and Mechanical Production, Energy and Fluid Technologies as well as such areas as Automotive & Automation and Control & Robotics (tuition of these two courses depend on the number of students enrolled).

Key learning outcomes:

Holders of the Mechanical Engineering degree should be able to:

- Design mechanical projects;
- Select and test materials;
- Design metallic structures;
- Understand the energy production process;
- Design fluid networks;
- Build, manufacture and assemble machines, equipments and facilities;
- Understand automated processes;
- Design internal combustion engines;
- Design moulds;
- Design heat transfer and combustion systems;
- Manage industrial sectors and processes;
- Design AVAC systems;
- Understand thermal behaviour of buildings;
- Design refrigeration systems;
- Draw up safety plans;
- Use machine tools.

Occupational profiles of graduates with examples:

Career prospects for the graduates from this program include performing middle- or upper management functions in companies engaged in industrial, commercial and service provision activities in such areas as:

- Metalworking;
- Transportation;
- Special installations (lifts, rolling stairs, electropneumatics and hydraulics);
- Industrial management and maintenance;
- Project (industrial automation, compressed-air networks, electronics, mechanical construction, moulding, product and equipment development, fluid network, heating/air-conditioning systems, electrical machines);
- Production planning and organisation;
- Public works;
- Technical/commercial activities;
- Consultancy.

Access to further studies:

The mechanical engineering degree gives access to second-cycle programs within the IPT or other higher education establishments as according to admission requirements set forth for those programmes. Within ESTA school, it gives access to the Master's degree in Mechanical engineering-Project, mechanical production and Master's degree in maintenance of technical installations and to several postgraduate programs such as the one in Industrial Production.

Course structure diagram with credits

Course Title	Year	Semester	Credits
Applied Chemistry	1	S1	4
Linear Algebra	1	S1	5
Mathematical Analysis I	1	S1	6
Mechanics and Waves	1	S1	5
Programming	1	S1	5
Technical Drawing I	1	S1	5
Applied Mechanics I	1	S2	5
Electricity and Electronics	1	S2	5
Materials Science and Engineering	1	S2	5
Mathematical Analysis II	1	S2	6
Numerical and Statistical Methods	1	S2	4
Technical Drawing II	1	S2	5
Applied Mechanics II	2	S1	5
Materials Technology	2	S1	5
Mathematical Analysis III	2	S1	5
Mechanical Behaviour of Materials	2	S1	4.5
Mechanical Systems Design	2	S1	5
Thermodynamics	2	S1	5.5
Fluid Mechanics	2	S2	5
Heat Transfer	2	S2	5
Hydraulics and Pneumatics	2	S2	5
Industrial Maintenance	2	S2	5
Industrial Organisation	2	S2	4
Mechanics of Materials I	2	S2	6
Electrical Machines	3	S1	5
Mechanical Engineering Design I	3	S1	5.5
Option I (Year3 Sem1)	3	S1	5.5
op: Air Conditioning and Refrigeration (*)	3	S1	5.5
op: Instrumentation and Measurements (*)	3	S1	5.5

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

Course structure diagram with credits (cont.)

Course Title	Year	Semester	Credits
Option II (Year 3 Sem 1)	3	S1	5
op: Thermal Machines (*)	3	S1	5
op: Materials Joining Technology (*)	3	S1	5
Option III (Year 3 Sem 1)	3	S1	4.5
op: Health and Safety at Work (*)	3	S1	4.5
op: Quality (*)	3	S1	4.5
Option IV (Year 3 Sem 1)	3	S1	4.5
op: Health and Safety at Work (*)	3	S1	4.5
op: Quality (*)	3	S1	4.5
Industrial Automation	3	S2	4
Mechanical Engineering Design II	3	S2	5
Option V (Year 3 Sem 2)	3	S2	4
op: Machine Tools (*)	3	S2	4
op: Turbomachines (*)	3	S2	4
Option VI (Year 3 Sem 2)	3	S2	4
op: Machine Tools (*)	3	S2	4
op: Turbomachines (*)	3	S2	4
Option VII (Year 3 Sem 2)	3	S2	2
op: Engineering Ethics (*)	3	S2	2
op: Technical English (*)	3	S2	2
Option VIII (Year 3 Sem 2)	3	S2	11
op: Internship in the field of Materials Science and Technology (*)	3	S2	11
op: Internship in the field of Structural Mechanics (*)	3	S2	11
op: Internship in the field of Mechanical Project (*)	3	S2	11
op: Internship in the field of Robotics, Instrumentation and Automation (*)	3	S2	11
op: Internship in the field of Production and Construction Technologies (*)	3	S2	11
op: Internship in the field of Energy and Fluid Technologies (*)	3	S2	11

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

Examination regulations, assessment and grading

General

General assessment rules are in line with the Portuguese law and described in the Academic Regulations of ESTA-IPT available at <http://webmanager.ipt.pt/mgallery/default.asp?obj=4178>.

The licenciado degree is awarded a final grade between 10 and 20 within a 0/20 scale as well as its equivalent in the European grading scale.

Specific

The assessment criteria for each individual course unit are established in the respective course information sheet.

Graduation requirements:

Completion of the study program requires a pass in all its constituent course units and 180 accumulated ECTS credits.

Mode of study:

Full- or part-time.

Program director or equivalente

Director: Isabel Maria Duarte Pinheiro Nogueira

Erasmus coordinator: Carlos Alexandre Campos Pais Coelho

ECTS coordinator: Flávio Rodrigues Fernandes Chaves

B - Description of individual course units

Course unit title	Applied Chemistry
Course unit code	912306
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Valentim Maria Brunheta Nunes
Learning outcomes of the course unit	To learn and develop basic knowledge of Chemistry principles relevant to other modules in the programme. Stimulate the study of chemistry and show their significance to Industry and Society. The students should be able to solve basic problems of chemistry and perform simple laboratory tasks.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	1. Basic tools of chemistry. Atoms, molecules and ions. Chemical reactions and stoichiometry; 2. Chemical bonding and states of matter. Gases. Intermolecular forces, liquids and solids. Polymers; 3. Chemical equilibrium. Acid – Base equilibrium. 4. Electrochemistry. Redox reactions. Introduction to corrosion.
Recommended or required Reading	- Chang, R.(2013). <i>Química</i> . Lisboa: McGraw-Hill - Simões, J.(2000). <i>Guia do Laboratório de Química e Bioquímica</i> . Lisboa: Lidel - Treichel, P. e Kotz, J. (2003). <i>Chemistry & Chemical Reactivity</i> . London: Thomson Books
Planned learning activities and teaching methods	Lectures providing description of course contents. Tutorials involving exercise solving and practical execution of laboratorial activities.
Assessment Methods and criteria	Final written exam (75%) and reports of laboratorial activities (25%).
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Linear Algebra
Course unit code	912301
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Maria Isabel Vaz Pitacas
Learning outcomes of the course unit	Using Logic, Matrices and Determinants to solve linear equations systems with application to analytic geometry. Basic concepts of eigenvalues and eigenvectors that will allow to develop reasoning skills and acquire knowledge required to other modules of the programme.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1. Introduction to Mathematical Logic 2. matrices 3. determinants 4. Matrices, Determinants and Analytical Geometry 5. Eigenvalues and eigenvectors
Recommended or required Reading	
Planned learning activities and teaching methods	Resort to media resources. Practical exercises and laboratorial experiences as needed.
Assessment Methods and criteria	2 written tests (F1 and F2) marked classified from 0 to 20 and Test 1 (T1) marked from 0 to 20 or 2 written tests (F1 and F2) marked from 0 to 20 Final grade = $0.9 \times [(F1+F2)/2] + 0.1 \times T1$ or grade = $(F1+F2)/2$. E/or exam.
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mathematical Analysis I
Course unit code	912302
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Maria Helena Morgado Monteiro
Learning outcomes of the course unit	a) Consolidate and expand students' knowledge of mathematics; b) Know and apply the basic foundations to the mathematical procedures used in the curricular units of course; c) Interpret data, formulate and solve problems related to differential and integral calculus.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	High-school level mathematics.
Recommended optional programme components	Not applicable.
Course contents	1.Real functions. 2.Differential calculus - definition, differentiation formulas, derivatives and its application (related rates, extreme values, extremum problems, graph of a function). 3.Integral calculus - indefinite integral, definite integral (calculation of an area of a region between two graphs, volume of a solid of revolution and length of a plane curve), improper integral.
Recommended or required Reading	- Monteiro, H.(2014). <i>Apontamentos de Análise Matemática I</i> . Abrantes: ESTA - Stewart, J.(2002). <i>Cálculo</i> . (Vol. I). São Paulo: Pioneira Thomson Learning - Edwards, B. e Hostetler, R. e Larson, R. (2006). <i>Cálculo</i> . (Vol. I). São Paulo: McGraw-Hill
Planned learning activities and teaching methods	Presentation of theoretical contents followed by exercise solving under the teacher's supervision.
Assessment Methods and criteria	Mid-term assessment: three written tests (0-4; 0-8; 0-8), with a minimum of 3 points in 3 points in the last two tests; Final assessment: written exam (0-20). Students will pass if they obtain a minimum grade of 10 points (out of a 0-20 scale).
Language of Instruction	Portuguese Mentoring in French
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mechanics and Waves
Course unit code	912304
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes Teresa Leonor Ribeiro C. M. Morgado
Learning outcomes of the course unit	Teach students the basic knowledge within the framework of classical mechanics and electromagnetism.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable
Recommended optional programme components	Not applicable
Course contentes	Classical Mechanics Kinematics of material points Newtonian Dynamics Conservative and Non-conservative forces Wave motions Electromagnetism
Recommended or required Reading	- Alonso, M. e , E. (2012). <i>Física</i> . (Vol. I). (pp. 1-936). Lisboa: Escolar Editora - Deus, J. e Pimenta, M. e Noronha, A. e Pena, T. e Brogueira, P. (2014). <i>Introdução à Física</i> . (Vol. I). (pp. 1-655). Lisboa: Escolar Editora
Planned learning activities and teaching methods	The learning methods and theoretical, theoretical-practical and laboratory procedures provide knowledge about program contents and development capabilities for mechanical and waves, in order to enable the analysis of the problem, encourage understand
Assessment Methods and criteria	Students are assessed through written exams in one of the three institution evaluation periods. The written test will have a minimum of 9.5 for approval.
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable

B - Description of individual course units

Course unit title	Programming
Course unit code	912305
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Toni dos Santos Alves
Learning outcomes of the course unit	Students should get basic knowledge of algorithmics and C-programming, get familiarised with MatLab and LabView softwares and use them to develop programs and solve engineering problems.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Algorithmics. 2. C programming language. 3. Matlab programming language. 4. LabView programming language.
Recommended or required Reading	- Manzano, J.(2009). <i>Algoritmos</i> . (Vol. 1). Brasil: Érica - Mizrahi, V.(2013). <i>Treinamento em Linguagem C</i> . (Vol. 1). S. Paulo: McGraw Hill
Planned learning activities and teaching methods	Theoretical/practical classes.
Assessment Methods and criteria	
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Technical Drawing I
Course unit code	912303
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Bruno Miguel Santana Chaparro
Learning outcomes of the course unit	To enable students to Computer Aided Design (CAD), to provide them a tool to support other courses and to gain the necessary bases for future progress in CAD.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1. Preliminary concepts. 2. Orthogonal projections. 3. Axonometric projections. 4. Introduction to CAD.
Recommended or required Reading	- Silva, A. e Dias, J. e Sousa, L. e Ribeiro, C. <i>Desenho Técnico Moderno.</i> : Lidel - Morais, S.(2006). <i>Desenho Técnico Básico.</i> (Vol. 3). : Porto Editora
Planned learning activities and teaching methods	After the exposure moments of the theoretical concepts, several practical exercises in CAD will be solved. The Autocad software will be used as a tool to apply the theoretical concepts and to solve practical exercises.
Assessment Methods and criteria	Students will be assessed through written tests/exams (60%) and individual theoretical-practical work that will be performed during the semester (40%). For the written tests/exams a minimum of 7 values must be obtained for approval.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Applied Mechanics I
Course unit code	912311
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Carlos Alexandre Campos Pais Coelho
Learning outcomes of the course unit	Provide students with theoretical and practical knowledge to the modeling of real problems of Mechanics Physics. Provide an introduction to the Static equilibrium. Determine Centroids and Centres of Gravity Examine structures and machinery.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1. Statics of Particles: plane and space forces. 2. Rigid Bodies: Equivalent Systems of Forces (Two- and three-dimensional). 3. Equilibrium of Rigid Bodies. 4. Distributed Forces, Centroids and Centres of Gravity. 5. Analysis of structures.
Recommended or required Reading	
Planned learning activities and teaching methods	The theoretical concepts will be presented in classroom with the aid of audiovisual media. Worksheets will be resolved in class.
Assessment Methods and criteria	Continuous evaluation: The final grade (NFinal) is calculated considering the exams grades (NProvas) and individual coursework (NTrab.): $N_{Final}=0,75 \times N_{provas}+0,25 \times N_{trab}$ or only NProvas Final grade: Written exam
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Electricity and Electronics
Course unit code	912310
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Luís Miguel Marques Ferreira
Learning outcomes of the course unit	Fundamentals of electric and electronic circuits. At the end of the year, students should be able to use appropriate tools and concepts to analyse simple electric circuits as well as some basic electronic circuits with operational amplifiers, diodes, transistors or digital logic ports.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	1. The composition of matter 2. DC circuits 3. Single-phase AC circuits 4. Operational Amplifier (AmpOp) 5. Semi-conductors theory, Diode 6. Bipolar junction transistor
Recommended or required Reading	<ul style="list-style-type: none"> - Alves, T.(2015). <i>Sebenta Electricidade e Electrónica</i>. (Vol. 1). (pp. 1-234). ESTA: ESTA/IPT - Markus, O.(2008). <i>Circuitos Elétricos - Corrente Contínua e Corrente Alternada</i>. (Vol. 1). (pp. 01-279). São Paulo: Érica - Albuquerque, E.(2006). <i>Análise de Circuitos em Corrente Alternada</i>. (Vol. 1). (pp. 13-225). São Paulo: Érica - Cruz, E.(2007). <i>Eletrónica Aplicada</i>. (Vol. 1). (pp. 15-293). São Paulo: Érica
Planned learning activities and teaching methods	Lectures, tutorials and laboratory sessions.
Assessment Methods and criteria	Ongoing assessment: 9 written assignments Mid-term assessment: written test, exam, make-up exam or exam for working students
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Materials Science and Engineering
Course unit code	912308
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	Characterize different materials in structural and microstructural terms and group them in different classes. Understand phenomena such as solubility in solid state diffusion and solidification. Understand the connections material - processing - microstructure - properties.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1.Introduction to materials; 2.Atomic structure, atomic bonds and properties of materials; 3.Crystal structure and noncrystalline solids. Structure of different materials. Crystalline defects; 4.Nucleation and solidification of metals; 5.Diffusion in Solids and industrial applications; 6.Introduction to the mechanical behavior of materials; 7.Other properties of materials; 8.Phase diagrams.
Recommended or required Reading	
Planned learning activities and teaching methods	Lectures, tutorials and laboratory demonstrations. Technical visits.
Assessment Methods and criteria	Written tests (continous evaluation), individual and group work or final exams with work.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mathematical Analysis II
Course unit code	912307
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	Maria Helena Morgado Monteiro
Learning outcomes of the course unit	Develop the skills of students to interpret data, formulate and solve problems that occur in engineering and relate to: a) Representation of functions by series and calculate approximate values; b) Concepts and applications of derivatives and integrals of functions with more than one variable.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	1.Series: series of numbers and functions; 2.Differential calculus in R^n - partial derivatives; differentiability; maxima, minima and saddle points, Lagrange's multipliers. 3.Multiple integrals – definition, properties, evaluation and applications of the double integral and the triple integral
Recommended or required Reading	- Edwards, B. e Hostetler, R. e Larson, R. (2006). <i>Cálculo</i> . (Vol. II). São Paulo: McGraw-Hill - Stewart, J.(2002). <i>Cálculo</i> . (Vol. II). São Paulo: Pioneira Thomson Learning - Costa, J. e Breda, A. (1996). <i>Cálculo com funções de várias variáveis</i> . Lisboa: McGraw-Hill - Monteiro, H.(2012). <i>Apontamentos de Análise Matemática II</i> . Abrantes: ESTA
Planned learning activities and teaching methods	Presentation of the theoretical contents. Worksheets solved in class under the teacher's supervision.
Assessment Methods and criteria	Mid-term assessment: three tests (0-6, 0-7, 0-7, with a minimum of 2 points); Final assessment: written exam (0-20 points). Students pass if they obtain a minimum grade of 10 points (out of a 0-20 scale).
Language of Instruction	Portuguese Mentoring in French
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Numerical and Statistical Methods
Course unit code	912312
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Maria Isabel Vaz Pitacas
Learning outcomes of the course unit	
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	1. Preliminary Analysis of Data 2. Introduction to Probability 3. Random unidimensional Variables 4. Theoretical distributions 5. Introduction to Estimation 6. Simple Linear Regression 7. Roots of Nonlinear Equations 8. Polynomial interpolation. 9. Numerical Integration (or Numerical quadrature) 10. Equations Systems
Recommended or required Reading	<ul style="list-style-type: none"> - Pestana, D. e Velosa, S. (2010). <i>Introdução à Probabilidade e à Estatística</i>. Lisboa: Fundação Calouste Gulbenkian - Maroco, J.(2014). <i>Análise Estatística com o SPSS Statistics</i>. Lisboa: ReportNumber - Pina, H.(2010). <i>Métodos Numéricos</i>. Lisboa: Escolar Editora - Santos, F.(2002). <i>Fundamentos de Análise Numérica</i>. Lisboa: Sílabo
Planned learning activities and teaching methods	Lectures with the aid of media resources and laboratory experiences.
Assessment Methods and criteria	
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Technical Drawing II
Course unit code	912309
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	First Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Luís Miguel Marques Ferreira
Learning outcomes of the course unit	To enable students to 3D Computer Aided Design (CAD). Advanced dimensioning: dimensional and geometrical tolerances, fittings, surface finish. Machine elements drawings.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Previous knowledge of geometric solid projections, cuts and sections and axonometric perspectives.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Dimensional tolerances and surface finish. 2. Geometric tolerances 3. Technical drawing of welded joints. 4. Machine components. 5. Advanced application in CAD.
Recommended or required Reading	
Planned learning activities and teaching methods	After the exposure moments of the theoretical concepts, several practical exercises in CAD will be solved. The SolidWorks® software will be used as a tool to apply the theoretical concepts and to solve practical exercises.
Assessment Methods and criteria	Students will be assessed through written tests/exams (60%) and individual theoretical-practical work that will be performed during the semester (40%). For the written tests/exams a minimum of 7 values must be obtained for approval.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Applied Mechanics II
Course unit code	912316
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Jorge Manuel Afonso Antunes
Learning outcomes of the course unit	This course is organised into two parts: - The first part (a follow-up of Applied Mechanics I) deals with static mechanics including analysis of external forces on structures and machines, friction and inertia. - The second part deals with kinematics
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1.Forces on beams, structures and machines 2.Friction 3.Inertia 4.Kinematics of rigid bodies 5.Planar motion of rigid bodies, forces and accelerations
Recommended or required Reading	- Beer, F.(2000). <i>Mecânica Vectorial para Engenheiros – Estática</i> ”,.: McGraw-Hill. - Beer, F.(2000). <i>Mecânica Vectorial para Engenheiros – Dinâmica</i> . :
Planned learning activities and teaching methods	Lectures and tutorials
Assessment Methods and criteria	Written test (100%)
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Materials Technology
Course unit code	912317
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Carlos Alexandre Campos Pais Coelho
Learning outcomes of the course unit	Students should: - be able to characterise the different types of materials - be familiar with the different thermal treatments of metal alloys and its purposes - know the appropriate procedures for each material - be familiar with metal characterisation techniques
Mode of delivery	Face-to-face
Prerequisites and co-requisites	While not compulsory, a pass in Materials Science and Engineering will be useful.
Recommended optional programme componentes	Not applicable.
Course contents	- Industrial production of iron alloys - Iron-carbon alloy systems - Alloy and non-alloy steel - Thermal treatment of steels - Classification of steels - Cast irons - Non-ferrous metallic materials - Non-metallic materials - Introduction to meta
Recommended or required Reading	
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes. Technical visits.
Assessment Methods and criteria	Written tests and individual and group coursework, the latter being compulsory in every assessment season.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mathematical Analysis III
Course unit code	912313
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Maria Helena Morgado Monteiro
Learning outcomes of the course unit	Extend students' knowledge about the differential and integral calculus so they can formulate, analyze and solve problems which are related to: a) The behavior of physical phenomena when their variation rates and restrictions are known; b) The effect of vector fields in the movement of particles.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Mathematical Analysis I and Mathematical Analysis II.
Recommended optional programme components	Not applicable.
Course contents	1. Differential equations – first-order differential equations and linear differential equations of order n, Laplace's transform, linear differential equations systems; 2. Vectorial calculus - vectorial functions, line integrals, surface integrals.
Recommended or required Reading	<ul style="list-style-type: none"> - Monteiro, H.(2014). <i>Apontamentos de Análise Matemática III</i>. Abrantes: ESTA - Stewart, J.(2002). <i>Cálculo</i>. (Vol. II). São Paulo: Pioneira Thomson Learning - Zill, D.(2001). <i>Equações Diferenciais</i>. (Vol. I). São Paulo: Makron Books - Edwards, B. e Hostetler, R. e Larson, R. (2006). <i>Cálculo</i>. (Vol. II). São Paulo: McGraw-Hill
Planned learning activities and teaching methods	Lectures. Worksheets solved in class under the teacher's supervision.
Assessment Methods and criteria	Mid-term assessment: two tests (0-20 points, with a minimum of 6 points); Final assessment: written exam (0-20 points). Students pass if they obtain a minimum grade of 10 points (out of a 0-20 scale).
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mechanical Behaviour of Materials
Course unit code	912314
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	Carlos Alexandre Campos Pais Coelho
Learning outcomes of the course unit	The students should: .know the concepts of elasticity and plasticity . know the key material deformation mechanisms . understand the different types of material behaviour when subject to mechanical load and kow how to use them . be familiarised with mechanical tests
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Although it is not mandatory, a previous pass in the module Materials Science and Engineering would be useful
Recommended optional programme componentes	Not applicable.
Course contentes	Elasticity - tension and deformation analysis Plasticity and forms of damage Traction test and relevant standards Materials compression Evaluation of the hardness of materials Bending and twisting test Materials fatigue Creep, relaxation and recovery
Recommended or required Reading	
Planned learning activities and teaching methods	Lectures, tutorials and laboratory sessions.
Assessment Methods and criteria	Assessment includes written tests and individual coursework in class. Coursework is compulsory and a minimum of 10 grade points is required. Written assessment includes tests and/or exams
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mechanical Systems Design
Course unit code	912315
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Bruno Miguel Santana Chaparro
Learning outcomes of the course unit	To enable students to drawing of mechanical assemblies using advanced 3D Computer Aided Design (CAD) techniques.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Previous knowledge of geometric solid projections, cuts and sections, dimensioning, dimensional and geometric tolerancing.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Technical drawing of mechanical assemblies 1.1. Introduction 1.2. Structures 1.3. Mechanisms 2. Advanced application in CAD - Computer Aided Design 2.1. Advanced solid modelling 2.2. Surface modelling 2.3. Check mounting assemblies 2.4. Presentation of models in photo-realistic images (render) 2.5. Convert to other CAD formats
Recommended or required Reading	- Silva, A. e Dias, J. e Sousa, L. e Ribeiro, C. e , . <i>Desenho Técnico Moderno</i> . : Lidel - Cunha, L.(2010). <i>Desenho Técnico</i> . Lisboa: Fundação Calouste Gulbenkian - Morais, S.(2006). <i>Desenho Técnico Básico</i> . (Vol. 3). : Porto Editora
Planned learning activities and teaching methods	After the exposure moments of the theoretical concepts, several practical exercises in CAD will be solved. The SolidWorks software will be used as a tool to apply the theoretical concepts and to solve practical exercises.
Assessment Methods and criteria	Students will be assessed through individual theoretical-practical work that will be performed during the semester (40%) and by a final practical work (60%).
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Thermodynamics
Course unit code	912318
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Flávio Rodrigues Fernandes Chaves
Learning outcomes of the course unit	This course presents an initial approach of thermodynamics from the point of view of Mechanical Engineering. Case studies are used to address problems typically found by mechanical engineers in their profession.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	Chapter 1: Basic concepts and definitions. Chapter 2: Energy and transfer modes. Chapter 3: Fundamental properties of gases. Chapter 4: Properties of a pure substance. Chapter 5: First principle of Thermodynamics - control volumes. Chapter 6: Second law of thermodynamics. Chapter 7: steam power cycles .
Recommended or required Reading	- Cengel, Y.(2013). <i>Introduction to Thermodynamics and Heat Transfer</i> . NA: McGraw-Hill - Cengel, Y. e Boles, M. (2012). <i>Termodinâmica</i> . NA: McGraw-Hill
Planned learning activities and teaching methods	Tutorials including data-show. Practical exercises solved on the blackboard and laboratory experiments as needed.
Assessment Methods and criteria	Final mark (FM)is calculated according to the following criteria: Written test (T) - 60% Lab work(Lab) - 40% $FM = 0.60 \cdot T + 0.40 \cdot Lab$
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Fluid Mechanics
Course unit code	912321
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Flávio Rodrigues Fernandes Chaves
Learning outcomes of the course unit	Understanding the static and fluid dynamics and effects of fluid flow on the contours, which can be solid surfaces or interfaces with other fluids. Structuring problem solving.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contentes	1. Physical properties of fluids. 2. Dimensional analysis. 3. Hydrostatic. 4. Hydro kinetics. 5. Hydrodynamics. 6. Global study of fluid flows. 7. Uniform flow resistance formulae.
Recommended or required Reading	
Planned learning activities and teaching methods	Tutorials including data-show. Practical exercises solved laboratory experiments as needed.
Assessment Methods and criteria	Final mark (NF) is calculated according to the following criteria: Written test (T) - 60% Lab experiments (lab) - 40%
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Heat Transfer
Course unit code	912324
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Flávio Rodrigues Fernandes Chaves
Learning outcomes of the course unit	Understanding of heat transfer phenomena, working principle and mechanisms. Establishing fundamental equations and boundary conditions for typical simplifying assumptions conduction problems, convection and radiation. Structure problem solving.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1. Introduction 2. Heat transfer-conduction. 3. Heat conduction in one-dimensional steady state, and without heat generation. 4. Heat conduction in one-dimensional steady state, and with heat generation. 5. Fin. 6. Transient heat. 7. Convection. 8. Heat exchangers: types of heat exchangers. 9. Radiation through transparent media.
Recommended or required Reading	
Planned learning activities and teaching methods	Tutorials with the aid of datashow and exercise solving and laboratory classes.
Assessment Methods and criteria	The tests of knowledge assessment consist of an evaluation component written and laboratory component.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Hydraulics and Pneumatics
Course unit code	912319
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Toni dos Santos Alves
Learning outcomes of the course unit	An introduction of hydraulic and pneumatic systems in industrial processes.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	1. Introduction to automation (2h) 2. Introduction to digital systems (2h) 3. Numbering and code systems (4h) 4. Boole algebra and logic circuits (12h) 5. Hydraulics and Pneumatics (20h) 6. Sequential method (20h)
Recommended or required Reading	<ul style="list-style-type: none"> - Fialho, A.(2003). <i>Automação Pneumática</i>. (Vol. 1). (pp. 1-324). Didáctica Érica: Didáctica Érica - Novais, J.(1997). <i>Método Sequencial Para Automatização Electropneumática</i>. (Vol. 1). (pp. 1-473). Fundação Calouste Gulbenkian: Fundação Calouste Gulbenkian - Fialho, A.(2004). <i>Automação Hidráulica</i>. (Vol. 1). (pp. 1-200). Didáctica Érica: Didáctica Érica - Alves, T.(2015). <i>Sebenta Hidráulica e Pneumática</i>. (Vol. 1). (pp. 01-88). Abrantes: ESTA
Planned learning activities and teaching methods	Lectures and tutorials including case study analysis. Laboratory classes.
Assessment Methods and criteria	Ongoing assessment: 5 laboratory assignments; Mid-term assessment: test, exam, make-up exam or employed student exam. Final assessment: written part minimum mark of 9 and coursework part minimum mark of 10
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Industrial Maintenance
Course unit code	912320
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Teresa Leonor Ribeiro C. M. Morgado
Learning outcomes of the course unit	Ministering to the students knowledge of Maintenance Management. Equip students with tools capable of organizing and / or managing a maintenance department.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Prior knowledge of statistics and reliability
Recommended optional programme componentes	Excel
Course contentes	1. Introduction to Industrial Maintenance 2. Equipments 3. Behaviour of goods and equipments 4. Reliability-based maintenance 5. Maintainability and availability 6. Analysis of maintenance costs 7. Preparation of maintenance procedures 8. Planning 9. Managment of maintenance services 10.Maintenance policies
Recommended or required Reading	- Ferreira, L.(1998). <i>Uma introdução à manutenção</i> . (Vol. .). (pp. 1-193). Portugal: Publindústria
Planned learning activities and teaching methods	Lectures and theoretical-practical sessions with content presentation and resolution of worksheets. Fieldwork classes include on-site visits to industry and workshops with Maintenance Engineer as a guest speaker.
Assessment Methods and criteria	Two written tests (75%) and fieldwork report (s) (25%) Written assessment includes tests and/or exams. A minimum of 7.0 is required in the written test
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Industrial Organisation
Course unit code	912323
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes
Learning outcomes of the course unit	The students should - be aware of the significance of management issues - acquire essential concepts, instruments and tools for the strategic management of an organisation which will improve decision-making
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1. Project 2. Organisations - Types 3. A project's lifespan 4. Project planning 5. Budgeting and cost estimation 6. Preparation of a project 7. Developing an application with Microsoft Project 8. Production management
Recommended or required Reading	
Planned learning activities and teaching methods	Lectures, tutorials and case study analysis
Assessment Methods and criteria	Written test (100%)
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mechanics of Materials I
Course unit code	912322
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Second Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	6
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes
Learning outcomes of the course unit	The students will be provided with the basics of twisting, bending and transverse loads that will enable them to design beams and shafts.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable
Recommended optional programme components	Not applicable
Course contentes	Stress and strain Torsion Pure bending Transverse loads Beam and shaft project Calculus of beam deflection - integration method
Recommended or required Reading	
Planned learning activities and teaching methods	Lectures and tutorials
Assessment Methods and criteria	Coursework (50%)+ written test (50%)
Language of Instruction	Portuguese
Work placement(s)	Not applicable

B - Description of individual course units

Course unit title	Electrical Machines
Course unit code	912325
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Toni dos Santos Alves
Learning outcomes of the course unit	Students should familiarised themselves with the constructive structure and appropriate use of electrical machines.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Previous knowledge of electricity and electronics
Recommended optional programme componentes	Not applicable.
Course contents	1. Introduction to electrical installations (5h) 2. Introduction to automation systems (5h) 3. Introduction to electrical machines (2h) 4. Transformers (13H) 5. Asynchronous motors (20h) 6. Dynamo/DC motor (15h)
Recommended or required Reading	<ul style="list-style-type: none"> - Matias, J.(2005). <i>Máquinas Eléctricas Corrente Alternada</i>. (Vol. 1). (pp. 1-112). Lisboa: Didáctica Editora - Rodrigues, J. e Matias, J. (1992). <i>Máquinas Eléctricas - Transformadores</i>. (Vol. 1). (pp. 1-137). Lisboa: Didáctica Editora - Matias, J.(1990). <i>Máquinas Eléctricas Corrente Contínua</i>. (Vol. 1). (pp. 1-87). Lisboa: Didáctica Editora
Planned learning activities and teaching methods	Lectures, tutorials and laboratory sessions, case-study analysis and practical coursework.
Assessment Methods and criteria	Ongoing assessment - 5 practical assignments Mid-term assessment - written test, exam, make-up exam and employed student exam Final assessment - minimum mark of 9 in the written part and a minimum mark of 9.5 in practical assignments
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mechanical Engineering Design I
Course unit code	912361
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Teresa Leonor Ribeiro C. M. Morgado Pedro Alexandre de Almeida do Vale Antunes
Learning outcomes of the course unit	The students should learn the basic concepts: of failures resulting from static and variable loading; of lubrication and wear. And be able to design of mechanical elements as welding, brazing, bonding, screws, fasteners, mechanical springs shafts and axles.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	A pass in previous modules: Physical; Applied Mechanics; Mechanics of Materials
Recommended optional programme componentes	Not applicable.
Course contentes	Fatigue project; shafts and axles; welding, brazing, bonding and the design of permanent joints; screws, fasteners and the design of nonpermanent joints; mechanical springs; lubrication and wear.
Recommended or required Reading	- Mischke, C. e Shigley, J. (2013). <i>Mechanical Engineering Design</i> . (Vol. 1). (pp. 1-1248). EUA: McGraw-Hill
Planned learning activities and teaching methods	Presentation of key theoretical concepts. Theoretical/practical classes including case study discussions.
Assessment Methods and criteria	Students are assessed through written exams in one of the three instituion evaluation periods. The written test will have a minimum of 9.5 for approval.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Air Conditioning and Refrigeration (*)
Course unit code	912326
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Flávio Rodrigues Fernandes Chaves
Learning outcomes of the course unit	Concepts of climate control and refrigeration. Classification of climate control systems, air diffusion in indoor spaces, ventilation. Refrigeration applications. Steam compression system. Refrigerant fluids. Refrigeration equipments, thermal loads.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	AIR CONDITIONING 1. Psychrometrics 2. Thermal comfort and climate action 3. Characterisation of thermal behaviour of buildings 4. Air conditioning systems 5. Dimensioning of refrigeration ducts REFRIGERATION 1. Refrigeration theory and cycles and 2. Refrigerants 3. Study of the components of refrigeration plants 4. Calculation of refrigeration plants
Recommended or required Reading	- Creus, J.(2008). <i>Tratado Prático de Refrigeração Automática</i> . Lisboa: Dinalivro - Stocker, W.(1998). <i>Industrial Refrigeration Handbook</i> . : McGraw-Hill - Çengel, Y. e Boles, M. (2000). <i>Termodinâmica</i> . : McGraw-Hill - , ..DL 118/2013, <i>Regulamento de desempenho energético dos edifícios de habitação (reh)</i> .. : .
Planned learning activities and teaching methods	Lectures and tutorials including exercise solving and laboratory experiments
Assessment Methods and criteria	Final mark will be calculated according to: Written test - 60% Reports of the work done - 40%
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Instrumentation and Measurements (*)
Course unit code	912327
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5.5
Name of Lecturer(s)	Toni dos Santos Alves
Learning outcomes of the course unit	Students should: -acquire key concepts about measurement, error, uncertainty and calibration - Become familiar with the use of the main electrical measurement tools - Become acquainted with signals and filter processing systems, sensors, actuators and data acquisition and transmission systems.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	While not compulsory, previous knowledge of the course Electricity and Electronics is useful.
Recommended optional programme componentes	Not applicable.
Course contentes	
Recommended or required Reading	- Campilho, A. <i>Instrumentação Electrónica. Métodos e Técnicas de Medição</i> . Porto: FEUP - Cabral, P.(2004). <i>Erros e Incertezas nas Medições</i> . Porto: IEP-ISEP
Planned learning activities and teaching methods	
Assessment Methods and criteria	
Language of Instruction	Portuguese Mentoring in French
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Materials Joining Technology (*)
Course unit code	912330
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Jorge Manuel Afonso Antunes
Learning outcomes of the course unit	This discipline aims to provide students with knowledge in the field of welding processes
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contentes	1. Introduction 2.welding of metallic materials and related techniques 3.welding joint tests 4 welding metallurgy 5.Metal cutting
Recommended or required Reading	- Quintino, L. <i>Processos de soldadura</i> . Lisboa: ISQ
Planned learning activities and teaching methods	Lectures, tutorials and laboratory sessions
Assessment Methods and criteria	Written test (100%)
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Thermal Machines (*)
Course unit code	912331
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Jorge Manuel Afonso Antunes Flávio Rodrigues Fernandes Chaves
Learning outcomes of the course unit	Technical training on the operation of piston engines (diesel and explosion). Project and design of heat engines: dimensioning parameters, construction, performance and its impact on energy production, pollutant emissions, fuel consumption, etc..
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Understanding the concepts of thermodynamics, heat transfer, kinematics and chemistry are the basis for success.
Recommended optional programme components	Not applicable.
Course contentes	1.Types of piston engines and their operation; 2.Engine friction and lubrication 3.Cooling 4.Design parameters and operation 5.Thermochemistry of fuel-air mixtures; 6.Working fluid properties 7.Ideal models for engine cycles; 8.Gas exchange processes; 9.Pollutant formation and monitoring; 10. Engine operation features 11.Thermodynamic Systems and Cycles
Recommended or required Reading	
Planned learning activities and teaching methods	Theoretical/practical classes including description of the basic concepts. The students will have the opportunity to solve real problems and reflect on the results.
Assessment Methods and criteria	Written test divided into theoretical and practical (50% each).
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Health and Safety at Work (*)
Course unit code	912336
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes
Learning outcomes of the course unit	Students should be able to: - Understand the main legal instruments and become aware of the rights and obligations on this area. - Participate in the process of hazard identification and risk assessment and implementation of control measures. - know the machine requirements
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Applicable legislation and legal obligations. 2. OSH Indicators. 3. Individual Protection equipment 7. Electrical hazards 8. Chemical Hazards 9. Physical Hazards 10. Safety of Machinery and Equipment 11.Cargo movement 12. Fire prevention and protection
Recommended or required Reading	- Gomes, A.(2004). <i>Apontamentos Higiene e Segurança</i> . Abrantes: Autor - Miguel, A.(2014). <i>Manual de Higiene e Segurança do Trabalho</i> . Porto: Porto Editora
Planned learning activities and teaching methods	The theoretical concepts will be presented with the aid of audiovisual media. Practical problems will be solved in class.
Assessment Methods and criteria	Individual assignments to be presented at the end of semester.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Quality (*)
Course unit code	912337
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	First Semester
Number of ECTS credits allocated	4.5
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes
Learning outcomes of the course unit	The students should have learned the necessary concepts to implement a quality system and promote the accreditation of laboratories.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable
Recommended optional programme components	Not applicable
Course contents	Quality Certification Systems Non-destructive tests Quality management Organisation of the quality function Quality assurance Seven traditional tools New quality tools Implementation of a quality system Quality audit Quality management vs certification Laboratory accreditation Total quality Excellence Models Management of change
Recommended or required Reading	<ul style="list-style-type: none"> - Bernillon, A. e Cerutti, O. (1995). <i>A Qualidade Total - Implementação e Gestão</i>. Lisboa: LIDEL - Edições Técnicas Limitada - Gomes, A.(1989). <i>A Gestão do Processo em Cadeia</i>. Lisboa: Edição particular - Qualidade, N.(2000). <i>Normas da Qualidade</i>. IPQ: IPQ
Planned learning activities and teaching methods	Lectures supported by case study analysis and debate.
Assessment Methods and criteria	Individual assignments to be presented at the end of semester.
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Industrial Automation
Course unit code	912362
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Bruno Miguel Santana Chaparro
Learning outcomes of the course unit	In this course the students should gain the ability to identify situations where the industrial automation can bring advantages. It is also intends mastering the equipment used in automation and its programming techniques.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme componentes	Not applicable.
Course contents	1. Introduction to automation 2. Sensors and actuators 3. Electric logic circuits 4. Programmable Logic Controlrs (PLCs) 5. PLC programming 6. Automatic control
Recommended or required Reading	- Pires, J.(2012). <i>Automação Industrial</i> . (Vol. NA). Portugal: ETEP - Francisco, A.(2003). <i>Autómatos Programáveis</i> . (Vol. NA). Portugal: LIDEL
Planned learning activities and teaching methods	Lectures, tutorials and laboratory classes
Assessment Methods and criteria	The evaluation will be performed based on written tests according the schedule and criteria defined on the academic regulation.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Mechanical Engineering Design II
Course unit code	912363
Type of course unit	Compulsory
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	5
Name of Lecturer(s)	Teresa Leonor Ribeiro C. M. Morgado
Learning outcomes of the course unit	Students should become familiar with the design and selection of clutches, brakes, sliding bearings, ball bearings, belt drive components, chain drive components, gear drive components, gear trains.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Mechanics and Waves, Applied Mechanics, Mechanics of Materials,
Recommended optional programme componentes	Not applicable.
Course contentes	1. Clutches and brakes; 2.Sliding bearings; 3. Rolling bearings; 4. Mechanical drive; 5.Belt drive; 6.Chain drive; 7.Gears.
Recommended or required Reading	- Shigley, J.(2013). <i>Mechanical Engineering Design</i> . (Vol. I). (pp. 1-1248). EUA: McGraw-Hill
Planned learning activities and teaching methods	Theoretical classes describes and illustrates the application of fundamental principles. Theoretical and practical classes are propose solving practical cases.
Assessment Methods and criteria	Students are assessed, one of the four evaluation periods established by the institution through written tests. The written test will take a minimum of 9.5 for approval.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

B - Description of individual course units

Course unit title	Machine Tools (*)
Course unit code	912342
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Jorge Manuel Afonso Antunes Bruno Miguel Santana Chaparro
Learning outcomes of the course unit	
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contentes	
Recommended or required Reading	
Planned learning activities and teaching methods	Lectures, Tutorials and laboratory work.
Assessment Methods and criteria	Assessment includes coursework and a written test.
Language of Instruction	Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Turbomachines (*)
Course unit code	912346
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	4
Name of Lecturer(s)	Jorge Manuel Afonso Antunes
Learning outcomes of the course unit	An overview of the various types of turbomachinery, highlighting different constructive provisions and main applications. Pipeline project training taking into account the demand in this area, applicable standards and codes. Common practices and construction details.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Concepts of fluid mechanics, kinematics, physics and materials.
Recommended optional programme components	Not applicable.
Course contents	1.Features of the Global Operating Turbomachinery 2.New dimensionless coefficients 3.Specific Speed??. Definition of Geometry 4.Cavitation 5.Equipment and Securities 6.Pumping installations; 7.Piping Project 8.Sizing Valves 9.Steam Traps, Separators and Filters Miscellaneous 10.Expansion Joints
Recommended or required Reading	
Planned learning activities and teaching methods	Theoretical and practical classes which describes the basic principles. Problems will be solved to consolidate the subject matter. Mandatory discussion on the results of each problem. Presentation of educational materials. Laboratory tests.
Assessment Methods and criteria	Written test divided into theoretical and practical (50% each). Open-book practical test. Theoretical and practical group work with a weight of 30%. A minimum of 10 grade points in the written test is required to pass.
Language of Instruction	Portuguese Mentoring in Portuguese
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Engineering Ethics (*)
Course unit code	912350
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	2
Name of Lecturer(s)	Teresa Leonor Ribeiro C. M. Morgado
Learning outcomes of the course unit	This course on engineering ethics is intended to provide the students with skills that will enable them make ethical decisions both as leaders or as members of a working team.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course content	Basic concepts (ethics, integrity, honesty, reliability); Ethical Principles (ethical values, decision-making), American Society of Mechanical Engineers (ASME) Code of Ethics of Engineers; professional duties (art. 86, art. 87th , art. 88, art. 89. Ethical leadership, individual liability and the virtues of the engineer, case analysis
Recommended or required Reading	- Rego, A.(2010). <i>Ética para engenheiros</i> . LX: Lidel
Planned learning activities and teaching methods	Theoretical/practical method - case analysis and use of media resources.
Assessment Methods and criteria	Ongoing assessment: Participation in case discussion - 5% Final assessment: practical work 95%: written part 45% and oral part 50% (presentation and discussion)
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Technical English (*)
Course unit code	912352
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	2
Name of Lecturer(s)	Marta Margarida S. Dionísio de Azevedo
Learning outcomes of the course unit	- provide students with language skills that will enable them to communicate effectively with the world around them, particularly in the work context; - provide language and communication skills targeted to engineering and technology
Mode of delivery	Face-to-face
Prerequisites and co-requisites	A2 Level according to the Common European Framework of Reference for Languages.
Recommended optional programme componentes	Not applicable.
Course contentes	1. Engineering, Technology and Society: What's it all about? 2. An Engineering Student 3. Careers in Engineering 4. Applying for a Job 5. Engineering Materials 6. Mechanisms 7. Forces in Engineering 8. Safety at Work 9. Transports 10. Mechanical Devices: components and instructions
Recommended or required Reading	
Planned learning activities and teaching methods	Theoretical and practical lessons where the students are to develop the following skills: reading, listening, speaking and writing with implicit grammar.
Assessment Methods and criteria	- A written test at the end of semester (60%) - Ongoing assessment including practice and class discussion (written and oral) and assiduity (20%) - Research assignment (written and oral) (20%)
Language of Instruction	English Mentoring in English
Work placement(s)	Not applicable.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Internship in the field of Energy and Fluid Technologies (*)
Course unit code	912360
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	11
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes Bruno Miguel Santana Chaparro Carlos Alexandre Campos Pais Coelho Flávio Rodrigues Fernandes Chaves Jorge Manuel Afonso Antunes Teresa Leonor Ribeiro C. M. Morgado Toni dos Santos Alves Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	Acquisition of a practical overview of the various types of activities of the Mechanical Engineer. Integration and application of concepts acquired in the MEB in solving problems related with the future occupation.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	As internship is a curricular unit, students must be in the final year of their programme of study.
Recommended optional programme components	Not applicable.
Course content	Syllabus is varied according to the specific choices of students. The training part is taken through a guided study. Are assigned and scheduled jobs internship in the industry, companies, laboratories IPT or even in foreign educational institutions through the ERASMUS program.
Recommended or required Reading	
Planned learning activities and teaching methods	Work carried out in a real work environment. In addition, there will be significant time to clarify the main problems encountered in the work and to make the final report.
Assessment Methods and criteria	Assessment is in accordance with the Internal Training Regulations of ESTA's Mechanical Engineering Department. For Erasmus internships, assessment follows Erasmus regulations.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Training with an industry or institution

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Internship in the field of Materials Science and Technology (*)
Course unit code	912355
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	11
Name of Lecturer(s)	Teresa Leonor Ribeiro C. M. Morgado Bruno Miguel Santana Chaparro Carlos Alexandre Campos Pais Coelho Flávio Rodrigues Fernandes Chaves Isabel Maria Duarte Pinheiro Nogueira Jorge Manuel Afonso Antunes Toni dos Santos Alves António Jorge Martins de Araújo Gomes
Learning outcomes of the course unit	Acquisition of a practical overview of the various types of activities of the Mechanical Engineer. Integration and application of concepts acquired in the MEB in solving problems related with the future occupation.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	As internship is a curricular unit, students must be in the final year of their programme of study.
Recommended optional programme componentes	Not applicable.
Course contentes	Syllabus is varied according to the specific choices of students. The training part is taken through a guided study. Are assigned and scheduled jobs internship in the industry, companies, laboratories IPT or even in foreign educational institutions through the ERASMUS program. These works are integrated into the scientific area of Materials Science and Technology.
Recommended or required Reading	
Planned learning activities and teaching methods	Work carried out in a real work environment. In addition, there will be significant time to clarify the main problems encountered in the work and to make the final report.
Assessment Methods and criteria	Assessment is in accordance with the Internal Training Regulations of ESTA's Mechanical Engineering Department. For Erasmus internships, assessment follows Erasmus regulations.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Training with an industry or institution.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Internship in the field of Mechanical Project (*)
Course unit code	912357
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	11
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes Bruno Miguel Santana Chaparro Carlos Alexandre Campos Pais Coelho Flávio Rodrigues Fernandes Chaves Jorge Manuel Afonso Antunes Teresa Leonor Ribeiro C. M. Morgado Toni dos Santos Alves Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	The course internship is intended to give the student a practical overview of the various types of activities in the area of Scientific Mechanical Design. The student should be able to integrate and apply the notions acquired in the course in solving problems of the future profession.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	As internship is a curricular unit, students must be in the final year of their programme of study.
Recommended optional programme components	Not applicable.
Course contentes	Are established concrete programs for each Internship together with industries, companies, IPT laboratories or others in the scientific area Mechanical Design being suggested by some industry/ company.
Recommended or required Reading	
Planned learning activities and teaching methods	Supervision of the work developed at the host organisation and preparation of a final project or report.
Assessment Methods and criteria	Students are evaluated according to the rules established in Stages of Rules of Degree in Mechanical Engineering ESTA.
Language of Instruction	Portuguese Mentoring in English
Work placement(s)	Training with an industry or institution.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Internship in the field of Production and Construction Technologies (*)
Course unit code	912359
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	11
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes Bruno Miguel Santana Chaparro Carlos Alexandre Campos Pais Coelho Flávio Rodrigues Fernandes Chaves Jorge Manuel Afonso Antunes Teresa Leonor Ribeiro C. M. Morgado Toni dos Santos Alves Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	Students should develop skills in the area of production and manufacturing technologies.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	As internship is a curricular unit, students must be in the final year of their programme of study.
Recommended optional programme components	Not applicable.
Course contents	Course contents is varied according to students' choice from among all the suggested options. Training is supervised. Internships are held in the industry, organisations, IPT laboratories or in foreign educational establishments under the Erasmus program.
Recommended or required Reading	
Planned learning activities and teaching methods	Supervision of the work developed at the host organisation and preparation of a final project or report.
Assessment Methods and criteria	Assessment is in accordance with the Internal Training Regulations of ESTA's Mechanical Engineering Department. For Erasmus internships, assessment follows Erasmus regulations.
Language of Instruction	Portuguese
Work placement(s)	Training with an industry or institution.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Internship in the field of Robotics, Instrumentation and Automation (*)
Course unit code	912358
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	11
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes Bruno Miguel Santana Chaparro Carlos Alexandre Campos Pais Coelho Flávio Rodrigues Fernandes Chaves Jorge Manuel Afonso Antunes Teresa Leonor Ribeiro C. M. Morgado Toni dos Santos Alves Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	The students must apply the skills acquired during the course in a real work context.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Not applicable.
Recommended optional programme components	Not applicable.
Course contents	Course contents is varied according to students' choice from among all the suggested options.
Recommended or required Reading	
Planned learning activities and teaching methods	Supervision of the work developed at the host organisation and preparation of a final project or report.
Assessment Methods and criteria	Assessment is in accordance with the Internal Training Regulations of ESTA's Mechanical Engineering Department.
Language of Instruction	Portuguese
Work placement(s)	Training with an industry or institution.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

B - Description of individual course units

Course unit title	Internship in the field of Structural Mechanics (*)
Course unit code	912356
Type of course unit	Optional
Level of Course unit	First Cycle
Year of Study	Third Year
Semester/Trimester when the course unit is delivered	Second Semester
Number of ECTS credits allocated	11
Name of Lecturer(s)	António Jorge Martins de Araújo Gomes Bruno Miguel Santana Chaparro Carlos Alexandre Campos Pais Coelho Flávio Rodrigues Fernandes Chaves Jorge Manuel Afonso Antunes Teresa Leonor Ribeiro C. M. Morgado Toni dos Santos Alves Isabel Maria Duarte Pinheiro Nogueira
Learning outcomes of the course unit	Internship is intended to provide the students with the opportunity of getting in touch with the several mechanical engineering activities. Students are expected to apply in the working context the concepts and skills acquired throughout their course.
Mode of delivery	Face-to-face
Prerequisites and co-requisites	Mechanics and Waves; Applied Mechanics; Mechanics of Materials; Machine Bodies; Computer-Aided Drawing; Technical Drawing
Recommended optional programme components	Not applicable.
Course contents	Course contents is varied according to students' choice from among all the suggested options. Training is supervised. Internships are held in the industry, organisations, IPT laboratories or in foreign educational establishments under the Erasmus program.
Recommended or required Reading	
Planned learning activities and teaching methods	Supervision of the work developed at the host organisation and preparation of a final project or report.
Assessment Methods and criteria	Assessment is in accordance with the Internal Training Regulations of ESTA's Mechanical Engineering Department. For Erasmus internships, assessment follows Erasmus regulations.
Language of Instruction	Portuguese
Work placement(s)	Industrial placement.

(*) This course may not be available in certain academic years. Please confirm availability with the Erasmus coordinator.

