

A - General description

Programme Title – Mechanical Engineering

Qualification awarded – BSc degree (*Licenciatura*)

Admission requirements – General Application for Admission to Higher Education and average mark for national examinations.

Educational and Professional goals – Part A Educational and Professional goals.

This programme is intended to provide the students with strong practical and experimental foundations in areas such as:

- Computer-aided production, design and manufacturing;
- Structural project, machine parts and devices;
- Analysis, control, organization and production management;
- Automation and maintenance of industrial equipment.

Skills acquired during the programme prepare the students to exercise such functions as intermediate managers and develop into top management positions in industrial, commercial and services companies in related sectors, including:

- Project and industrial development (industrial automation, pneumatic networks, mechanical construction, moulding, product and equipment design, fluid networks, heating/air conditioning systems; electrical machines);
- Energetic and technological audits;
- Metallurgy and metalworking industries;
- Production and industrial organization

Access to further studies – Master’s Degree

Course structure diagram with credits (60 per year)

Course Title	Year	Semester	ECTS
Mathematical Analysis I	1	1	6
Mechanics and Waves	1	1	5
Programming	1	1	5
Technical Drawing I	1	1	5
Applied Chemistry	1	1	4
Linear Algebra	1	1	5
Mathematical Analysis II	1	2	6
Electricity and Electronics	1	2	5
Technical Drawing II	1	2	5
Statistical and Numerical Methods	1	2	4
Applied Mechanics I	1	2	5

Science and Engineering of Materials	1	2	5
Technical Drawing Applied to Mechanics	2	1	5
Mechanical Behaviour of Materials	2	1	4.5
Materials Technology	2	1	5
Mathematical Analysis III	2	1	5
Applied Mechanics II	2	1	5
Thermodynamics	2	1	5.5
Mechanics of Materials I	2	2	6
Fluid Mechanics	2	2	5
Hydraulics and Pneumatics	2	2	5
Heat Transfer	2	2	5
Industrial Organisation	2	2	4
Industrial Maintenance	2	2	5
Electrical Machines	3	1	5
Machine Parts I	3	1	5.5
Elective I (Mechanics of Materials II, Climate Control and Refrigeration, Instrumentation and Measurement, Vehicle Mechanics)	3	1	5.5
Elective II (Materials Bonding Technology, Vehicle Mechanics, Industrial Computer Systems, Thermal Machines)	3	1	5
Elective III (Casting Technology, Financial Management, Human Resources Management, Quality, Health and Safety, Vehicle Electricity and Electronics, Electrical Installations)	3	1	4.5
Elective IV (Casting Technology, Financial Management, Human Resources Management, Quality, Health and Safety, Vehicle Electricity and Electronics, Electrical Installations)	3	1	4.5
Machine Parts II	3	2	5
Industrial Automation	3	2	4
Elective V (Tool-Machines, Plastic Conformation Processes, Engine Testing, Turbomachines, Industrial Robotics, Data	3	2	4

Acquisition Systems)			
Elective VI (Tool-Machines, Plastic Conformation Processes, Engine Testing, Turbomachines, Industrial Robotics, Data Acquisition Systems)	3	2	4
Elective VII (Technical English, French, German, Engineering Ethics, Oral and Written Communication, Introduction to Law, Public Relations)	3	2	2
TRAINING (Elective VIII)	3	2	11

Final examination, if any – Not Applicable

Final and continuous assessment regulations – Not Applicable

ECTS departmental co-ordinator – Carlos Alexandre Campos Pais Coelho

B - Description of individual course units	
Course title	Mathematical Analysis I
Course code	912302
Type of course	Compulsory/Theoretical and Practical
Level of Course	I
Year of study	1
Semester/trimester	1 st semester
Number of credits	6
Name of lecturer	Maria Helena Morgado Monteiro
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will learn to interpret data, to formulate and to solve problems connected with differential calculus and integral calculus of functions of one real variable.
Prerequisites	Secondary education-level Mathematics.
Course contents	Real functions. Differential calculus - definition, differentiation formulas, derivatives and its application (related rates, extreme values, extremum problems, graph of a function). Integral calculus - indefinite integral, definite integral (calculation of an area of a region between two graphs, a volume of a solid of revolution and length of a plane curve), improper integral.
Recommended reading	Anton, Howard, " <i>Cálculo, um novo horizonte</i> ", 6 ^a ed., Bookman, Porto Alegre, 2000. Larson, Ron e outros, " <i>Cálculo</i> ", vol. 1, 8 ^a ed., McGraw-Hill, São Paulo, 2006. Monteiro, Helena, " <i>Análise Matemática I, Apontamentos das Aulas Teóricas</i> ", ESTA, 2007.
Teaching methods	Presentation of the theoretical matter followed by exercise resolution under the teacher's guidance.
Assessment methods	Mid-term assessment (two mini-tests and two mid-term tests) and final assessment (examination).
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Mechanics and Waves
Course code	912304
Type of course	Compulsory: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	NA
Year of study	First
Semester/trimester	First
Number of credits	5
Name of lecturer	
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will familiarise themselves with the course subject matters.
Prerequisites	Not Applicable
Course contents	Classical Mechanics. Material-point Kinematics. Newtonian Dynamics. Conservative and Non-Conservative forces. Wave Motion. Electromagnetism.
Recommended reading	<i>Física - um curso Universitário</i> , Alonso & Finn, vol. I e vol II Edgard Blutcher (Ed.), <i>Física</i> , Halliday & Resnick, vols. I e II, Livros Técnicos e Científicos (Ed.); <i>Curso de Física II</i> , Maria Amélia Cutileiro Índias, McGraw-Hill (Ed.), 1994; <i>Vibration Engineering</i> , Andrew D. Dimarogonas, Livraria Escolar Editora (Ed.); <i>Mecânica Vectorial para Engenheiros: Estática</i> , Ferdinand P. Beer; E. Russel Johnston, Jr. McGraw-Hill (Ed.), 1998
Teaching methods	Lectures. Theoretical-practical sessions including case study analysis. Laboratory sessions – lab experiments
Assessment methods	Continuous assessment: Lab coursework Final assessment: Exam.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Programming
Course code	912305
Type of course	Compulsory: 30TP+45PL+3,5OT
Level of Course	NA
Year of study	1
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Toni Santos Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will be provided with necessary knowledge of algorithmic and programming to be able to use MatLab and LabView software to develop programs and to solve engineering problems in this environment.
Prerequisites	Not Applicable
Course contents	Algorithmic, Programming C, Matlab and LabView.
Recommended reading	Handouts prepared by the lecturer. Victorine Viviane Mizrahi, Treinamento em linguagem C, MCGraw Hill
Teaching methods	Lectures and tutorials.
Assessment methods	Exam and works
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Technical Drawing I
Course code	912303
Type of course	Compulsory: T:15 + PL:45 + OT:3.5
Level of Course	1
Year of study	1
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Luis Miguel Marques Ferreira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide the students with solid computer-aided drawing (CAD) foundations so that they can use it as a support tool to other courses.
Prerequisites	Not Applicable
Course contents	Standards for technical drawing. Geometric drawing. Orthogonal projections: European and American methods. Axonometric Perspectives. Cuts and sections. Dimensioning. Computer-aided drawing: Drawing commands, visualization, modification and edition. Text edition. Layers. Viewports. Block design. Dimensioning. User's coordinate system. Introduction to three-dimensional modeling.
Recommended reading	Silva, Arlindo; Dias, João; Sousa, Luís – “Desenho Técnico Moderno”, Lidel Cunha, Luís Veiga da – “Desenho Técnico”, Fundação Calouste Gulbenkian Manuais de Autocad 2D
Teaching methods	Lectures presenting the basic concepts using the episcope. Problem resolution resorting to CAD. Use of AUTOCAD as a work tool to apply theoretical concepts.
Assessment methods	Tests and individual assignments using CAD software. Minimum passmark is 7 (out of a 0-20 scale). Final mark is calculated as follows: Tests 60% + assignments 40%.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Applied Chemistry
Course code	912306
Type of course	Compulsory: T:15 + TP:15 + PL:15 + OT:3
Level of Course	NA
Year of study	1
Semester/trimester	1 st semester
Number of credits	4
Name of lecturer	Valentim Maria Brunheta Nunes
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Learn and develop basic knowledge of chemistry that will serve as a basis to other courses. Stimulate the study of chemistry as a science and show its importance for industry and society, in particular for the activity of the future Mechanical Engineer.
Prerequisites	Not Applicable
Course contents	Basic chemistry tools. Atoms, molecules and ions. Chemical reactions and stoichiometry. Chemical bonding and States of Matter. Gases. Intermolecular forces, liquids and solids. Polymers. Chemical equilibrium. Acid – Base equilibrium. Electrochemistry. Introduction to corrosion. Surface treatments by electrochemical methods.
Recommended reading	Chang, R., Química, 8 ^a edição, McGraw-Hill, Lisboa, 2005 Kotz&Treichel, Chemistry and Chemical Reactivity, 5 th ed., Thomson Books, 2003 Simões, J.M., Guia do Laboratório de Química e Bioquímica, Lidel, 2000.
Teaching methods	Lectures and tutorials.
Assessment methods	Final written exam and reports of laboratorial activities.
Language of instruction	Portuguese. Possibility of tutorial lectures in English.

B - Description of individual course units	
Course title	Linear Algebra
Course code	912301
Type of course	Compulsory; T, T/P
Level of Course	1
Year of study	1
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Maria Isabel Vaz Pitacas
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students are expected to learn how to use Matrices and Determinants in the resolution of linear equation systems, with particular application to analytical geometry. They must have basic notions of eigenvalues and eigenvectors.
Prerequisites	Secondary education level Mathematics
Course contents	Matrices: matrix algebra, LU decomposition, resolution of linear equation systems. Determinants: calculation, applications. Matrices, determinants, and analytical geometry: internal, external and mixed product; analytical layout of straight and horizontal lines; angles; distances. Eigenvalues and eigenvectors.
Recommended reading	<p>Luís, Gregório e Ribeiro, C. Silva, "Álgebra Linear", McGraw-Hill, Lisboa, 1985</p> <p>Monteiro, António e Pinto, Gonçalo, "Álgebra Linear e Geometria Analítica, Problemas e Exercícios", McGraw-Hill, Lisboa, 1997.</p> <p>Monteiro, Helena, "Álgebra Linear, Apontamentos das aulas teóricas", ESTA, 2003.</p>
Teaching methods	Presentation of the theoretical matters followed by exercise resolution under the teacher's guidance.
Assessment methods	Mid-term assessment (two mini-tests and two mid-term tests) and final assessment (examination)
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Mathematical Analysis II
Course code	912307
Type of course	Compulsory/Theoretical and Practical
Level of Course	2
Year of study	1
Semester/trimester	2 nd semester
Number of credits	6
Name of lecturer	Maria Helena Morgado Monteiro
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will learn how to solve problems connected with differential and integral calculation of functions with more than one real variable and to represent some functions by real power series.
Prerequisites	Mathematical Analysis I
Course contents	Differential calculus in \mathbb{R}^n - partial derivatives; differentiability; maxima, minima and saddle points, Lagrange's multipliers, tangent plane of a surface. Multiple integrals – definition, properties, evaluation and applications of the double integral and the triple integral (area of a plane region, volume of a solid; moments and center of mass of a thin plate and of a solid). Series: series of numbers and series of functions.
Recommended reading	Breda, A. e Costa, J., “ <i>Cálculo com funções de várias variáveis</i> ”, McGraw-Hill, Lisboa, 1996. Larson, R, “ <i>Cálculo</i> ”, vol 2, 8 ^a ed., São Paulo, McGraw-Hill, 2006. Monteiro, Helena, “ <i>Análise Matemática II, Apontamentos das Aulas Teóricas</i> ”, ESTA, 2007.
Teaching methods	Lectures and tutorials.
Assessment methods	Mid-term assessment (two mini-tests and two mid-term tests) and final assessment (examination)
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Electricity and Electronics
Course code	912325
Type of course	15 (T) + 15 (TP) + 30 (PL) + 4.5 (OT)
Level of Course	NA
Year of study	1
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Toni dos Santos Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	An introduction to electronics and electricity.
Prerequisites	Not Applicable
Course contents	Basic definitions and conventions. Fundamentals of passive and active circuits. Electromotive force. Circuit analysis: Kirchoff laws, mesh current method. Thévenin and Norton theorems, superposition theorem. Diodes and transistors. Operational amplifiers. Periodic functions and alternate current. Digital instrumentation. Practical works.
Recommended reading	Matias, José – Electricidade, Didáctica Editora (Vol. 1, 2 e 3) Malvino – Princípios de Electrónica – Vol. 1 – McGrawHill. Malvino, Electrónica, Makron Books.
Teaching methods	Lectures and tutorials.
Assessment methods	Exam and practical assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Technical Drawing II
Course code	912309
Type of course	Compulsory: T:15 + PL:45 + OT:3.5
Level of Course	2
Year of study	1
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Luis Miguel Marques Ferreira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will be provided with notions of 3-D computer-aided tools (CAD). Sizing: dimensional and geometric tolerances, resizing, surface modeling. Drawing of machine parts.
Prerequisites	Projections and perspectives. Crop and sections. Sizing. Concepts of computer-aided drawing.
Course contents	Complements of sizing: tolerances, adjustments, and functional dimensioning. Drawing of attaching parts. Drawing of machine parts. Computer-aided drawing: Three-dimensional modelling. Surface modelling. Render. Two-dimensional drawing from three-dimensional models.
Recommended reading	Silva, Arlindo; Dias, João; Sousa, Luís – “Desenho Técnico Moderno”, Lidel Cunha, Luís Veiga da – “Desenho Técnico”, Fundação Calouste Gulbenkian SolidWorks manuals
Teaching methods	Lectures presenting the basic concepts using the episcopo. Problem resolution resorting to CAD. Note: Use of Solidworks as a worktool for concept application.
Assessment methods	Tests and individual assignments using CAD software. Minimum passmark is 7 (out of a 0-20 scale). Final mark is calculated as follows: Tests 60% + assignments 40%.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Statistical and Numerical Methods
Course code	912312
Type of course	Compulsory:Theoretical-practical, Laboratory
Level of Course	1
Year of study	1
Semester/trimester	2 nd semester
Number of credits	4
Name of lecturer	Maria Isabel Vaz Pitacas
Objectives of the course (preferably expressed in terms of learning outcomes competences)	<p><i>Statistical Methods:</i> The students will learn how to read and communicate information using the tools available in the Descriptive Statistics, as well as build, use and interpret intervals estimation and hypothesis tests.</p> <p><i>Numerical Methods:</i> The students will be provided with basic concepts of Numerical Analysis to solve engineering problems, to know and to apply the appropriate numerical method to each problem.</p>
Prerequisites	Secondary education-level Mathematics and Mathematical Analysis I
Course contents	<p>Descriptive statistics. Introduction to probability theory; random variables; discrete theoretical distributions, continuous theoretical distributions; point and interval estimation, hypothesis tests, linear regression.</p> <p>Error analysis. Non-linear equation roots, polynomial interpolation, numerical integration. Equation systems resolution.</p>
Recommended reading	<p>ROSS, S. M. (1987). <i>Introduction to Probability and Statistics for Engineers and Scientists</i>. New York: John Wiley & Sons.</p> <p>SPIEGEL, M. R. (1993). <i>Estatística</i>. São-Paulo: McGraw-Hill.</p> <p>FAIRES, J. D. & BURDEN, R. (1998). <i>Numerical Methods</i>. Pacific Grove: Brooks/Cole Publishing Company.</p> <p>PINA, H. (1995). <i>Métodos Numéricos</i>. Lisboa: McGraw-Hill.</p>
Teaching methods	Presentation of the theoretical matter followed by exercise solving, under the teacher's guidance.
Assessment methods	Mid-term assessment (two mini-tests and two mid-term tests) and final assessment (examination)
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Applied Mechanics I
Course code	912311
Type of course	Compulsory: T:15 + TP:45 + OT:3.5
Level of Course	NA
Year of study	1
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Isabel Ludovino
Objectives of the course (preferably expressed in terms of learning outcomes competences)	<ul style="list-style-type: none"> - Provide an in-depth introduction of Static equilibrium. - Know how to determine Centroids and Centres of Gravity - Examine structures and machinery.
Prerequisites	NA
Course contents	Statics of Particles: plane and space forces. Rigid Bodies: Equivalent Force Systems (Two- and three-dimensional Equilibrium of Rigid Bodies). Distributed Forces: Centroids and Centers of Gravity. Analysis of structures and machinery.
Recommended reading	Ferdinand P. Beer , E. Russel Johnston, Jr – “Vector Mechanics for Engineers”, McGraw-Hill.
Teaching methods	Theoretical classes using media resources. Classroom exercises.
Assessment methods	The final mark is calculated as follows: examinations 70% exams and individual works 30%. Final mark=0,7xexams+0,3xworks
Language of instruction	Portuguese

B – Description of individual course units	
Course title	Science and Engineering of Materials
Course code	912308
Type of course	Compulsory: T:30 + TP:30 + OT:4.5
Level of Course	NA
Year of study	1
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Carlos Alexandre Campos Pais Coelho
Objectives of the course (preferably expressed in terms of learning outcomes competences)	<p>Characterise the various types of materials in structural and microstructural terms.</p> <p>Understand the material-processing- microstructure – properties relationship.</p> <p>Be familiar with the life span of the different materials.</p>
Prerequisites	Not Applicable
Course contents	An introduction to materials and raw materials; Atomic structure. Crystallographic structure and geometry. Solidification, crystalline imperfections and solid diffusion. Mechanical properties of metals. Electrical and other properties of materials. Phase diagrams. Eco-friendly materials.
Recommended reading	Lecturer's handouts Princípios de Ciência e Engenharia dos Materiais - W.F. Smith ed. McGraw-Hill - Lisboa, 1998
Teaching methods	Lectures and tutorials.
Assessment methods	<p>Continuous assessment: grade is the weighted average of two tests and several assignments</p> <p>Final assessment: final grade is the weighted average of final exam and final assignment.</p>
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Technical Drawing Applied to Mechanics
Course code	912315
Type of course	Compulsory: T:15 + PL:45 + OT:3.5
Level of Course	3
Year of study	2
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Luis Miguel Marques Ferreira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide the students with skills that enable them to draw mechanical elements using advanced CAD applications.
Prerequisites	Projections and perspectives. Crop and sections. Sizing. Concepts of computer-aided drawing.
Course contents	Drawing of mechanical assemblies: Drawing of structures. Drawing of mechanisms. Advanced computer-aided drawing: advanced three-dimensional modeling. Sheet-metal modeling. Advanced two-dimensional drawing from three-dimensional models.
Recommended reading	Silva, Arlindo; Dias, João; Sousa, Luís – “Desenho Técnico Moderno”, Lidel Cunha, Luís Veiga da – “Desenho Técnico”, Fundação Calouste Gulbenkian Solidworks manuals
Teaching methods	Lectures presenting the basic concepts using the episcopo. Problem resolution resorting to CAD. Note: Use of Solidworks as a worktool for concept application.
Assessment methods	Tests and individual assignments using CAD software. Minimum passmark is 7 (out of a 0-20 scale). Final mark is calculated as follows: Tests 60% + assignments 40%.
Language of instruction	Portuguese

B – Description of individual course units	
Course title	Mechanical Behaviour of Materials
Course code	912314
Type of course	Compulsory: T:15 + TP:15 + PL:30 + OT:3.5
Level of Course	NA
Year of study	2
Semester/trimester	1
Number of credits	4,5
Name of lecturer	Carlos Alexandre Campos Pais Coelho
Objectives of the course (preferably expressed in terms of learning outcomes competences)	An introduction to the key mechanisms for material deformation. Identify and explain the various responses of materials to mechanical stress and impact. Be familiar with the various tests for the characterization and evaluation of the mechanical properties of materials.
Prerequisites	Not Applicable
Course contents	Introduction: theories and tests on the analysis of the mechanical behaviour of running materials. Project in compliance with the requirements. Dimensioning criteria. Properties of materials. Mechanical behaviour of continuous, homogeneous and isotropic materials. Traction testing: elastic limit, proportionality limit, plastic deformation, ductility limit, breaking tension, resistance to traction and compression. Ductile and fragile behaviour. Materials decay. Safety coefficient. Resilience testing. Deformation energy on traction/compression, pure cutting, torsion, and flexion. Tension concentration and distribution. Stiffness and fatigue testing. Creep testing.
Recommended reading	Course handouts prepared by the lecturer. Sebenta “Tecnologia Mecânica I – Ensaios e Processos” – Eng.º João André F. Baptista, I.S.E.C. “Ensaios Mecânicos e Tecnológicos” – J. P. Davim e A. G. Magalhães, Estante Editora, Aveiro, 1992. “Princ. de Ciência e Eng. dos Mat.” – W. F. Smith, ed. Mcgraw-Hill.
Teaching methods	Lectures, Tutorials and laboratory sessions.
Assessment methods	Continuous assessment: grade is the weighted average of two tests and several assignments Final assessment: final grade is the weighted average of final exam and laboratory coursework.
Language of instruction	Portuguese

B – Description of individual course units	
Course title	Materials Technology
Course code	912317
Type of course	Compulsory:T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	NA
Year of study	2
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Carlos Alexandre Campos Pais Coelho
Objectives of the course (preferably expressed in terms of learning outcomes competences)	<ul style="list-style-type: none"> - Characterise the different types of materials. - Be familiar with the various thermal treatments of metal alloys and its objectives. - Be familiar with the appropriate treatment for every type of material and with metal characterization techniques.
Prerequisites	Not Applicable
Course contents	Ferrous alloys. Steel classification and usage. Thermal treatments. Thermochemical treatments. Electrolytic treatments. Non-ferrous metals. Aluminium alloys. Copper alloys. Composite materials. Ceramic materials. Polymers. Thermoplastics and thermosets. Materials selection introduction.
Recommended reading	<ul style="list-style-type: none"> - Handouts prepared by the lecturer - Aços: Características e Tratamentos, 5^a ed., Pinto Soares, ed. Livroluz, Porto, 1992 (ESTA 638) - Princípios de Ciência e Engenharia dos Materiais, W. F. Smith, ed. Mcgraw-Hill (ESTA 1268, 62, 608) - Metalurgia Geral – vol. II e III, Antera Valeriana de Seabra
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	<p>Continuous assessment: grade is the weighted average of two tests and several assignments</p> <p>Final assessment: final grade is the weighted average of final exam and laboratory coursework.</p>
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Mathematical Analysis III
Course code	912313
Type of course	Compulsory, T and T/P
Level of Course	3
Year of study	2
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Maria Helena Morgado Monteiro
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students should learn how to formulate and solve problems connected with differential equations, line integrals and surface integrals.
Prerequisites	Mathematical Analysis II
Course contents	Differential equations – first-order differential equations and linear differential equations of order n. Laplace's transform. Systems of linear differential equations. Vectorial calculus - vectorial functions, line integrals (the concept of work as a line integral, independence of the path, Green's theorem), surface integrals (fluid flow through a surface, divergence theorem, Stokes' theorem).
Recommended reading	Breda, A. e Costa, J., <i>Cálculo com funções de várias variáveis</i> , McGraw-Hill, Lisboa, 1996. Monteiro, Helena, <i>Apontamentos de Análise Matemática III</i> , ESTA, 2008. Zill, Dennis, <i>Equações Diferenciais</i> , MaKron Books, São Paulo, 2001.
Teaching methods	Presentation of the theoretical matter followed by exercise solving under the teacher's guidance.
Assessment methods	Mid-term assessment (two mini-tests and two mid-term tests) and final assessment (examination)
Language of instruction	Portuguese

B – Descrição das unidades curriculares	
Course title	Applied Mechanics II
Course code	912316
Type of course	Compulsory: T:15 + TP:45 + OT:3.5
Level of Course	II
Year of study	2
Semester/trimester	1st semester
Number of credits	5
Name of lecturer	Isabel Ludovino
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Analyze structures and machinery and determine the forces applied to various elements. Calculate centres of inertia. Calculate the speed and acceleration of any point of a mechanism.
Prerequisites	Not applicable
Course contents	Friction. Distributed Forces: Moments of Inertia. Kinematics of Rigid Bodies. Plane Motion of Rigid Bodies: Forces and Accelerations
Recommended reading	Ferdinand P. Beer , E. Russel Johnston, Jr – “Vector Mechanics for Engineers”, McGraw-Hill.
Teaching methods	Lectures and tutorials.
Assessment methods	The final mark is calculated as follows: examinations 70% exams and individual works 30%. Final mark= $0,7 \times \text{exams} + 0,3 \times \text{works}$
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Thermodynamics
Course code	912318
Type of course	Compulsory:T:30 + TP:30 + OT:4.5
Level of Course	NA
Year of study	2
Semester/trimester	1 st semester
Number of credits	5.5
Name of lecturer	Flávio Rodrigues Fernandes Chaves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The main objective of this unit is to remind and consolidate some concepts in this area of knowledge, presenting a comprehensive and rigorous coverage of thermodynamics concepts, thus providing a solid base for subsequent courses in this area.
Prerequisites	Not Applicable
Course contents	Basics on thermodynamics: reversibility, energy, thermodynamic coordinates, transforms representation, energy conservation principle and its implications. Thermodynamic principles. Closed systems transformations. Gases: perfect gases equation, internal energy of a gas and Joule's law, entropy variation of a perfect gas. Transformation of gases within closed systems: polytropic, adiabatic, isothermal. Carnot principle. Power cycles: Carnot, Otto, Diesel, Mixed, Stirling, Ericsson and Brayton. Liquids and vapours: phase changes, p-t diagram, t-h diagram and critical point, p-v diagram, p-v-t surface, t-s diagram, throttling effect in a vapour, water vapour changes. Vapour and mixed cycles: Rankine cycle.
Recommended reading	Chaves, F., Sebenta de Termodinâmica – elementos de apoio , Biblioteca da ESTA, 2006/2007. Çengel, Y. A., Boles, Michael A., Termodinâmica , 3rd Ed.; McGraw-Hill, 2000. Çengel, Y. A., Introduction to Thermodynamics and Heat Transfer , McGraw-Hill, 1997.
Teaching methods	Lectures, tutorials and laboratory.
Assessment methods	Assessment is divided into two compulsory complementary parts: Written test and practical assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Mechanics of Materials I
Course code	912322
Type of course	Compulsory: T:30 + TP:30 + PL:15 + OT:5
Level of Course	I
Year of study	2
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Isabel Ludovino
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Calculate simple mechanical elements (bars, shafts and beams) under axial and transverse loads and moments of twisting and bending.
Prerequisites	NA
Course contents	Concept of stress; Stress and strain-axial loading; Torsion; Pure bending; Shearing stresses in beams; Analysis and design of beams for bending; Deflection of beams.
Recommended reading	Beer, Ferdinand P.; Johnston Jr., E. Russel – “Mechanics of Materials
Teaching methods	Theoretical classes using media resources. Classroom exercises.
Assessment methods	Final mark is calculated as follows: examinations 70% exams and individual works 30%. Final mark=0,7xexams+0,3xworks
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Fluid Mechanics
Course code	912321
Type of course	Compulsory: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	NA
Year of study	2
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Flávio Rodrigues Fernandes Chaves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will acquire technical and scientific skills on the hydrostatics and drainage of compressible and incompressible fluids with a special focus on stationary pipe drainage.
Prerequisites	Not Applicable
Course contents	Physical properties of fluids. Dimensional analysis. Hydrostatics. Hydrokinematics. Fundamentals of hydrodynamics. Basics of liquid flows. Laminar and turbulent regime. Duct flow under incompressible and compressible conditions.
Recommended reading	Lecturer's handout and worksheets. White, F. M., Mecânica dos Fluidos , McGraw-Hill 4ª edição, 2002. Quintela, A. C., Hidráulica , 1981, ed. Fundação Gulbenkian. Lencastre, A., Hidráulica Geral , 1983, ed. Hidroprojecto. Manzanares, A., Hidráulica Geral , 1980, ed. AEIST, 2 volumes. Novais Barbosa, J., Mecânica dos Fluidos e Hidráulica Geral , 1985, ed. Porto Editora, 2 volumes.
Teaching methods	Lectures and Tutorials.
Assessment methods	Assessment includes two parts: Written test and practical assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Hydraulics and Pneumatics
Course code	912319
Type of course	Compulsory: 15T+15TP+30PL+3,5OT
Level of Course	NA
Year of study	2
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Toni Santos Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Basics of Pneumatics and Hydraulics.
Prerequisites	Not Applicable
Course contents	Automation fundamentals. Introduction to digital systems. Numbering systems and codes. Boole algebra and logical circuits. Pneumatics. Sequential method.
Recommended reading	Eng.º Toni Alves, " Sebenta de Hidráulica e Pneumática ", E.S.T. Abrantes , 2007 Eng. Arivelto Fialho, " Automação Pneumática ", Didáctica Érica, 2003 José Novais, " Método Sequencial Para Automação Electropneumática ", 3.ªEdição, Fundação Calouste Gulbenkian, 1997
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	Exam and assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Heat Transfer
Course code	912324
Type of course	Compulsory: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	NA
Year of study	2
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Flávio Rodrigues Fernandes Chaves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Basic concepts of heat transfer and mechanisms involved such as: conduction, convection and radiation.
Prerequisites	Not Applicable
Course contents	Heat transfer mechanisms: conduction, convection, and radiation. Permanent, one-dimensional conduction, with presence and absence of heat generation, through flat walls and cylindrical systems. Thermal insulation: critical radius of insulation. Fins: effectiveness, yield, global heat transfer coefficient. Radiation through a transparent and absorbing medium. Convection fundamentals: forced and natural. Heat exchangers.
Recommended reading	Incropera, F. P.; De Witt, D. P. – Fundamentals of Heat and Mass Transfer, John Wiley & Sons, 2002. Çengel, Y. A., Introduction to Thermodynamics and Heat Transfer; McGraw-Hill.
Teaching methods	Lectures and tutorials.
Assessment methods	Assessment includes two parts: Written test and assignments.
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Industrial Organization
Course code	912323
Type of course	Compulsory: T:15 + TP:30 + OT:3
Level of Course	NA
Year of study	2
Semester/trimester	2 nd semester
Number of credits	4
Name of lecturer	António Jorge Martins de Araújo Gomes
Objectives of the course (preferably expressed in terms of learning outcomes competences)	An introduction to the basic concepts of Industrial Organization.
Prerequisites	NA
Course contents	Historical evolution of industrial companies. Concept of company. Company classification. Corporate management. Procurement function. Production function. Commercial function. Personnel function. Financial function.
Recommended reading	Organização e Modernização Industrial. Autor: J. C. Charrier, K. Kemoune. LIDEL – Edições Técnicas Portuguesas 1990; As Novas Regras de Produção. Autor: Pierre Béranger. LIDEL – Edições Técnicas Portuguesas 1989. Gestão da Produção. Autor: A. Courtois, M. Pillet e C. martin. LIDEL – Edições Técnicas Portuguesas 1997. Programa 8S. Autor: José Abrantes. Editora Interciência 2001
Teaching methods	Lectures including case studies.
Assessment methods	An assignment with presentation and discussion.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Industrial Maintenance
Course code	912320
Type of course	Compulsory: T:15 + TP:30 + TC:15 + OT:3.5
Level of Course	NA
Year of study	2
Semester/trimester	2
Number of credits	5
Name of lecturer	Maurício Baptista Carlos
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Maintenance planning. Guidelines for an effective maintenance. Tools to organize and/or manage a maintenance department..
Prerequisites	NA
Course contents	Maintenance organization; Maintenance strategies; Maintenance work; Monitoring techniques; Maintenance planning; Maintenance of equipment.
Recommended reading	Cabral, José Saraiva, Organização e Gestão da Manutenção, Lidel, Lisboa, 1998 Ferreira, Luís Andrade, Uma Introdução à Manutenção –, Publindústria, Porto, 1998 Lindley R. Higgins, Maintenance Engineering Handbook, McGraw-Hill, 1995
Teaching methods	Lectures with datashow
Assessment methods	A written test
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Electrical Machines
Course code	912325
Type of course	Compulsory: 15T+30TP+15PL+3,5OT
Level of Course	NA
Year of study	3
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Toni Santos Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will learn about the different types of electric machines, its constructive aspects and respective use.
Prerequisites	Not Applicable
Course contents	Electric installation. Three-phase and one-phase transformers. Asynchronous machines. Dynamo/Current DC machines.
Recommended reading	Handouts prepared by the teacher. José Matias, Ludgero Leote, Automatismos Industriais, Didáctica Editora, 1993 José Matias, Máquinas Eléctricas Corrente Alternada, Didáctica Editora, 1994 José Matias, Máquinas Eléctricas Corrente Continua, Didáctica Editora, 1990
Teaching methods	Lectures and tutorials.
Assessment methods	Exams and practical works.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Machine Parts I
Course code	912361
Type of course	Compulsory: T:30 + TP:30 + OT:4.5
Level of Course	I
Year of study	3
Semester/trimester	1 st semester
Number of credits	5.5
Name of lecturer	Teresa Leonor Ribeiro C. M. Morgado
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Basics of static and fatigue design, selection and design of mechanic elements, basic concepts of lubrication.
Prerequisites	Not Applicable
Course contents	Fatigue dimensioning: characterisation of the process. Fatigue stresses. Oligo-cyclical fatigue. Shafts and respective connections: shaft dimensioning for static loads. Dimensioning of shafts with respect to fatigue. Tension concentration. Dimensioning of shafts with respect to deformation. Materials used for shafts. Shaft connections. Lubrication principles: various types of lubrications and lubricants. Welded connections: joint types. Static calculation of welded joints. Fatigue dimensioning of welded structures. Fastening screws and devices: types of threads. Types of screws. Resistance of screwed connections. Resistance of riveted connections. Keys, pins and collars. Springs: tensions and deformations of helicoidal springs. Dimensioning of helicoidal springs. Torsion bars. Laminated springs.
Recommended reading	J. E. Shigley - <i>“Mechanical engineering Design”</i> , McGraw-Hill C. Moura Branco, J. Martins Ferreira, J. Domingos da Costa, A. Silva Ribeiro – <i>“Projecto de Órgãos de Máquinas”</i> , Fundação Calouste Gulbenkian, 2005
Teaching methods	Theoretical sessions: Presentation of theoretical concepts. Theoretical-practical: application examples, including case studies and practical works.
Assessment methods	Minimum pass mark for written test is 7,5 and for reports and presentation 0,95. Final mark (NF) is calculated as follows: written test 80% (NE) and reports 20%. $NF = 0,80 NE + 0,20 NP$
Language of instruction	Portuguese

B – Description of individual course units	
Course title	Mechanics of Materials II (option 1)
Course code	912329
Type of course	Elective: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	3
Year of study	3
Semester/trimester	1 st semester
Number of credits	5.5
Name of lecturer	Teresa Leonor Ribeiro C. M. Morgado
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will be provided with knowledge that will enable them to determine beam stresses and deformations, articulated structures and columns using simple, energetic and the finite elements methods.
Prerequisites	NA
Course contents	Energetic methods; curved beams; columns; stress and deformation; combined loads.
Recommended reading	Beer, Johnston e DeWolf, “Resistência dos Materiais”, McGraw Hill Branco, Carlos Moura, “Mecânica dos Materiais”, Fundação Calouste Gulbenkian
Teaching methods	Lectures including practical exercises. Case study analysis resorting to finite elements software.
Assessment methods	Final written test – 75% of final grade Reports and respective presentation - 25% of final grade
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Climate Control and Refrigeration(Option 1)
Course code	912326
Type of course	Elective: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	NA
Year of study	3
Semester/trimester	1 st semester
Number of credits	5.5
Name of lecturer	Flávio Rodrigues Fernandes Chaves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The main objective of this unit is to present the Fundamentals of Climatization and Refrigeration, and the general concepts for heating, ventilation and air conditioning.
Prerequisites	Not Applicable
Course contents	Classification of climate systems, psychrometrics, indoor air diffusion, ventilation. Air-water vapour mixtures and respective changes, refrigeration cycles. Special emphasis is placed on refrigeration equipments and systems, its operating principles and appropriate usage. Cold applications. Vapour compression system. Refrigeration fluids. Equipments for a vapour compression system - compressors, evaporators, condensers, pumping, valves, reservoir pump. Multiple compression vapour systems. Calculation of thermal charges. Design of a refrigeration system. Regulations for safety and climate control in buildings - RCCTE and RSECE.
Recommended reading	Chaves, F., Sebenta de Climatização e Refrigeração, Escola Superior de Tecnologia de Abrantes, 2003. Pereira, N., Sebenta de Climatização I, Escola Superior de Tecnologia de Setúbal, 1998. Creus, J. Alarcon, Tratado Prático de Refrigeração Automática, Dinalivro, Lisboa. Stocker, W. F., Industrial. Refrigeration Handbook, McGraw-Hill, 1998.
Teaching methods	Lectures and tutorials
Assessment methods	Assessment includes two parts: written test and assignments.
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Instrumentation and Measurement (option1)
Course code	912327
Type of course	Elective: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	3
Year of study	3
Semester/trimester	1 st Semester
Number of credits	5.5
Name of lecturer	A lecturer from the Robotics, Instrumentation and Industrial Automation Area (RIAI)
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Study and function analysis of the main equipment used in electrical measures. A special emphasis is placed on metrological functions and characteristics of electronic and digital devices and on the measurement principles for non-electrical measurement units (transducers).
Prerequisites	NA
Course contents	Measurement principles Analogue measurement devices Basics of digital instrumentation Power, energy and impedance measurement units Display and recording devices Functional modules for measuring non-electrical units and its application in instrumentation and measurement.
Recommended reading	Bibliografia suplementar: Larry D.Jones A.Foster Chin, "Electronic Instruments and Measurements", Prentice-Hall. C.S. Rangan, G.R. Sarma, V. Mani, "Instrumentation: Devices and Systems", McGraw-Hill. D.G. Fink, D. Christiansen, "Electronics Engineers' Handbook", McGraw-Hill. J.F. Borges da Silva, "Medidas Eléctricas", AEIST 1972. Direcção Geral da Qualidade, "Vocabulário Internacional de Metrologia", Lisboa 1985. B.M. Oliver, McGraw-Hill, "Electronic Measurement and Instrumentation", 1971.
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	Written test and laboratory work.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Vehicle Mechanics(Option 1)
Course code	912328
Type of course	Elective: TP: 30 + PL: 30 + OT: 3
Level of Course	3
Year of study	3
Semester/trimester	1 st Semester
Number of credits	5.5
Name of lecturer	A lecturer from the Mechanical Project Area
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Upon completion of course, the students are supposed to interpret and describe: the impact of the different engine/drive configurations of an automobile on the mass geometry and consequently on its dynamic behaviour; the different constructive solutions used in steering and suspension and its relationship with the response to side/transversal movement of vehicle; the different construction solutions used in the braking systems of an automobile; the ABS and ESP systems; the components and functions of a drive system; the different solutions used in the construction of drive systems.
Prerequisites	Not Applicable
Course contents	An introduction to vehicle mechanics; steering/suspension systems; braking systems; drive systems.
Recommended reading	Gillespie, Thomas D.;Fundamentals of Vehicle Dynamics, SAE. ISBN: 1-56091-199-9 Milliken, Douglas L.;Race Car Vehicle Dynamics, SAE. ISBN: 1-56091-526-9
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	Written test and assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Materials Bonding Technology (option 2)
Course code	912330
Type of course	Elective: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	NA
Year of study	3
Semester/trimester	1 st semester
Number of credits	5
Name of lecturer	Isabel Ludovino
Objectives of the course (preferably expressed in terms of learning outcomes competences)	An in-depth introduction to materials bonding technology with emphasis on welding technology. The most important welding processes are studied providing fundamental information about technical, physical, metallurgic and mechanical aspects. Non-destructive tests knowledge is also provided to students.
Prerequisites	NA
Course contents	<p>Welding Fundamentals: Historic development; Joint concept and types; Welding Symbols; Welded joints; Pressure and fusion welding; Health and Safety. Welding machines. Electric arc physics: heat and metal transfer. The effect of heating. Fissuring. Thermal treatment. Non- destructive testing of weld.</p> <p>Classification and analysis of welding processes: Manual metal arc welding; Gas Tungsten Arc Welding; Gas Metal Arc Welding; Cored Wire Welding; Plasma Arc Welding; Submerged Arc Welding; Gas Welding; Resistance; brazing; Ultrasonic Welding; Welding; Electro-Slag Welding; Electron-beam Welding; Laser-beam Welding; Friction Welding. Adhesives.</p>
Recommended reading	J. F. Oliveira Santos e L. Quintino – “Processos de soldadura”, Ed. Técnicas do ISQ; Lisboa, 1998
Teaching methods	Theoretical classes using media resources. Laboratory sessions/workshops on manufacturing processes.
Assessment methods	Final mark is calculated as follows: tests and examinations 70% and practical assignments 30%.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Electrical Installations (Options III and IV)
Course code	912340
Type of course	Elective: T:15 + TP:30 + PL:15 + OT:3.5
Level of Course	3
Year of study	3
Semester/trimester	1 st Semester
Number of credits	5
Name of lecturer	A lecturer from the Robotics, Instrumentation and Industrial Automation Area (RIAI)
Objectives of the course (preferably expressed in terms of learning outcomes competences)	A general overview of Electrical Installations including components and technologies and execution of a project in this area.
Prerequisites	NA
Course contents	Design and reading of electrical schemes Energy distribution. Low voltage networks Collective electric installations Energy usage Exploration of electrical installations
Recommended reading	Safety Regulations, catalogues and tables by the manufacturers of cables and fittings. Varied Technical Guides Varied support texts.
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	Minimum pass mark is 9.5 (out of a 0-20 scale) and minimum grade in each assessment component is 7.5.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Industrial Computer Systems (Option II)
Course code	912332
Type of course	Elective - T + TP + OT
Level of Course	3
Year of study	3
Semester/trimester	1 st Semester
Number of credits	5
Name of lecturer	Lecturer from the Robotics, Instrumentation and Industrial Automation Area (RIAI)
Objectives of the course (preferably expressed in terms of learning outcomes competences)	This course is intended to develop the following skills: be able to analyse, structure, design, implement and document medium-level industrial control systems resorting to modelling tools and programming languages defined by IEC 61131-3 e IEC 61499 standards.
Prerequisites	A lecturer from the Robotics, Instrumentation and Industrial Automation Area (RIAI)
Course contents	UML modelling. Object-oriented programming according to IEC 61131-3 standard. Distributed programming in compliance to IEC 61499 standard. Introduction to OPC technology.
Recommended reading	Lewis, Robert W.;Modelling control systems using IEC 61499. ISBN: 0-85296-796-9 Fowler, Martin;UML distilled. ISBN: 0-201-65783-X Karl-Heinz John, Michael Tiegelkamp;IEC 61131-3: Programming Industrial Automation Systems, Springer; 1 edition (April 27, 2001), 2001. ISBN: ISBN-13: 978-3540677529
Teaching methods	Lectures and tutorials.
Assessment methods	Written test
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Thermal Machines(option 2)
Course code	912331
Type of course	Elective: TP:30 + PL:30 + OT:3
Level of Course	NA
Year of study	3
Semester/trimester	1
Number of credits	5
Name of lecturer	Maurício Baptista Carlos
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide technical training on the proper operation of piston engines. Design and thermal design engineering: parameters of sizing, construction, performance and its impact on energy production, emission and fuel consumption. Equip students with theoretical knowledge that will enable them to understand the mechanisms involved in the transformation of energy in that, particularly, work is involved ie, external combustion engines and internal combustion engine alternatives and rotating.
Prerequisites	Not Applicable
Course contents	Types of alternative engines and their operation; Friction and lubrication; Refrigeration system; Design and operation parameters for piston engines; Thermo chemistry of air-fuel mixture; Properties of working fluids; Ideal motor cycles models; Gas exchanges; Training and monitoring of emissions; Operation features; Systems and thermodynamic cycles;
Recommended reading	Notes of Thermal Machinery (to be provided by the teacher) Heywood, John B.; Internal Combustion Engine Fundamentals; McGraw-Hill; Lopes, José Miguel; Motores de Combustão Interna – uma abordagem termodinâmica; Theoretical notes; ASHRAE HANDBOOK; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Çengel, Yunus A. e Boles, Michael A.; Termodinâmica; McGraw Hill; Moran, M. J., Shapiro, H. N., Fundamentals of Engineering Thermodynamics (SI Version), (Third edition), Wiley (1998) Giacosa, Dante; Motores Endotérmicos; Editorial Científico-Médica.
Teaching methods	Lectures including datashow and exercises
Assessment methods	Written test and theoretical and practical work
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Casting Technology(option 3 and 4)
Course code	912338
Type of course	Elective: TP:30 + PL:15 + TC:15 + OT:3
Level of Course	NA
Year of study	3
Semester/trimester	1 st semester
Number of credits	4.5
Name of lecturer	Teresa Leonor Ribeiro C. M. Morgado
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide the students with theoretical, practical and laboratory skills that allow them to understand the processes involved in casting technology. They should acquire the skills required to design parts for casting.
Prerequisites	Not applicable.
Course contents	Casting fundamentals. Classification of different casting types. Selection criteria. Metal melting: solidification of pure metals and alloys. Solidification by casting. Melting defects. Casting alloys. Casting furnace. Moulding, metal die-casting. Moulding sand testing. Filling systems. Feeding systems. Permanent steel moulds injection. Project planning considerations.
Recommended reading	Ferreira, José Carvalho; "Tecnologia da Fundição", Fundação Calouste Gulbenkian. Kalkjian, Serope - " <i>Manufacturing Engineering and Technology</i> ", Ed. Addison Wesley. Nebel, Benjamin W.; Draper, Alan B.; Wysk, Richard A. - " <i>Modern Manufacturing Process Engineering</i> ", McGraw-Hill International Editions, 1989.
Teaching methods	Lectures. Laboratory work and on-site visits.
Assessment methods	Four on-site visits to four different companies will be carried out. The students must present and defend the respective reports. Assessment will be done through practical assignments. Final mark (NF) is calculated as follows: on-site visits (15%) and practical assignments/projects (85%).
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Financial Management (option 3 and 4)
Course code	912335
Type of course	Elective: T:30 + TP:30 + OT:4.5
Level of Course	NA
Year of study	3
Semester/trimester	5
Number of credits	4,5
Name of lecturer	Cláudia Pires da Silva
Objectives of the course (preferably expressed in terms of learning outcomes competences)	This course is intended to provide the students with the basic principles that will allow them to understand the economic and financial activity and the functioning of an enterprise. They should be able to interpret key financial statements by understanding such concepts as Solvency, Financial Balance, Financial Autonomy, Current Accounts/Management Accounts relationship, Calculus of Operating Fund and Operating Fund Needs. The students will also be provided with project analysis and evaluation tools.
Prerequisites	
Course contents	Key financial and economical concepts: Real Flows; Financial Flows (immediate, periodic, multiple and autonomous); Financial cycles (exploration-, investment-, financial operations- related); Cash Flow; Economical Assets; Concepts related with key corporate financial statements: Current Accounts/Management Accounts relationship; Calculus of Operating Fund and Operating Fund Needs. Use of Project analysis and evaluation tools.
Recommended reading	<i>Course Handouts</i> ; A Gestão Financeira das Empresas – Caldeira de Menezes ; Revistas de Gestão nacionais e Executive Digest; Jornais: Semanário Económico; Diário Económico; Suplementos económicos do Expresso, Diário de Notícias, Público, Independente e Semanário; Análise Financeira - Conceitos, Técnicas e Aplicação, de Arlindo F. Santos, INIEF – Economia e Gestão, Lda.
Teaching methods	Powerpoint, Exercises, Case studies.
Assessment methods	Pass requirements: Mini-test – 10% of final grade Class assiduity and participation – 10% of final grade Mid-term test – 80% of final grade (minimum mark:8 grade points out of a 0-20 scale)
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Human Resources Management (option 3 and 4)
Course code	912334
Type of course	Elective III or IV: T:30 + TP:30 + OT:4.5
Level of Course	2
Year of study	3
Semester/trimester	1 st Semester
Number of credits	4.5
Name of lecturer	Sílvia Manuel da Rocha Brito
Objectives of the course (preferably expressed in terms of learning outcomes competences)	An introduction to human resources management and some tools that facilitate business management particularly in terms of staff management.
Prerequisites	
Course contents	1- Administrative Management of Human Resources 2- Analysis and description of job duties 3- Staff recruitment and selection 4- Motivation management and team development 5- Career organization and planning 6- Health, prevention and safety at work
Recommended reading	Câmara, P. Guerra, P. Rodrigues, J. (2000). <i>Humanator – Recursos Humanos e Sucesso Empresarial</i> . Publicações. D. Quixote. Ceitil, Mário (2006) <i>Gestão dos Recursos Humanos para o séc. XXI</i> , Edições Sílabo. Chiavenato, I. (2000). <i>Recursos Humanos</i> . Coleção Atlas. Chiavenato, I. (2006). <i>Recursos Humanos</i> . Edição Compacta, Coleção Atlas
Teaching methods	Lectures and tutorials
Assessment methods	Continuous assessment. Final exam for the students with an average mark below 10 grade points (out of a 0-20 scale). Practical assignments.
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Quality (option 3 and 4)
Course code	912337
Type of course	Elective: T:30 + TP:30 + OT:4.5
Level of Course	NA
Year of study	3
Semester/trimester	1 st semester
Number of credits	4,5
Name of lecturer	Amândio Gonçalves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide the students with management, control and quality improvement techniques so that they can establish, implement and develop quality management systems in the organizations. Acquire the necessary competences that enable them to control quality processes in the organizations.
Prerequisites	Not applicable
Course contents	<p>Introduction to quality management: concepts and historical context – From inspection to TQM (Total Quality Management). Approaches to quality improvement (Juran, Deming).</p> <p>Quality management models and systems. ISO 9000. ISO 9001 requirements. Portuguese Quality System and certification. Quality audits. Management systems development: quality, environment (ISO 14001) and safety integration (OHSAS 18001). Product and services certification.</p> <p>Quality control. Statistical process control. Sampling procedures for inspection.</p> <p>Quality improvement and total quality management: concepts and ISO 9000. Quality improvement and problem solving projects.</p>
Recommended reading	<p>Pires, A. Ramos – “Quality – Quality Management Systems”, Sílabo.</p> <p>Straker, David– “A Toolbook for quality improvement and problem solving”, Prentice Hall.</p> <p>Juran, J. M. ; Godfrey. A. B. – “Juran´s Quality Handbook” (fifth edition), McGraw-Hill.</p> <p>Juran, J.M.– “Juran on Leadership for Quality”, Pioneira Editora.</p> <p>Gama, Pedro– “Quality tools”, IPQ – Quality Portuguese Institute.</p> <p>ISO 9000 standards IPQ – Quality Portuguese Institute:</p> <p>ISO 9000: 2005 – “Quality management systems - Fundamentals and vocabulary”.</p> <p>ISO 9001: 2000 – “Quality management systems - Requirements “.</p> <p>ISO 9004: 2000 – “Quality management systems - Guidelines for performance improvements” .</p>
Teaching methods	Lectures and tutorials.
Assessment methods	Continuous assessment (two tests and three practical works), final assessment (a final examination and a practical work).
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Health and Safety (option 3 and 4)
Course code	912336
Type of course	Theoretical and Practical
Level of Course	
Year of study	3
Semester/trimester	1
Number of credits	4.5
Name of lecturer	Manuel Soeiro Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	<p>Upon completion of course the students should:</p> <ul style="list-style-type: none"> - Be aware of the importance and role of health and safety at work. - Be familiar with national and international laws and HSE legislation. - Be able to evaluate and anticipate eventual professional risks and promote health and safety of employees. - Be aware of the importance of safety plans and their implementation. - Be able to perform ergonomic analyses and development studies.
Prerequisites	Not Applicable
Course contents	Health and Safety concepts, risk analyses, administrative and organizational aspects, provisions concerning individual protection, protective and preventive actions against fire and electric risks, maintenance, chemical contamination, noise, vibrations, environmental climate, radiation, illumination and ergonomics.
Recommended reading	Manual de Higiene e Segurança no Trabalho – Alberto Sérgio, Porto Editora; Manual de higiene e segurança na indústria – Ricardo Macedo; Ergonomia prática – J. Dul e B. Weerdemeester Higiene e segurança nos locais de trabalho – Dir. Geral da Indústria; Colectânea de legislação sobre segurança, higiene e saúde no trabalho; Concepção dos locais de trabalho - IDICT
Teaching methods	
Assessment methods	<p>Mid-term test that exempts the students final exam. Final mark will be the average of mid-term test (NE) + assignments (NT) + individual participation (NA) according to the following formula: $NF = NE (70\%) + NT (20\%) + NA (10\%)$ Using this formula, a minimum mark of 7 (seven) in the mid-term test is required to pass. As for examination, a grade higher than ten is required to pass.</p>
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Vehicle Electricity and Electronics (option 3 and 4)
Course code	912333
Type of course	Elective: T + TP + PL + OT
Level of Course	2
Year of study	3
Semester/trimester	1 st Semester
Number of credits	4.5
Name of lecturer	Lecturer from the Robotics, Instrumentation and Industrial Automation Area (RIAI)
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Identify the standards for the sector; Describe the operation requirements of the various automobile systems; Project and integrate the various automobile subsystems.
Prerequisites	NA
Course contents	The automobile electronics panorama; Electrical and electronic circuits; Introduction to control theory; Engine control; Safety; Comfort.
Recommended reading	H. Shiga and S. Mizitani, Car Electronics, ALCA Inc, Japan, 1988. (BPG-SDUM 90491) W. B. Ribbens, Understanding Automotive Electronics, SAMS, 1988. (BPG-SDUM 90492) R. Jurgen, Automotive Electronics Handbook, McGraw-Hill, Inc., 1995. (BPG-SDUM 134598)
Teaching methods	Lectures, tutorials and laboratory sessions
Assessment methods	Written test and laboratory assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Machine Parts II
Course code	912363
Type of course	Compulsory: T:30 + TP:30 + OT:4.5
Level of Course	II
Year of study	3
Semester/trimester	2
Number of credits	5
Name of lecturer	Teresa Leonor Ribeiro C. M. Morgado
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Basics of selection and design of clutches, brakes, mechanical drives, chain transmission, transmission by gears and gear trains. Select and design mechanic elements. Basic concepts of lubrication.
Prerequisites	Not Applicable
Course contents	Clutches, brakes, Couplings and flywheels: Classification, selection and design. Bearings: Different types of bearings; Bearing selection. Mechanical drives: selection principles. Comparative analysis of the different kinds of mechanical drives. Designing belt drives, chain drives, and gear drives. Speed reducers.
Recommended reading	J. E. Shigley - "Mechanical engineering Design", McGraw-Hill C. Moura Branco, J. Martins Ferreira, J. Domingos da Costa, A. Silva Ribeiro – "Projecto de Órgãos de Máquinas", Fundação Calouste Gulbenkian, 2005
Teaching methods	Lectures and tutorials.
Assessment methods	Written test, reports and its presentation.
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Industrial Automation
Course code	912358
Type of course	Compulsory: 30TP+30PL+4OT
Level of Course	NA
Year of study	3
Semester/trimester	2 nd semester
Number of credits	5
Name of lecturer	Toni Santos Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students should acquire abilities that allow them to identify equipments and master programming techniques in order to be prepared to solve future professional problems.
Prerequisites	Not Applicable
Course contents	Automation fundamentals. Industrial sensors. Sequences circuits of relay. Programmable automatons. Execution of a PLC. Programming language of programmable automatons. Automatic control.
Recommended reading	Datashow prepared by the lecturer. J.Novais, " Método Sequencial para Automatização Electropneumática ", 3 ^a Edição, Fundação Calouste Gulbenkian, 1997. António Francisco, " Autómatos Programáveis – Programação, Grafcet e Aplicações ", ETEP (Edições Técnicas e Profissionais), 2002
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	Exams and practical assignments.
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Turbomachines(option 5 and 6)
Course code	912346
Type of course	Elective: TP:30 + PL:30 + OT:3
Level of Course	NA
Year of study	3
Semester/trimester	2
Number of credits	4
Name of lecturer	Maurício Baptista Carlos
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The various types of Turbomachines. Foundations required to be able to characterise Turbomachines, including the use of dimensionless coefficients and operation curves. Training in the draft pipes, standards and apply codes. Characterization of valves and other accessories needed for water projects. Knowledge of software for designing fluid networks.
Prerequisites	Not Applicable
Course contents	Characteristics of Global Operations of Turbomachines; New dimensionless coefficients; Specific speed. Definition of geometry; Cavitation; Equipment and Security; Pumping facilities; Draft piping; Sizing of valves; Separators and filters; Expansion joints; CADVENT (Industrial Ventilation Networks and fluids).
Recommended reading	Notes of Hydraulic Machinery (ISEC) – Mendes, J., 2002. Notes of Fluid Networks (ISEL) – CESE 1994/95 – compilação efectuada pelo professor da disciplina - Turbomáquinas) Manual do CADVENT Bombas Grundfos Portugal Lda, (1999). Manual de Engenharia – Sistemas com Bombas Submersíveis. Bombas Grundfos Portugal Lda, (1988). Abastecimento de Água Doméstica Centrifugal Pump Lexicon – KSB Mecânica dos Fluidos – Streer Hidráulica 7ª Ed. – Quintela, A., Fundação Calouste Glubenkian Mechanics of Fluids – Massey Mecânica dos Fluidos e Hidráulica – Giles, R., Schaum Mecânica dos Fluidos 4ª Ed. – White, F., McGraw-Hill UK National Engineering Laboratory “Steam Tables 1964” Smithsonian Physical Tables, Mark’s Engineers Handbook J. A. Fox, “Hydraulic Analysis”
Teaching methods	Lectures including datashow, practical exercises.
Assessment methods	Written test and theoretical and practical work.
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Plastic Conformation Processes (option 5 and 6)
Course code	912343
Type of course	Elective: TP + OT
Level of Course	3
Year of study	3
Semester/trimester	2 nd semester
Number of credits	4
Name of lecturer	Isabel Ludovino
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will be provided with knowledge of plastic behaviour of materials; plastic deformation mechanisms; manufacturing processes involving plastic deformation of materials.
Prerequisites	Not applicable
Course contents	Basics of plasticity. Plastic deformation mechanisms. Shape-forming processes by plastic deformation: Forging; Lamination; Extrusion and Wire-Drawing; Folding; Drawing; Blanking; Conventional blanking; Shaving or Trimming; Precision Cutting. Stress Calculus: Uniform-deformation energy method; Slice Method; Lower-Limit Method; Higher-Limit Method.
Recommended reading	Handouts prepared by the lecturer; Fernandes, V. - "Plasticidade", Universidade de Coimbra; Chiaverini, V.- "Tecnologia Mecânica", Makron Books; Smith, W. F. - "Princípios de Ciência e Engenharia dos Materiais", Mc. Graw Hill; Dieter, G. - "Metalurgia Mecânica", Aguilar
Teaching methods	Lectures making use of media resources. Practical sessions including exercise solving.
Assessment methods	Final grade (NFinal) is calculated as follows: tests (Nprovas) are worth 70% of final grade + individual assignments (Ntrab) are worth 30% of final grade. $N_{Final} = 0,7 \times N_{provas} + 0,3 \times N_{trab}$
Language of instruction	Portuguese

	B - Description of individual course units
Course title	Engine Testing (option 5 and 6)
Course code	912341
Type of course	Elective: TP + PL + OT
Level of Course	NA
Year of study	3
Semester/trimester	2 nd Semester
Number of credits	4
Name of lecturer	Lecturer of the Energetic and Fluid Technologies (TEF) Area
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students should familiarise themselves with the existing standards on engine testing, the devices and equipment used, the response of the various engines and determination of its properties.
Prerequisites	Not applicable
Course contents	Applicable standards, equipment used and essays on thermal combustion and electrical engines. Result analysis: Characteristic curves and emissions.
Recommended reading	Heywood, John B.; Internal Combustion Engine Fundamentals; McGraw-Hill Ensaios de Máquinas Eléctricas; Martignoni, A.; Editora Globo
Teaching methods	Lectures, tutorials and laboratory sessions.
Assessment methods	Written test and practical assignments
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Machine-Tools(option 5 and 6)
Course code	912342
Type of course	Elective: TP:30 + PL:30 + OT:4
Level of Course	NA
Year of study	3
Semester/trimester	2 nd semester
Number of credits	4
Name of lecturer	Luis Miguel Marques Ferreira
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students will familiarise themselves with the fundamentals of technological processes and respective machine tools (conventional and CNC), its potential and limitations in industry in order to be prepared to solve industrial production related problems and maximize connection between the project and manufacturing as according to the "Design for Manufacturing" concept.
Prerequisites	Not Applicable
Course contents	Motions and geometric relations in machining by stock removal. Cutting tools: materials and geometry. Cutting parameters: cutting speed, feed rate and cutting depth. Calculation of cutting power: turning, milling and drilling. Calculation of cutting times. Other conventional machine tools. CNC machines: programming and operation of turning and milling machines.
Recommended reading	Handouts prepared by the lecturer. Manual de operação do centro de maquinagem HAAS VF4. Máquinas Ferramentas, Ruy Mesquita, Jorge Rodrigues e Rui Baptista, 1997
Teaching methods	Lectures including datashow. Laboratory sessions including problem solving.
Assessment methods	An examination (50% of final grade - minimum pass mark 10 grade points). Individual assignment (50% of final grade - minimum pass mark 10 points).
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Industrial Robotics (Option 5 and 6)
Course code	912344
Type of course	Elective: 30 (TP) + 30 (PL) + 3 (OT)
Level of Course	NA
Year of study	3
Semester/trimester	2 nd Semester
Number of credits	4
Name of lecturer	Toni dos Santos Alves
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide the students with the necessary information on the different types of robots, the constructive aspects, the form of programming and its application.
Prerequisites	Not Applicable
Course contents	Part I: Systems control. Part II: Fundamentals of robotic systems, robot applications, robot mechanisms and categories, constituents of a robotic system, robot characteristics. Direct and inverse kinematics. Robot control. Robot mobile.
Recommended reading	J. Norberto Pires – “ <i>Automação Industrial</i> ”, ETEP, 2002, ISBN 972-8480-05-9. P. McKerrow – “Introduction to Robotics”, Addison-Wesley, 1993. R. Paul – “Robot Manipulators: Mathematics, Programming and Control”, MIT Press 1981. M. P. Grover et al., “Industrial Robotics: Technology Programming and Applications”, McGraw-Hill, 1986. Gregory Dudek, Michael Jenkin – “Computational Principles of Mobile Robotics”, Cambridge, 2000, ISBN 0-521-56876-5.
Teaching methods	Lectures and Tutorials.
Assessment methods	Exams and practical assignments
Language of instruction	Portuguese

B - Description of individual course units	
Course title	Data Acquisition Systems (Option 5 e 6)
Course code	912345
Type of course	Elective: TP:30 + PL:30 + OT:3
Level of Course	2
Year of study	3
Semester/trimester	2 nd Semester
Number of credits	4
Name of lecturer	A lecturer from the Robotics, Instrumentation and Industrial Automation Area (RIAI)
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The students are expected to be able to understand, project and construct data acquisition systems. These systems are vital for the control and optimization of varied industrial processes or others. Therefore, the students should be able to select the system that best adapts to each application.
Prerequisites	
Course contents	Basics of data acquisition, typical configurations, signal classification, sensors, signal conditioning, noise and interferences, PC acquisition, acquisition plates, data transmission networks types, autonomous controllers, microprocessors.
Recommended reading	<p>Stuart R. Ball, Debugging Embedded Microprocessor Systems, Butterworth Heinemann, 1998</p> <p>Mohammad. Farsi, Manuel. Barbosa, CANopen Implementation: Applications to Industrial networks, Research Studies Press, 2000.</p> <p>Practical Data Acquisition for Instrumentation and Control Systems ,John Park, Steve Mackay, 2003</p>
Teaching methods	Oral presentation resorting to audiovisual media.
Assessment methods	<p>Mid-term test that exempts the students final exam. Final mark will be the average of mid-term test (NE) + assignments (NT) + individual participation (NA) according to the following formula: $NF = NE (70\%)+NT (30\%)$</p> <p>As for examination, a grade higher than 10 (ten) is required to pass.</p>
Language of instruction	Portuguese

B – Description of individual course units	
Course Title	Technical English (Option 7)
Course Code	912352
Type of Course	Elective: TP:30 + OT:1.5
Level of Course	1
Year of Study	3
Semester/Trimester	2 nd Semester
Number of credits	2
Name of Lecturer	Zélia Patrocínio
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The English course is intended to provide the students with skills that enable them to understand technical texts dealing with course content topics and familiarise themselves with specific vocabulary. Upon completion of course the students should be able to express themselves in English fluently both orally and in writing.
Prerequisites	Not applicable
Course contents	Grammar structures Technical languages
Recommended Reading	Due to its length, the reading list was not included here.
Teaching Methods	Lectures and tutorials.
Assessment Methods	Final grade is the weighted average of a mid-term test, compulsory coursework and participation/assiduity. Minimum passing grade is 10 out of 0-20 scale.
Language of Instruction	English

B – Description of individual course units	
Course Title	French (Option 7)
Course Code	912351
Type of Course	Elective: TP:30 + OT:1.5
Level of Course	1
Year of Study	3
Semester/Trimester	2 nd Semester
Number of credits	2
Name of Lecturer	Sofia Mota
Objectives of the course (preferably expressed in terms of learning outcomes competences)	The course Foreign Language-French aims at providing the students with language skills needed by an adult possessing a medium-level culture.
Prerequisites	NA
Course contents	Study of French Civilization, Society and Literature. Civilization and Society Contemporary Literature Comprehension and documentary interpretation Grammar structures Discourse functions
Recommended Reading	Due to its length, the reading list was not included here.
Teaching Methods	Lectures and tutorials.
Assessment Methods	Final grade is the weighted average of a mid-term test, compulsory coursework and participation/assiduity. Minimum passing grade is 10 out of 0-20 scale.
Language of Instruction	French

B – Description of individual course units	
Course Title	German (Option 7)
Course Code	912348
Type of Course	Elective: TP:30 + OT:1.5
Level of Course	1
Year of Study	3
Semester/Trimester	2 nd Semester
Number of credits	2
Name of Lecturer	Marta Dionísio de Azevedo
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Knowledge of German Language and an improvement of general communication skills – oral and written comprehension and expression.
Prerequisites	NA
Course contents	Course contents 1.1. Personal Identification 1.3. School life 1.4. Interpersonal relationships 1.5. Work 1.6. Leisure Morphosyntatic Component
Recommended Reading	Behal-Thomsen, H., Lundquist-Mog, A., Mog, P., Typisch Deutsch, Langenscheidt KG, Berlin Bohn, R., Probleme der Wortschatzarbeit, Langenscheidt KG, Berlin Borbein, V., Menschen in Deutschland, Langenscheidt KG, Berlin Griesbach, H., Die Bundesrepublik Deutschland, Langenscheidt KG, Berlin
Teaching Methods	Lectures: written and oral practice. Worksheets and projects
Assessment Methods	Written test and practical assignments
Language of Instruction	Portuguese and German

	B - Description of individual course units
Course title	Engineering Ethics (Option 7)
Course code	912350
Type of course	Elective:TP:30 + OT:1.5
Level of Course	
Year of study	3
Semester/trimester	2 nd semester
Number of credits	2
Name of lecturer	João Paulo Tomás Henriques
Objectives of the course (preferably expressed in terms of learning outcomes competences)	An introduction to ethics for engineers.
Prerequisites	Not Applicable
Course contents	The course deals with ethics and good practices applied to the engineering profession.
Recommended reading	Ética para engenheiros Arménio Rego/ Jorge Braga Lidel ISBN : 972-757-341-X
Teaching methods	Lectures and case studies.
Assessment methods	Practical assignment. Final grade is awarded on a 0-20 scale basis.
Language of instruction	Portuguese

B – Description of individual course units	
Course Title	Oral and Written Communication (Option 7)
Course Code	912349
Type of Course	Elective: TP:30 + OT:1.5
Level of Course	1
Year of Study	3
Semester/Trimester	2 nd Semester
Number of credits	2
Name of Lecturer	Maria Romana
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Understand the Portuguese Language as a means to access forms of representation of different world views. Expand writing and oral skills that enable the students to understand and interpret complex current texts and follow the evolution of Portuguese Language.
Pré-requisitos	NA
Conteúdos da Unidade Curricular	Communication forms Morphology Lexicology Utterance Text and discourse Oral expression Written expression
Recommended Reading	Barroso, Henrique – “O Aspecto Verbal Perifrástico em Português Contemporâneo”, Porto Editora, 1994. Campos, Maria H. C. – “Tempo, aspecto e Modalidades”, Porto Editora, Porto, 1996. Jakobson, Roman – “Linguística e Comunicação”, Cultrix, S. Paulo 1969. Rodrigues, Adriano Duarte, “A Partitura Invisível – Para a abordagem interactiva da linguagem” Edições Colibri, Lisboa, 2001 Vilela, Mário – “Estruturas Léxicas do Português”, ed. Almedina Coimbra.
Teaching Methods	Lectures and practical exercises. Conferences.
Assessment Methods	Written test and practical assignments
Language of Instruction	Portuguese

B – Description of individual course units	
Course Title	Introduction to Law (Option 7)
Course Code	912353
Type of Course	Elective: TP:30 + OT:1.5
Level of Course	NA
Year of Study	3
Semester/Trimester	2 nd Semester
Number of credits	2
Name of Lecturer	Paula Almeida
Objectives of the course (preferably expressed in terms of learning outcomes competences)	Provide an overview of legal system: its different meanings, sources, branches, law interpretation and integration and its application in time and space.
Prerequisites	Not Applicable
Course contents	Chapter I – Introductory notions; Chapter II – Sources of Law; Chapter III – Branches of Law; Chapter IV – Law interpretation and integration; Chapter V – Application of law in time; Chapter VI – Application of law in space; Chapter VII – Acting according to law; Chapter VIII – Acting against law; Chapter IX – Legal coercion; Chapter X – Juridical relation
Recommended Reading	Castro Mendes, João de “ Introdução ao Estudo do Direito”, PF, Lisboa,1994; Telles, Inocêncio de Galvão, “ Introdução ao Direito”, Coimbra Editora, 2004; Telles, Inocêncio Galvão, “ Direito das Obrigações”, Coimbra Editora, 2006; Sousa, Marcelo Rebello de, “ Introdução ao Estudo do Direito”.
Teaching Methods	Lectures and teamwork.
Assessment Methods	<p>Mid-term test that exempts the students from taking exam. Final mark is the average of mid-term test(NE)+assignments(NT)+individual participation(NA) according to the following formula:</p> $NF = NE (70\%)+ NT (20\%)+NA (10\%)$ <p>Using this formula, a minimum mark of 10.00 (ten) in mid-term test is required to pass.</p> <p>As for final examination, a grade higher than ten is required to pass.</p>
Language of Instruction	Portuguese

	B – Description of individual course units
Course Title	Public Relations(Option 7)
Course Code	912354
Type of Course	Elective: TP:30 + OT:1.5
Level of Course	NA
Year of Study	3
Semester/Trimester	2 nd Semester
Number of credits	2
Name of Lecturer	Lecturer from the Economical and Social Sciences Area.
Objectives of the course (preferably expressed in terms of learning outcomes competences)	<p>The students should be able to:</p> <ul style="list-style-type: none"> • Position public relations in the context of the organizational communication and organizational studies; • Approach public relations as a strategic management function; • Analyse/apply professional public relations strategies, techniques and routines.
Prerequisites	
Course contents	<p>PR, organizational communication and study. Theoretical principles, history, models and key topics for Public Relations. PR strategy, programmes and campaigns. Organise the Public Relations function.</p>
Recommended Reading	<p>Heath, Robert (2001) (org.), Handbook of public relations, Sage Publications. Hunt, Todd; Grunig, James E. (1994), Public relations techniques, Harcourt Brace College.</p>
Teaching Methods	Lectures and case studies.
Assessment Methods	Written test and practical assignments.
Language of Instruction	Portuguese

B - Description of individual course units	
Course title	Training (Option 8)
Course code	912355; 912356; 912357; 912358; 912359; 912360
Type of course	Elective: OT: 30 + E:75
Level of Course	NA
Year of study	3
Semester/trimester	2 nd semester
Number of credits	11
Name of lecturer	Several lecturers from various scientific areas of the degree.
Objectives of the course (preferably expressed in terms of learning outcomes competences)	This Training Period aims to provide the students direct contact with some Mechanical Engineering tasks. They should be able to integrate and apply the knowledge and skills acquired during the degree in the resolution of real problems. Joint actions are established in collaboration with industries, IPT laboratories and other institutions in areas such as total or partial design of mechanical systems, production management, quality management, industrial maintenance, industrial automation, thermal and fluid selection of materials and systems.
Prerequisites	Not Applicable
Course contents	Building on knowledge and skills acquired during the degree, this discipline aims to provide the students with an overall concept of a mechanical project in order to facilitate their integration in a prospect career as an engineer. Data are provided that relate to a mechanical systems project as a whole or part of it, which is suggested by industrial companies as possible. For the calculation of machine parts, development of industrial-oriented software programmes is encouraged. Apart from usual supervision of the works in course, useful data are provided such as standards, manufacturing codes and construction details.
Recommended reading	Bibliography and authorized elements of study are in accordance with the individual training plan.
Teaching methods	A training period in an enterprise or institution with personalized supervision.
Assessment methods	Evaluation of work carried out during training and of presentation of Training Report.
Language of instruction	Portuguese