Polytechnic Institute of Coimbra (P COIMBRA 02)
Coimbra Institute of Engineering - ISEC
Mechanical Engineering Department

ECTS CATALOGUE 2021-2022

The main language of instruction at Coimbra Institute of Engineering is Portuguese. However, some courses from degree and master programs can be offered in English or with a tutorial support in English.

The ECTS catalogue includes subject contents in English Language. The Students can choose subjects from this Catalogue to the study plan proposal (Learning Agreement) to be analyzed carefully by the Departmental Coordinators and to be adjusted, after the student's arrival, if necessary.

This ECTS catalogue contains information which is valid for this academic year. ISEC reserves the right to adjust the courses offered during the academic year and is not responsible for typing errors or printing mistakes.

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Polytechnic Institute of Coimbra (P COIMBRA 02)
Coimbra Institute of Engineering - ISEC
Mechanical Engineering Department

ECTS CATALOGUE

BACHELOR Mechanical Engineering Course

Old Code	New Code	Title - Portuguese	Title - English	ECTS	Term
1.º ano / 1st Year					
912301	60024310	Análise Matemática I	Mathematical Analysis I	6	Autumn
912302	60024321	Álgebra Linear	Linear Algebra	5	Autumn
912310	60024403	Mecânica Aplicada	Applied Mechanic	5	Autumn
912304	60024343	Química	Chemistry	4	Autumn
912305	60024357	Desenho Técnico	Technical Drawing	5	Autumn
912306	60024368	Introdução à Programação	Introduction to Programming	5	Autumn
912307	60024379	Análise Matemática II	Mathematical Analysis II	6	Spring
912308	61000560	Fundamentos de Ciência dos Materiais	Fundamentals of Materials Science	5	Spring
912309	60024396	Termodinâmica	Thermodynamics	6	Spring
912303	60024332	Física Aplicada	Applied Physic	5	Spring
912311	60024414	Desenho de Construções Mecânicas	Mechanical Engineering Drawing	5	Spring
912312	60024420	Inglês	Technical English	3	Spring
2.º ano / 2nd Year					
912313	60024431	Métodos Estatísticos	Statistical Methods	4	Autumn
912314	60024442	Materiais de Engenharia	Engineering Materials	6	Autumn
912315	60024458	Resistência dos Materiais I	Strength of Materials I	5	Autumn
912316	60024469	Mecânica dos Fluidos	Fluid Mechanics	5	Autumn
912317	60024475	Tecnologia Mecânica I	Mechanical Technology I	5	Autumn
912318	60024486	Eletrotecnia	Electrotechnics	5	Autumn
912319	60024497	Resistência dos Materiais II	Strength of Materials II	5	Spring
912320	60024505	Transmissão de Calor	Heat Transfer	5	Spring
912321	60024516	Tecnologia Mecânica II	Mechanical Technology II	5	Spring
912322	60024527	Processos de Maquinagem	Machining Processes	5	Spring
912323	60024538	Máquinas Hidráulicas	Hydraulic Machines	5	Spring
912324	60024549	Automação	Automation	5	Spring
3.º ano / 3rd Year					
912325	60024551	Órgãos de Máquinas I	Machines Elements I	5	Autumn
912326	60024562	Climatização e Refrigeração	Air Conditioning and Refrigeration	5	Autumn
912327	60024573	Máquinas Alternativas	Reciprocating Engines	5	Autumn
912328	60024584	Equipamentos e Processos Térmicos	Equipments and Thermal Processes	5	Autumn
912329	60024590	Laboratórios de Engenharia de Produção	Laboratory of Computer Aided Engineering and Manufacturing	6	Autumn
		Opção 1	Optional I*	4	Autumn
912334	60024639	Órgãos de Máquinas II	Machines Elements II	5	Spring
912335	60024645	Manutenção Industrial	Industrial Maintenance	4	Spring
912336	60024650	Organização e Gestão	Organization and Management	4	Spring
912337	60024661	Laboratórios de Engenharia Térmica	Laboratory of Thermal Machines	6	Spring
912338	61000571	Projeto	Project	7	Spring
		Opção 2	Optional II*	4	Spring
Optional I * – Autumn semester					
912333	60024628	Gestão da Qualidade	Quality Management	4	Autumn
912332	60024617	Programação de Autómatos	PLC Programming	4	Autumn
912331	60024606	Aquisição e Processamento de Dados	Data Acquisition and Processing	4	Autumn
Optional II * – Spring semester					
912340	60024683	Fabrico de Moldes	Manufacture of Molds	4	Spring
912341	60024694	Instalações de Climatização	Air Conditioning Installations	4	Spring
912342	60024707	Novas Tecnologias de Motores	Internal Combustion Engines - New Technologies	4	Spring

*Not recommended to choice more than one optional subject in each semester since exams are in the same dates.

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Licenciatura – BSc Engenharia Mecânica (Português)

Licenciatura – BSc Mechanical Engineering (Inglês)

Academic Year:2018/2019

Program Contents

Course Unit QUALITY MANAGEMENT

Specialization (s)

Subject type Complementary Sciences **Research Area** Engineering and Industrial Management

Year 3rd **Semester** 1st **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	24
Works / Group Works	35
Project	
Evaluation	3
Additional	

Total of Working Hours 104

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	David José Rocha Domingues	Msc	Ad.Prof
Practical-Laboratoty Lectures	David José Rocha Domingues	MSc	Ad. Prof
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) David José Rocha Domingues

Goals

Mastering the concept of Quality, its historical evolution and value for business development policies;
Familiarization with the Quality documentation as ISO 9000 standards.
Integration between Quality, Strategy and Marketing;
Interpretation and mastery of Quality tools, particularly statistical tools.
Design of quality control tools, particularly control charts and acceptance plans;

Skills

Ability to understand Quality Management Systems, design and use the main tools of the Quality in industrial environments.
Ability to understand the models used in Quality Management Systems.

Program Contents

1. Introduction to Quality Assurance
Quality Definitions; Origin of the Quality problems; Myths of Quality; Quality Models and gurus; Historical perspective of Quality in organizations; Quality management systems; Quality Assurance Standards; Total Quality Management.

2. Formalization of the Quality System
Interpretation and implementation of ISO 9001: 2015; New concepts and Terminology; Requirements. Management by processes ; Documentation and Mapping of processes; Targets and indicators; Portuguese Quality System.

3. Integration of the Quality in Management
Product/service life cycle analysis and QMS; Quality Assurance and Management; Quality for competitiveness; Quality and strategy; Innovation vs. Continuous improvement.

4. Tools for Quality
Check sheets; Histograms; Pareto diagrams; "Fishbone" diagrams; Trending Graphs; Control Charts.

5. Statistical Process Control
Statistics applied to Quality: main distributions and the central limit theorem; Trends detection; Control charts for attributes and for variables; Process capability.

6. Product acceptance based on sampling plans
Sampling plans for attribute and for variables; Operating curves; Standard sampling plans.

Bibliography

1 Ramos Pires, A., "Qualidade - Sistemas de Gestão da Qualidade", 2a. ed., Edições Sílabo, Lda., Lisboa (2000).
2. Duarte, B., "Apontamentos de Optimização e Estratégias de Qualidade", Instituto Superior de Engenharia de Coimbra, Coimbra (2000)
3. Ganhão, F.N., Pereira, A., "A Gestão da Qualidade – Como Implementá-la na Empresa", Editorial Presença, Lisboa, 1992
4. Juran, J.M., Gryna, F.M., "Quality Planning and Analysis", 3rd. ed., MacGraw-Hill, Inc., New York (1993)
5. Mitra, A., "Fundamentals of Quality Control and Improvement", 2nd. ed., Prentice Hall, Inc., New Jersey (1998)
6. Montgomery, D.C., Runger, G.C., "Applied Statistics and Probability for Engineers", John Willey & Sons, NY (1994)
7. Bank, J., "Qualidade Total - Manual de Gestão", 2a. ed., Edições CETOP, Portugal (1998)
8.Roldão, V.S. , Ribeiro,J.S.; Gestão das Operações-Uma abordagem Integrada; Ed. Monitor, 2007
9.Lisboa,J. V., Gomes,C.F.; Gestão de Operações; Vida Económica; 2ªEd, 2008

Access Conditions and Attendance Excuse
Not applicable

Conditions for Exam Admission
All students regularly enrolled in this UC

Evaluation Method

The evaluation involves the results of Homeworks and Test, in addition to the official Exams.
There are two types of evaluation: "distributed" and "by exam".

P-Homeworks (2): written reports and oral presentations
T-Test at the end of the semester
Ex-Exam
NF-Final Mark

"Distributed" assessment applicable to students who take the test

NF = 0.5 * P + 0.5 * T

Assessment by exam
NF = maximum (0.5 * P + 0.5 * Ex; Ex)

In any of the modes, "Test" and "Exam" have a minimum of 30%.

Scheduling of Assessment Reports and Test
The first work report must be delivered by the end of November, with the presentations/discussions taking place in December. The second must be delivered before the start of the exam season.
The test occurs in the last class.

Consultation elements and equipment authorized during test/exams
The "test" and the "exams" are made up of two parts. In the first one is not allowed any type of consultation or support equipment. In the second part, it is allowed to consult books, notebooks, or any material that the student intends to take and can still use calculator or PC (communications disabled) to be defined in each case in relation to the problems placed in the test/exam.

Conditions for Results Improvement
By final exam acc regulatory terms

Date

14-Sept-2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: 

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: 2018/2019

Program Contents

Course Unit PLC PROGRAMMING

Specialization (s)

Subject type **Research Area** Mechanical Enginnering

Year 3º **Semester** 1º **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	1	14
Practical-Laboratory Lectures	2	28
Tutorial Orientation		
Project		
Total of Working Hours		42

Unaccompanied Working Hours

Activity Type	Total Hours
Study	62
Works / Group Works	
Project	
Evaluation	In classes
Additional	
	62

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	Pedro Jorge Borges Fontes Negrão Beirão	PhD.	Prof. Adjunto
Practical-Laboratoty Lectures	Pedro Jorge Borges Fontes Negrão Beirão	PhD.	Prof. Adjunto
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Pedro Jorge Borges Fontes Negrão Beirão

Goals
Acquaintance the student s with the structure and utilization of a programmable PLC.
Configure and program a programmable PLC to perform command and control actions on systems of various physical quantities.

Skills
Know how to command and control hydraulic, pneumatic or other systems, containing electrical drives, using specific software.

Program Contents

Theoretical-practical lectures:
1. Programmable PLCs
Introduction. Structure of a programmable PLC. Constitution and operation methods of a programmable PLC.
2. PLC Programming
Introduction. Ladder Language. Simple and structured programming. Functions and main instructions of a programmable PLC.

Laboratory lectures:
1. PC-PLC communication interface.

2. Hardware configuration and parameterization.
3. Visualization and practical simulation of functions and main instructions of a programmable PLC.
4. Interconnection between sequential electropneumatic circuits, physical systems and programmable PLCs.

Bibliography

• NOVAIS, J., Método Sequencial para Automatização Electropneumática, Ed. Calouste Gulbenkian, 1983
• SIEMENS, Simatic Step7 – Programação 1, Siemens SA, 2000
• SIEMENS, Simatic Step7 – Programação 2, Siemens SA, 2000
• PIRES, J., Automação Industrial, Ed. Técnicas e Profissionais ETEP, 2002
• FRANCISCO, A., Autómatos Programáveis, Ed. Técnicas e Profissionais ETEP, 2003
• PINTO, C., Técnicas de Automação, Ed. Técnicas e Profissionais ETEP, 2004
• BEIRÃO, P., Programação de Autómatos (Aulas Teórico-práticas), ISEC, 2008
• BEIRÃO, P., Programação de Autómatos (Aulas Práticas), ISEC, 2010
• Diapositivos em Power Point das aulas teórico-práticas

Access Conditions and Attendance Excuse

Course unit with continuous assessment.

Conditions for Exam Admission

Course unit with continuous assessment.

Evaluation Method

The assessment is carried out by continuous evaluation during the lectures and has two components:
• Theoretical-practical component: theoretical-practical test with a weight of 25%, carried out in the last week of lectures. The theoretical-practical test has a minimum score of 5 points (scale from 0 to 20 points).
• Practical component: three laboratory works with a weight of 25% each, usually made in group of two, maximum three students. Whenever possible, laboratory works are made individually. The dates foreseen for the laboratory works will be given by the teacher.
Approval, through continuous evaluation, is still subject to the following criterion of attendance: maximum of two absences to laboratory lectures. This criterion of attendance is not applicable to students with worker-student status or similar (however, for these students, the assessment is identical to the other students, that is, to be carried out during lectures, dates given by the teacher).
If the students do not meet the criterion of the minimum score of the theoretical-practical component they must undergo examination of this component in the dates defined in the examination schedule.
If the students do not meet the attendance criterion they must undergo examination of both components in the dates defined in the examination schedule.
Bibliographic elements are not allowed in the two knowledge assessment components. The use of computers is allowed in the practical component of the knowledge assessment.

Conditions for Results Improvement

Date	**Signature from the lecturer responsible for the course**
12/09/2018	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature:

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Academic Year 2018/2019

Program Contents

Course Unit LABORATORY OF COMPUTER AIDED ENGINEERING AND MANUFACTURING

Specialization (s)

Subject type Engineenring Sciences **Research Area** Mechanical Engineering

Year 3 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	4	56
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	17
Works / Group Works	80
Project	
Evaluation	3
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Fernando António Gaspar Simões	PhD	Coordinator Prof.
	Urbano Manuel Oliveira Ramos	PhD	Adjunt Prof.
	Pedro Manuel Soares Ferreira	PhD	Adjunt Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Fernando António Gaspar Simões

Goals
Know and use the technologies of computer aided design (CAD), Computer Aided Manufacturing (CAM) and Computer Aided Calculation (CAE) in mechanical engineering projects.

Skills
Learn to design mechanical components; Be able to implement solutions designed; Have the ability to transmit information, ideas, problems and solutions in a clear and objective mode; Ability to develop teamwork.

Program Contents

1 - CAD / CAM technologies
Machining operations on the machining center Leadwell with a Fanuc Controller
Techniques and clamping components to fix blocks in the machining center
Fastening systems of tools, types of tools and machining parameters.

Machining techniques used in CNC equipment.
Programming machining operations starting from 2D and 3D drawings
Simulation of machining toolpaths programmed
Post processing: Conversion of toolpaths in CNC language.
2 - CAD / CAE technologies
Drawing fundaments and parametric models.
Notion of finite element model.
Steps in the model definition.
Definition of boundary conditions and load conditions.
Mesh: The different types of elements and the correct selection of the mesh parameters.
Analysis and interpretation of results.
3 - From design to manufacture
Drawing, design and manufacturing of mechanical components in a machining center.

Bibliography

Controlo Numérico Computorizado - Conceitos fundamentais, Carlos Relvas – Publindústria, edições técnicas.
Princípios de Maquinagem, J. Paulo Davim, Edições Almedina.
CAD/CAM: Computer Aided Design and Manufacturing. Mikell P. Groover, Emory W. Zimmers Jr. Prentice Hall 1984
Manual do controlador do centro de maquinagem Fanuc Series O-M.
Manuais do software Mastercam
Compilação de textos sobre maquinagem, CNC, CAD/CAM e utilização do centro de maquinagem Leadwell e controlador Fanuc Series O-M.
Manual do programa Solidworks.
Manual do programa CosmosWorks.

Access Conditions and Attendance Excuse

Conditions for Exam Admission

Evaluation Method

The students prepare a report of the work group, being subject to presentation and discussion with the professors of this unit. The evaluation of each student relates only to the work group, being weighted in the final, the originality and difficulty of the work, the dynamics of group and the ability to solve problems and explain the solutions.

Conditions for Results Improvement

Date

14/09/2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Licenciatura – BsC em Engenharia Mecânica (Português)

BsC in Mechanical Engineering (Inglês)

Academic Year: **2018 / 2019**

Program Contents

Course Unit THERMAL EQUIPMENT AND PROCESSES

Specialization (s)

Subject type Specialty Curricular Unit **Research Area** Mechanical Engineering

Year 3rd **Semester** 1st **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratory Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	António Manuel de Morais Grade	MSc	Adjunct Professor
Theoretical-Practical Lectures	Maria Luísa Ingrês Pais	MSc	Adjunct Professor
Practical-Laboratory Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) António Manuel de Morais Grade

Goals

It is intended that students acquire congruent and in-depth knowledge in the areas of production, carrying and usage of thermal energy, and, in particular, that know the various types of boilers and heat exchangers and understand their operation, as well as have the ability to install, operate and do the maintenance of these equipment. It is also intended that students learn to perform combustion calculations, to analyze combustion charts and to carry out energy balances.

Skills

This course unit contributes to the achievement of the following specific skills:
- To know, understand and realize how to apply the laws of thermodynamics and the principles of heat transfer, including the ability to make thermal balances;
- To understand the process and have capability to install, operate and do the maintenance of common thermal equipment.

Program Contents

1. Combustion
   Definition. Complete and incomplete combustion. Stoichiometric combustion. Excess air. Fuels and their properties. Higher and lower heating values. Ignition temperature. Chemical reaction equations. Combustion calculations and analysis. Combustion graphs. Emissions limits.
2. Boilers
   Definition and main applications. Classification. Boiler types and their components. Boiler equipment and fittings. Combustion systems. Steam superheaters, desuperheaters and reheaters. Economizers and water preheaters. Combustion air heaters. Cogeneration plants. Boiler power output. Energy losses and boiler efficiency.
3. Heat exchangers
   Definition and application fields. Classification. Types of heat exchangers: double pipe heat exchangers, shell and tube heat exchangers, plate heat exchangers, extended surface heat exchangers and regenerators. Components and fittings. Operational features and selection.
4. Energy balances
   Energy balance of a thermal power plant.

Bibliography

- GLASSMAN, Irvin - Combustion, Academic Press, 3ª Ed., 1996. ISBN: 0122858522
- SINGER, Joseph G. - Combustion, Fossil Power Systems, Combustion Engineering, Inc.
- KITTO, J.B.; RAHN, C.H.; STULTZ, S.C. - Steam, Its Generation and Use, Babcock & Wilcox Co, 40ª Ed., 1992. ISBN: 0963457004
- STEINGRESS, Frederick M.; FROST, Harold J. - High Pressure Boilers, Amer Technical Pub.
- KOHAN, Anthony Lawrence - Boiler Operator's Guide, McGraw-Hill Professional, 4ª Ed., 1997. ISBN: 0070365741
- KAKAC, S.; LIU, Hongtan; KAKAC, Sadik - Heat Exchangers: Selection, Rating and Thermal Design, 2ª Ed., CRC Press, 2002. ISBN: 0849309026
- RAMESH, K. Shah; SEKULIC, Dusan P. - Fundamentals of Heat Exchanger Design, Wiley, 2002. ISBN: 0471321710
- RAZNJEVIC, Kuzman - Handbook of Thermodynamic Tables, Begell House, Inc., 2ª Rev. Ed., 1995. ISBN: 1567000460
- WALKER, G. - Industrial Heat Exchangers: A Basic Guide, John Benjamins Publishing Co, 2ª Ed., 1990. ISBN: 0891162305

Access Conditions and Attendance Excuse

N.A.

Conditions for Exam Admission

N.A.

Evaluation Method

The assessment is performed through a final written exam. Students must obtain a minimum of 30% in each of the two components: theoretical and theoretical-practical, for approval.
In the theoretical part no consultation elements are allowed. In the practical part, are allowed tables, diagrams and a specific formula set that are all in a separate folder of the u.c. in Moodle. The use of graph calculators and smartwatches is not permitted. If present they must remain turned off.

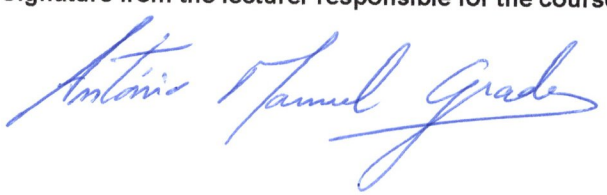
Conditions for Results Improvement

N.A.

Date

17.09.2018

Signature from the lecturer responsible for the course



Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature:_____

Licenciatura – BsC em Engenharia Mecânica (Português)

Licenciatura – BsC in Mechanical Enginnering (Inglês)

Academic Year: **2018 / 2019**

Program Contents

Course Unit RECIPROCATING ENGINES

Specialization (s) MECHANICAL ENGINEERING

Subject type Engineering Sciences **Research Area** Mechanical Engineering

Year 3º **Semester** 1º **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Carlos José de Oliveira Pereira e Jorge Alcobia	PhD	Prof. Adjunct
Theoretical-Practical Lectures	Carlos José de Oliveira Pereira e Jorge Alcobia	PhD	Prof. Adjunct
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Carlos José de Oliveira Pereira e Jorge Alcobia

Goals
Understand the constructive details and principles of operation, assess operating states, ensuring desired quality standards in the operation of internal combustion engines; capacity to install, operate and know how to intervene, through simple projects in power management, consumption and environmental impacts; know how to respond to maintenance and repair needs; selecting the different components and systems; know how to keep up with technological developments.

Skills
Understand the operation and ability to install, operate and service thermal machines in general, and in particular internal combustion engines.
The skills developed, integrated with other competences of the course, enhance capacities to ensure good standards of office management efficiency in the maintenance and repair of motor vehicles, as well as in the technical direction of road transport vehicle fleets.

Signature of Teacher:_____

Program Contents

PART I - THEORY OF ENGINES

1. Function, classification and principles of operation of engines

Function of internal combustion engines. Evolution, classification and nomenclature of existing engines.

2. Theoretical cycles of internal combustion engines

Theoretical cycles and real cycles. Thermal efficiency and mean pressure of the cycles. Generalized cycle. Otto cycle. Diesel Cycle. Mixed cycle of Sabatté. Analysis and comparison of theoretical cycles.

3. Fuels, operating fluid and lubricants

Fuels used. Octane number. Cetane number. Specific mass and calorific value. Other features.

Operating fluid. Composition. Atmospheric air. Stoichiometric ratio and real air-fuel ratio. Formation of air-fuel mixture in SI and CI engines. Elemental combustion reactions and their combustion products.

Lubricating oils. Properties and classifications of lubricating oils.

4. Real Cycles. Pressure diagrams.

Characterization of the processes that integrate the real cycle. Indicated average pressure. Diagnosis of faults based on examination of the indicated diagram. Diagram of pressures inside the cylinder as a function of the angular displacement of the crankshaft for 2 and 4 stroke engines.

5. Geometric and operating parameters. Engine power balance.

Alternative inertial forces and their influence on binary. Diagram of the resulting forces.

Indicated parameters, mechanical losses (absorbed power) and effective parameters. Characteristic curves. Income and consumption in SI and CI engines. Volumetric yield. Exhaust gas recirculation (EGR). Distribution diagram. Stability in engine operation. Inverters of phase. Engine power balance.

6. Spark-ignition engines and compression-ignition engines

Function, classification and operation. Carburettors. Injection systems. Composition and operation of ignition systems. Combined electronic system - injection / ignition. Motors with hybrid combustion processes. Types of combustion chambers.

7. 2-stroke engines

Types of washing. Geometries and components. Crankcase compression.

8. Overfeeding

Justification. Types of compressors. The turbo-compressor. Checking the supply pressure.

9. Motor friction and lubrication

Components under friction. Limit and hydrodynamic lubrication. Viscosity and viscosity index. Additions. Selection and use of lubricants.

10. Ecological parameters and anti-pollution systems

Pollutant formation and its control. Treatment of exhaust gases. Methods and technologies for reducing pollutants.

11. Test of dynamometer bench motors

Experimental means used to determine characteristic curves. Braking power and its measurement: Prony brakes, hydraulic brakes (Froude), electric and aerodynamic.

PART II - DESCRIPTION OF ENGINES AND THEORETICAL-PRACTICAL EXERCISES

12. Engine structure and connecting rod system

Block. Head. Cylinders, pistons and their dimensions. Number and arrangement of cylinders. Crank system and its most common defects.

13. Operating fluid distribution system

Scheme and operation of different distribution mechanisms of working fluid. Main malfunctions inherent in the distribution system.

14. Feed system

Gasoline engine power systems. Diesel engine power systems.

15. Spark ignition system

Conventional ignition. Electronic and transistorized ignition. Automatic advances. Spark plugs.

16. Starting system

Engine starting methods. Starter motor. Boot system malfunctions and their resolution.

17. Auxiliary groups

Cooling system. Lubrication system.

18. Resolution of theoretical-practical problems

- Sequence of the motor times for the different cylinders.
- Calculation of the main points of the cycles. Calculation of mean cycle pressure.
- Calculation of displacement, combustion chamber, total volume and compression ratio.
- Calculation of fluid force, inertia force and resulting force in the piston / connecting rod / crank system. Calculation of normal force, tangential force and motor torque.
- Calculation of the distance travelled by the piston, cylinder lateral surface, connecting rod obliqueness, instantaneous piston speed, average piston speed, piston acceleration and alternating force of inertia as a function of the crankshaft angular displacement.
- Calculation of effective power and motor torque as a function of effective mean pressure.
- Calculations of yield (including volumetric), air mass flow rate, mass flow rate of fuel (consumption) and air / fuel ratio.
- Thermal balance.

Signature of Teacher:_____

Bibliography

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- BOCCHI, Giuseppe - *Motori a Quattro Tempi*, Hoepli Editore, ISBN: 88-203-1533-5.
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- ARIAS-PAZ - *Manual da Técnica Automóvel*, Editora Mestre Jou, ISBN: 84-89656-09-6.
- STONE, Richard – *Introduction to Internal Combustion Engine*, Macmillan Press, Ltd., Second Edition, 1992, ISBN 0-333-55084-6.
- ROGOWSKI, A.R. – *Elements of Internal combustion Engine,* ISBN 07-053575-2.
- BERNARD, Adam – *Motores Diesel*, ISBN 84-7214-047-4.
- LICHETY, Lester C. – *Combustion Engine Processes,* McGraw Hill, ISBN 07-037720-0.
- Diapositivos em Power Point das aulas teóricas e aulas teórico-práticas.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Exam Admission

All students enrolled in the curricular unit in the current academic year have access to the exam.

Evaluation Method

Final exams set in the ISEC Assessment Regulations.
Each written test will consist of a theoretical component and a theoretical-practical component, each component having the quotation of 10 values.
The approval is conditioned to obtain a minimum of 30% of the quotation in each of the components: theoretical and theoretical-practical.
In the theoretical-practical component only the use of scientific calculating machine is allowed.

Conditions for Results Improvement

Those provided for in the legislation and regulations in force.

Date

08-09-2017

Signature from the lecturer responsible for the course

Carlos Alcobia

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature:_____

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: 2018/2019

Program Contents

Course Unit AUTOMATION

Specialization (s)

Subject type **Research Area** Mechanical Engineering

Year 2nd **Semester** 2nd **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	1	14
Theoretical-Practical Lectures		
Practical-Laboratorty Lectures	3	42
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Pedro Jorge Borges Fontes Negrão Beirão	PhD.	Prof. Adjunto
Theoretical-Practical Lectures			
Practical-Laboratory Lectures	Pedro Jorge Borges Fontes Negrão Beirão	PhD.	Prof. Adjunto
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Pedro Jorge Borges Fontes Negrão Beirão

Goals

Aware the students to the relevant role played by automatic systems (pneumatic and hydraulic) in several applications. Encourage the development of experimental work, namely the planning and testing of circuits, the identification of problems and the analysis of the information obtained.

Skills

Develop skills associated with experimental work, namely circuit planning and testing, problem identification and information analysis.
Apply the theoretical concepts to the resolution of laboratory exercises.

Program Contents

Theoretical part:
1. General principles: Review of some fundamental principles of Fluid Mechanics. Work, Power and Efficiency
2. Distributed and localized hydraulic resistances
3. Hydraulic fluids: Main properties. Special hydraulic fluids
4. Seals: O-rings, static and dynamic seals
5. Hydraulic cylinders: Dimensioning of a hydraulic cylinder
6. Hydraulic Pumps / Motors: Types of pumps / motors. Description and study
7. Valves: Direccional valves, pressure regulators, flow regulators. Other types.
8. Hydraulic accumulators: Types of accumulators. Calculus of an accumulator.

Lecturer's signature:_____

Laboratory Part:
1. Pneumatic: Introduction. Explanation of the working principle of various work elements. Symbology. Explanation and practical simulation of elementary pneumatic circuits. Explanation and practical simulation of advanced pneumatic circuits using the Phase diagram method.
2. Hydraulics: Introduction. Explanation of the working principle of various work elements. Symbology. Practical applications of theoretical concepts. Explanation and practical simulation of elementary hydraulic circuits. Explanation and practical simulation of advanced hydraulic circuits.

Bibliography
BEIRÃO, P. - Automação (aulas teóricas), DEM-ISEC, 2010
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ZIMMERMANN, A. - Hydraulics basic level - Workbook, Festo Didactic, 1995
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CROSER, P. - Pneumatics basic level TP101 - Textbook, Festo Didactic, 1989
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SPEICH, H., BUCCIARELI, A - Oleodinâmica, Ed. Gustavo Gili S.A, 1972

Access Conditions and Attendance Excuse
See "Evaluation Method".

Conditions for Exam Admission
See "Evaluation Method".

Evaluation Method
Distributed evaluation consisting of two tests:
• Access to the 1st test: minimum of 80% attendance to the theoretical lectures and laboratory lectures effectively lectured up to the date of the 1st test, except in cases provided for by the law. Prior registration is mandatory until the previous week scheduled for the date of the test. Expected date for the 1st test: week from April 1 to 5.
• Access to the 2nd test: minimum of 80% attendance to the theoretical lectures and laboratory lectures effectively lectured until the date of the 2nd test, except in cases provided for by the law and a classification in the 1st test of not less than 8 values (scale 0 to 20 points). Obligation of prior registration until the previous week scheduled for the date of the test.
Approval in distributed evaluation exempts the student from the final exam. To obtain approval in the distributed evaluation, the arithmetic mean of the two tests must be equal to or greater than 9.5 points (scale from 0 to 20 points) and in none of them, the grade may be less than 8 (scale from 0 to 20 points). Expected date for the 2nd test: last week of classes.
Final exam made at the scheduled dates. To obtain approval to the course unit the student must to obtain a classification of 9.5 points or higher (from 0 to 20 points) and a minimum classification of 25% in each of the components (theoretical and practical) assessed in the final exam.
The use of bibliographic elements and electronic equipment's are not allowed during the tests/exams.

Conditions for Results Improvement
Those provided for by the law.

Date	**Signature from the lecturer responsible for the course**
10/01/2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher 

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Academic Year 2018/2019

Program Contents

Course Unit MACHINING PROCESSES

Specialization (s)

Subject type Engineenring Sciences **Research Area** Mechanical Engineering

Year 2 **Semester** 2 **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	1	14
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	3	43
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	57
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Fernando António Gaspar Simões	PhD	Coordinator Prof.
Theoretical-Practical Lectures	Fernando António Gaspar Simões	PhD	Coordinator Prof.
Practical-Laboratoty Lectures	Pedro Miguel Soares Ferreira	PhD	Adjunt Prof.
	Celestino Tavares da Veiga	Master	Assistant Prof.
	José Pedro Pimentel de Almeida	Master	Assistant Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Fernando António Gaspar Simões

Goals
The Machining Processes unit intends to transmit the theoretical and practical knowledge of the process of obtaining parts in a gradual way, starting from an initial form, raw or semi-finished, to its final shape and dimensions, through cutting by machining. Principles of working with conventional and CNC tool machines are learned.

Skills
Know and use different machining processes involving conventional and computerized equipment's, tools, cutting parameters and CNC programming.
Know how to interpret technical drawings and diagrams
Know the properties and application fields of a wide range of engineering materials.

Program Contents

Fundaments of operations to obtain parts by chip removal: Sawing, threading, gridding, boring, drilling, turning, milling.
Machining movements and cutting parameters;
Specific pressure of cutting, machining power and rate of removal of material;

Geometry of cutting tools;

Chip formation mechanism, chip types and shapes;
Friction and heat generated during cutting;Lubrication and cooling during cutting;
Materials used in the production of cutting tools;
Tools for accuracy measure.
Operations on conventional machine tools
Numerical control of machine tools: CNC Main codes; programming procedures;
Use and training of main operations of Machining Centre and execution of CNC programs developed.

Bibliography

- *J. Paulo Davim - Princípios da Maquinagem, Almedina, Coimbra, 1995. ISBN: 972-40-0878-9*
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- John R. Walker - Machining Fundamentals, The Goodheart – Willcox Company, Illiinois, USA, 1998. ISBN: 1566374030
- Álisson Rocha Machado e outros - Teoria da Usinagem dos Materiais, Editora Blucher, 2009. ISBN: 9788521204527
- A. Completo e outros - Tecnologias de Fabrico, Publindústria, 2009. ISBN: 9789728953317
- A. L. Casillas, Máquinas: formulário técnico, Editor Mestre Jou – 1987
- Paulo amaro e Fernando Simões - Controlador Fanuc Series O-M, Manual do utilizador, ISEC 2009.

Access Conditions and Attendance Excuse

Conditions for Exam Admission

Evaluation Method

The evaluation of laboratorial component is done during the semester, in two different written tests. One of the tests is related with the procedures in CNC milling machine and the CNC programming (has a value of 1/3 of final mark).
The other test is related with conventional machining (has a value of 1/3 of final mark). The final exam is related with theoretical issues (has a value of 1/3 of final mark). If the student has not the minimum assiduity defined to the laboratorial classes, the theoretical and laboratory issues are mandatory evaluated in final exam.

Conditions for Results Improvement

Date

21/01/2019

Signature from the lecturer responsible for the course

Program Contents

Course Unit MECHANICAL TECHNOLOGY II

Specialization (s)

Subject type Engineering Sciences **Research Area** Mechanical Engineering

Year 2.º **Semester** 2.º **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	1	14
Theoretical-Practical Lectures		
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	85
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Pedro Miguel Soares Ferreira	PhD	Adjunct Professor
Theoretical-Practical Lectures			
Practical-Laboratoty Lectures	Marco Alexandre Sacramento Tomé	MSc	Invited Assist.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Pedro Miguel Soares Ferreira

Goals

To transmit the necessary knowledge about the physical principles, operational characteristics and practical applications of each of the welding processes studied.
To understand the mechanisms involved in the processes of welding and thermal cutting, to know how these processes should be selected, controlled and applied to each concrete case. They should also be able to diagnose faults involving both the welding processes and the thermal cutting processes and be able to define all the procedures in order to guarantee the necessary safety conditions for the handling of this technology.

Skills

This discipline gives the student skills in the selection of welding processes in view of the basic materials to be welded. They should know the welding and thermal cutting equipment and be able to identify the various welding defects and suggest techniques for their elimination.

Program Contents

Chapter 1 - Introduction to Welding Technology
- Historical evolution of welding processes
- Fusion Welding
- Solid state welding
- Thermal cutting

Chapter 2 - Welding Terminology and Symbology
- Terminology used in welding
- Symbols used in welding and technical drawings for welding

Chapter 3 - Welding Machines

Power sources, transformers, rectifiers and inverters
Characteristics of the welding machine and its manipulation
Welding Factor

Chapter 4 - Electrical Arc Physics

Principles of electric arc
Electrical characteristics and characteristics of electric arc zones
Types of current, polarity, temperature and radiation

Chapter 5- Welding by Shielded Metal Arc Welding (consumable electrode covered in flux)

Fundamentals of the process
Consumable electrode: covered functions, classification of covered electrodes, characteristics of electrode fusion and use of electrodes
Welding Parameters
Operative technique

Chapter 6- TIG Welding Process (Gas Tungsten Arc Welding)

Principle of the process
Consumables and equipment
Welding Parameters
Operative technique

Chapter 7 - MIG / MAG Welding Process (Gas metal arc welding)

Fundamentals of the process: Transfer modes, physical transfer of metal
Consumables and equipment
Welding Parameters
Operative technique

Chapter 8 - Welding Defects and Inspection Tests

Different types of weld defects
Destructive and non-destructive control methods

Chapter 9 - Preparing of joints

Terminology, types of joints and factors to take into account when choosing a joint. Technological processes for chamfering

Chapter 10 - Other Welding Processes

Welding by electroescory; Plasma welding; Submerged arc welding; Resistance welding; Oxygen and oxyfuel welding; Friction welding; Explosion welding; Ultrasonic welding; Electron beam welding and Laser welding

Bibliography

- KOCH, H. - Manual de la tecnologia de la soldadura eléctrica por arco, Reverté, Barcelona, 1965;
- SÉFÉRIAN, D. - Las soldaduras, Urmo, Bilbao, 1977. ISBN: 84-314-0065-X;
- RICHARD, K.G. - Joint preparations for fusion welding of steel, The welding Institute, Cambridge, 1976;
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- SANTOS, J.F. Oliveira, QUINTINO, L. - Processos de soldadura, Vol. I e II, Instituto de Soldadura e Qualidade Lisboa, 1993. ISBN: 972-9228-17-5 (Vol. I) e ISBN: 972-9228-24-8 (Vol. II);
- SILVA, F.J. Gomes - Tecnologia da Soldadura - Uma abordagem técnico-didática - 2ª edição, PUBLINDUSTRIA. ISBN: 978-989-723-17-04

Access Conditions and Attendance Excuse

Not applicable

Conditions for Exam Admission

Not applicable

Evaluation Method

The evaluation of knowledge comprises a final examination of all theoretical and practical contents. The final mark is classified by assigning a grade in the scale of 0 to 20 values and is calculated by the following weighting: the theoretical content is 50% (10 values) of the final mark and the practical content is 50% (10 values) of the final mark. The course approval requires a final classification of 10 values and is conditional on obtaining of a minimum of 7 values (in 20 values) in both content (theoretical and practical).

Conditions for Results Improvement

According to the laws and regulations of the school.

Date	Signature from the lecturer responsible for the course
16/01/2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: _____

Licenciatura em Engenharia Mecânica

BSc in Mechanical Engineering

Academic Year: **2018/2019**

Program Contents

Course Unit HEAT TRANSFER

Specialization (s)

Subject type Engineering Sciences **Research Area** Mechanical Engineering

Year 2 **Semester** 2 **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		
Total of Working Hours		130

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Gilberto Cordeiro Vaz	PhD	Coordinator Prof.
Theoretical-Practical Lectures	Maria Luísa Ingrês Pais Vaz	MSc	Adjunct Prof.
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Gilberto Cordeiro Vaz

Goals

The aim of this course is to convey to students the concepts of heat transfer relevant to the Mechanical Engineering Degree, so that they can acquire the required skills.

Skills

At the end of this course students should be able to:
- Understand the various mechanisms of heat transfer;
- Identify, formulate and solve engineering problems involving heat transfer;
- Participate in the design of equipment and thermal systems.

Program Contents

1. Introduction
   Heat transfer modes. Rate equations. Principle of conservation of energy. Methodology of analysis of heat transfer problems. Relevance of heat transfer.
2. Introduction to Heat Conduction
   The conduction rate equation. Thermal properties of matter. Heat diffusion equation. Boundary and initial conditions.
3. One-Dimensional Steady State Conduction
   Plane wall: temperature distribution, thermal resistances, composite wall, contact resistance. Analogy between the diffusion of heat and electrical charge. Cylindrical systems.

4. One-Dimensional Transient Conduction
   Biot Number. Lumped capacitance method. Heisler and Gröber charts.
5. Thermal Convection
   Physical mechanisms of convection. Boundary layers. Convection heat transfer coefficient-empirical correlations.
6. Heat Exchangers
   Types and modes of operation. Analysis and selection of heat exchangers.
7. Thermal Radiation
   Fundamental concepts. Planck distribution. Stefan-Boltzmann and Wien laws. Surface emission, absorption, reflection and transmission. Kirchhoff's law. Gray surfaces. Radiation exchange between surfaces: View factor. View factor relations.

Bibliography

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- INCROPERA, F.P.; DEWITT, D.P. - *Fundamentals of Heat and Mass Transfer* – John Wiley & Sons, 5th Ed., 2001. ISBN: 0471386502.
- FIGUEIREDO, RUI - Transmissão de Calor - Fundamentos e Aplicações. Lidel. ISBN: 978-972-757-983-9.
- ÇENGEL, Y.A. - *Heat Transfer: A Practical Approach*, WCB McGraw-Hill, 1998. ISBN: 0-07-115223-7.
- VAZ, G.C. – *Transmissão de Calor* – Apontamentos, 2019.
- PAIS, M.L.I. – *Transmissão de Calor* – Apontamentos, 2019.

Access Conditions and Attendance Excuse

Conditions for Exam Admission

Evaluation Method

The assessment of this curricular unit is carried out through two written tests or a final exam. The first test is at the middle of the semester and the second test will be held on the date of the normal exam, and students may choose to take the second test or the final exam in the normal period. Admission to the second test is conditional upon obtaining the minimum score of 7/20 values in the first test.

Both types of written tests (tests and final exams) include a theoretical component and a theoretical-practical component. The weight of each component is 50%. In each of the components of written tests, 30% of the value of the component is required as a minimum classification.

Conditions for Results Improvement

Date

21.01.2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:_ __

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC *Mechanical Engineering*

Academic Year: **2018/2019**

Program Contents

Course Unit STRENGHT OF MATERIALS II

Specialization (s)

~~**Engineering Sciences**~~ **Research Area**

Year 2 **Semester** 2 **ECTS**

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	1	14
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	85
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Urbano Manuel de Oliveira Ramos	PhD	Ass. Professor
Theoretical-Practical Lectures	Urbano Manuel de Oliveira Ramos	PhD	Ass. Professor
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Urbano Manuel de Oliveira Ramos

Goals

The aim of this course is to provide students with simple and practical methods for calculating the most common typical elements in structures, using a number of approximate calculation procedures.

Skills

Allow students to fully understand the various types of deformed, all types of composite bending. Analysis of 3D structures.

Program Contents

1.Tension due to bending
Normal stresses. Tensions of cut. Case studies of rectangular section, circular section, and fine web profiles. Combined

voltages. Criteria of plasticity and rupture. Criteria of maximum normal tension, maximum shear stress, maximum distortion energy and Mohr. Voltages allowable to static loads by the Steel Structures Regulation. Reference to bending of asymmetrical thin wall profiles - torsion center.
2. Bending deformation
Elastic line. Differential equation of the elastic line. Determination of the elastic line. Calculation of deformations by the method of the areas and the method of the conjugated beam. Calculation of deformations by tables.
3. Oblique bending
Tensions. Neutral line
4. Composite flexion with traction
Tensions. Neutral line.
5.Flexion combined with twist
Case studies of rectangular section bar and circular section bar.
6.Axial compression
Stability. Sizing. Reference to composite bending with compression

Bibliography

Resistência dos Materiais – v. Féodosiev, (Edições Lopes da Silva)

Mecânica dos Sólidos – Timosenko/Gere (Livros Técnicos e Científicos Editora)

Resistência dos Materiais –Ferdinand P.Beer; E.Russel Johnston,jr (McGraw-Hilll)

Problemas de Resistência de Materiais –I. Miroliúbov (Editorial MIR Moscú)

Access Conditions and Attendance Excuse

No special conditions of access to exam

Conditions for Exam Admission

No special conditions of access to exam

Evaluation Method
Final exam, covering the subject taught in theoretical and theoretical-practical classes;

Conditions for Results Improvement

Improvement of grade requires the provision of proof of resource examination

Date

18/01/2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Academic Year: **2018/2019**

Licenciatura em Engenharia Mecânica

BsC in Mechanical Engineering

Program Contents

Course Unit ELECTROTECNICS

Specialization (s)

Subject type Engineering Sciences **Research Area** Mechanical Engineering

Year 2nd **Semester** 1st **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Miguel Maia Carrapichano	PhD	Coord. Prof.
Theoretical-Practical Lectures	João Miguel Maia Carrapichano	PhD	Coord. Prof.
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) João Miguel Maia Carrapichano

Goals

To understand electric circuits analysis basic concepts. To determine electric parameters in direct current, in single- and in three-phase alternative current circuits. To choose equipment according to their electric characteristics. To know and use electric parameters measure instruments.

Skills

To be able to understand and operate circuits and electrical systems and made measurements of electrical quantities.

Program Contents

Introduction and definitions.
Direct current. Association of sources and receivers. Main analysis circuits laws and theorems. Series, parallel and both configuration circuits.
Alternative current. Alternating current effects. Sinusoidal single-phase alternative current. Mean and root mean square electric values. Mathematical and vetorial representation. Circuits R, L, C; RL, RC, RLC. Series and parallel resonance. Impedance and association of impedances. True, reactive and total electric power. Power factor compensation.
Three-phase systems. Simple and composed voltages. Wye and delta connections. Wye-delta equivalence. Three-phase

Powers. Power factor compensation.
Electric motors. Motors classification. Main characteristics and field of application of the several types of motors. Outburst types. Direct and pull wye-delta outburst.
Bases of Project of electrical distribution systems. Electric cables. Command, regulative and protective devices.

Bibliography

Class presentations and other documents supplied by the teacher.
Rizzoni, G, Principles and Applications of Electrical Engineering, McGraw-Hill, 2000, ISBN 0-07-118452-X
Dorf, RC, The Electrical Engineering Handbook, CRC Press LLC, 2000
Bessonov, Electricidade Aplicada para Engenheiros, Lopes da Silva, Porto, 1977
Gussow, M, Electricidade Básica, Schaum McGraw-Hil, 1985, ISBN 0-07-450182-8
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Access Conditions and Attendance Excuse

N/A

Conditions for Exam Admission

N/A

Evaluation Method

Final written exam. Theoretical part (25%) and Theoretical-Practical part (75%).
To Erasmus student's progress assessment can be established by lectures as complementary meetings in English language, to develop parallel written project work in a predefined subject, with individual final presentation and discussion.

Conditions for Results Improvement

N/A

Date	**Signature from the lecturer responsible for the course**
25/09/2018	

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Program Contents

Course Unit MECHANICAL TECHNOLOGY I

Specialization (s)

Subject type Specialty **Research Area** Mechanical Engineering

Year 2st **Semester** 1st **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	1	14
Tutorial Orientation		
Project		
Total of Working Hours		130

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Miguel Maia Carrapichano	PhD	Coord. Prof.
Theoretical-Practical Lectures	João Miguel Maia Carrapichano	PhD	Coord. Prof.
Practical-Laboratoty Lectures	João Miguel Maia Carrapichano	PhD	Coord. Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) João Miguel Maia Carrapichano

Goals

The main aims of this course unit is to provide the students with necessary knowledge about principles of physics, operational features and practical applications for each of the forming processes, as casting and working processes, learnt, and how these processes should be selected, controlled and applied to each concrete case, to manipulate materials for the mechanical construction of components, equipment and systems.
Another objective is solve theoretical-practical problems in the technological processes presented, resolution to be done mainly in theoretical-practical classes, that may, when necessary, be preceded by corresponding theoretical exposition.

Skills

At the end of this course unit the learner is expected to be able:
to know de proprieties and applications ways of engineering materials;
to understand the mechanisms that are part of the forming mechanical technology processes, know how these processes should be selected, controlled and applied in each specific situation.

Program Contents

Materials and processing. Classes of materials. Metallic materials: properties and plastic deformation mechanisms.
Technological processes of forming and manufacturing (general designations and characteristics).
Conformation by plastic deformation processes: rolling mill, extrusion, drawing and deep drawing processes.

Casting systems.
Generalities, principles and definitions on those forming mechanical technology processes, and respectively classifications.
Calculations and projects on forming mechanical technology processes and equipments.
Manufacturing and resultant products. Laboratory tests (as field tests) on the processes learnt.

Bibliography

KALPAKJIAN, Serope; SCHMID, Steven – Manufacturing Engineering Technology, 6th Edition
CHIAVERINI, Vicente – Tecnologia Mecânica (Vol II, ISBN: 9780074500903, Makron Books, 1986)
SCHEY, John A. – Introduction to Manufacturing Processes, 3th Edition
LASCOE, O.D. – Handbook of Fabrication Processes, ASM International Metals Park, Ohio
RODRIGUES, Jorge – Tecnologia Mecânica: Tecnologia da Deformação Plástica, Vol. I (Fundamentos Teóricos) e Vol. II (Aplicações Industriais), 2ª Edição, Escolar Editora, 2010
CAPPELO, Eduardo – Tecnologia de la Fundicion, Gustavo Gili Editorial S.A.
Supporting texts (by course unit teachers).

Access Conditions and Attendance Excuse

According to general rules used in the school.

Conditions for Exam Admission

According to general rules used in the school.

Evaluation Method

Final written exam grade (0-20) according to official school calendar. *To Erasmus student's progress assessment can be established by lectures as complementary meetings in English language, to develop parallel written project work in a predefined subject, with individual final presentation and discussion*.

Conditions for Results Improvement

Improving grades or retaking exams is allowed, according to general rules of the course and used in the school.

Date	**Signature from the lecturer responsible for the course**
17.09.2018	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: 

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: 2018 / 2019

Program Contents

Course Unit FLUID MECHANICS

Specialization (s) Not applicable

Subject type Specialty Sciences **Research Area** MECHANICAL ENGINEERING

Year **Semester** **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	
Theoretical-Practical Lectures	1	
Practical-Laboratoty Lectures	1	
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coordenador
Theoretical-Practical Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coordenador
Practical-Laboratory Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coordenador
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) João Carlos Antunes Ferreira Mendes

Goals

Provide the theoretical foundations necessary to study the behavior of resting and moving fluids. As an introductory discipline in the field of Fluid Mechanics will be privileged physical concepts rather than a more fundamental approach.

Skills

It is intended that the specific competence be acquired: to know, to understand and to know how to apply the laws of mechanics to incompressible fluids. The curricular unit also integrates very significant contributions in the acquisition of other competences, namely: knowing and knowing how to use instrumentation of measurement and control; be able to size, install, operate and maintain fluid networks, air conditioning and refrigeration systems; know how to design hydraulic and pneumatic systems; understand the operation and be able to install, operate and maintain thermal machines in general.

Program Contents

Introduction: Fluid characteristics. Molecular structure. Continuous media. Fluid properties: specific mass, relative density, density and specific volume. Pressure. Superficial tension. Steam pressure. Compressibility. Viscosity. Viscosity quantification. Equation of dimensions and units of

viscosity. Kinematic viscosity and its units. Variation of viscosity with pressure and temperature. Fluidity. Non-Newtonian fluids. Ideal fluid.
Fluid Statics: Introduction. Variation of pressure within a fluid. Pressure measurement: barometers; column manometers; metal or Bourdon gauge; Other gauges. Hydrostatic action on submerged surfaces: Resulting from actions on a flat surface; Center of pressures of flat surface. Resultant of actions on curved surfaces; Vertical component of the resultant; Horizontal component of the resultant; Floating force.
Principles of Fluid Movement: Introduction. Variation of the parameters in space and time. One-dimensional, two-dimensional and three-dimensional flow. Acceleration of a particle. Equation of continuity. Bernoulli equation. General equation of permanent flows. Practical form of the energy equation. Transformation of energy into a constant specific mass fluid. Applications of the Bernoulli equation: Flow through bevelled holes, submerged hole, values of hole coefficients.
The Two Types of Flow: Introduction. The demonstration by Reynolds of two types of flow. Flow criteria. Laminar flow and turbulent in tubes. Aspects of turbulence. Boundary layer. Laminar sublayer. Distribution of tangential stresses in a circular tube.
Laminar Flow: Introduction. Laminar flow in circular tubes. Law of Hagen-Poiseuille.
Turbulent Flow in Pipes: Introduction. Loss of charge in a tube. Study of the coefficient of friction. Friction in circular and non-circular ducts. Diagram of Moody. Other load losses in tubes. Loss of load on a sudden increase of section. Loss of load on a pipe outlet. Loss of load in a sudden contraction. Loss of load at the entrance. Diffusers. Losses in curves. Loss on accessories. Piezometric and full height line. Association of tubes in series. Association of tubes in parallel. Flow at the inlet of the tube. Input length.
Measuring Devices: Pitot tube. Determination of velocity of compressible fluids. Venturi. nozzle and orifice meter. Other measuring devices. Transducers. Flow measurement of liquids.

Bibliography

L. A. Oliveira e A. G. Lopes, Mecânica dos Fluidos, Lidel, 2016.
Mendes, João Carlos A. Ferreira, Apontamentos Teóricos de Mecânica dos Fluidos, I.S.E.C., Coimbra, 2005.
Mendes, João Carlos A. Ferreira, Problemas de Mecânica dos Fluidos, I.S.E.C., Coimbra, 2006.
White, F. M., Fluid Mechanics, International Student Edition, McGraw Hill, 2011.
Massey, B. S., Mecânica dos Fluidos, Fundação Calouste Gulbenkian, Lisboa, 2002.
L. A. Oliveira e A. G. Lopes, Mecânica dos Fluidos – Fundamentos de Física e Matemática, Lidel, 2016.

Access Conditions and Attendance Excuse

Final Exam and Resource Exam for all enrolled students.

Conditions for Exam Admission

Not applicable.

Evaluation Method

Each exam exam is divided into three components, theoretical, theoretical-practical and practical, with the quotation of nine, eight and three values, respectively.
Students attending practical classes may be exempted from the practical component of the exam by performing a mini-test.
The minitest P consists of the written answer to a question, focusing on the subject addressed in the practical classes and will be held in the last week of classes. The practical mini-test will have a maximum duration of 30 minutes and the result of this evaluation will have a maximum weight of 3 values, for a total of 20 values.
Examinations outside the assessment periods provided for in the school calendar may take the form of oral tests.

Conditions for Results Improvement

Those provided in the legislation.

Date

12/09/2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature:

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Academic Year 2018/2019

Program Contents

Course Unit ENGINEERING MATERIALS

Specialization (s)

Subject type Engineenring Sciences **Research Area** Mechanical Engineering

Year 2 **Semester** 1 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	56
Works / Group Works	28
Project	
Evaluation	2
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Fernando António Gaspar Simões	PhD	Coordinator Prof.
Theoretical-Practical Lectures	Fernando António Gaspar Simões	PhD	Coordinator Prof.
Practical-Laboratoty Lectures	Celestino Tavares da Veiga	Master	Assistant Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Fernando António Gaspar Simões

Goals

The main objectives of the course unit are: To enhance knowledge about the composition, structure, properties, applications and processing of different engineering materials; To provide hands-on experience in the use of metallographic techniques and interpretation of microstructures, as well as in the conduction of common heat treatments.

Skills

The completion of this unit will enable to achieve, or contribute to achieving, the following competences: Capacity to describe and understand the structure, specific properties, potential applications and processing methods of a wide range of engineering materials; Ability to perform different heat treatments and understand their effects;
Ability to use experimental techniques for the characterisation of materials; Capacity to report, analyse and discuss experimental results; Capacity to search, select, organise and communicate information; Ability to work in small groups.

Program Contents

Production of iron and steel.
Iron-carbon phase diagram; equilibrium microstructures of iron-carbon alloys.
Classification of steels.
Non-alloy steels: mechanisms of austenite transformation; mechanical properties of steel constituents; relations between steel microstructure and mechanical properties.
Alloy steels: distribution of alloying elements in steels; effects of alloying elements on the iron-carbon phase diagram; influence of alloying elements on steel microstructure.
Heat treatment of steels: austenite transformation diagrams and influence of alloying elements; annealing; normalising; quench hardening; tempering; surface hardening treatments.
Cast irons: white cast irons; grey cast irons; nodular cast irons; malleable cast irons.
Non-ferrous metals and alloys.
Introduction to metallography.
Polymeric materials: structure, properties, applications and processing.

Bibliography

• SMITH, William F. - Princípios de Ciência e Engenharia dos Materiais, McGraw-Hill de Portugal, 1998. ISBN: 972-8298-68-4
• SILVA, LUCAS F. – Materiais de Construção, Publindústria, 2013. ISBN: 978-989-723-049-3
• BARRALIS, J.; MAEDER, G. - Prontuário de Metalurgia, Fundação Calouste Gulbenkian, Lisboa, 2005. ISBN: 972-31-1106-3
• SEABRA, Antera Valeriana de - Metalurgia Geral, Vol. II e Vol. III, Laboratório Nacional de Engenharia Civil, Lisboa, 1995
• SOARES, Joaquim Pinto - Aços: Características, Tratamentos, 6.ª Edição, Publindústria, Porto, 2010. ISBN: 978-989-20-1797-6
• DORLOT, J.M.; BAÏLOU, J.P.; MASOUNAVE, J. - Des Matériaux, Éditions de L'École Polytechnique de Montréal, 1986. ISBN: 2-553-0176-2
• POUZADA, A.S. e BERNARDO, C.A. - Introdução à Engenharia de Polímeros, Universidade do Minho, 1983

Access Conditions and Attendance Excuse

Conditions for Exam Admission

Evaluation Method

Assessment is made through final exam (70%), report of the laboratory work (15%) and oral presentation of a bibliographic research work (15%).

Conditions for Results Improvement

Date

14/09/2018

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: _____

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: **2018_/2019_**

Program Contents

Course Unit STATISTICAL METHODS

Specialization (s) MATHEMATICS

Subject type Mathematics **Research Area** Mathematics

Year 2nd **Semester** 1st **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	14
Practical-Laboratory Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	58
Works / Group Works	
Project	
Evaluation	4
Additional	

Total of Working Hours 104

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Deolinda Maria Lopes Dias Rasteiro	PhD	Professor
Theoretical-Practical Lectures	Deolinda Maria Lopes Dias Rasteiro	PhD	Professor
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Deolinda Maria Lopes Dias Rasteiro

Goals

Development of critical spirit, coordination capacity, reflection attitudes and research, seeking the acquisition of indispensable basic knowledge for the group of disciplines of the course of Mechanical Engineering, namely probability and statistic applications.

Skills and Competencies

Capacity of use of mathematical techniques. To acquire knowledge of probability and statistics and their indispensable applications for the attendance of the course units of Mechanical Engineering. To develop the capacity of concepts' perception, abstract reasoning, results interpretation and its application to problems resolution. Therefore students must learn how:

- Think Mathematically
- Mathematically reasoning
- Identify and solve problems
- Mathematically model
- Represent mathematical entities
- Manipulate mathematical symbols and use formal language
- Mathematically communicate
- Use mathematical resources and tools

Lecturer's signature: D. Rasteiro

Program Contents

Probability theory.
One-dimension discrete random variables.
Two-dimension discrete random variables.
One-dimension continuous random variables.
Sample and estimation theory.
Hypothesis tests.

Bibliography

1. Teacher lecture notes.
2. Pedrosa, António C. and Gama, Sílvio M. A. (2004), Introdução Computacional à Probabilidade e Estatística, Porto Editora.
3. Ross, Sheldon M. (2004), Introduction to Probability and Statistic for Engineers and Scientists, 3rd Edition, Elsevier/Academic Press, Burlington, MA.
4. Montgomery, Douglas C. and Runger, George C. (2003), Applied Statistics and Probability for Engineers, 3rd Edition, John Wiley & Sons, New York.

Access Conditions and Attendance Excuse

To be a course student.

Conditions for Exam Admission

To be a course student.

Evaluation Method

Two written assessements during the semester and/or final written exam.
Only those students who obtain at least 6 values (without rounding) in the 1st assessment are admitted to the 2nd one.
DATES:
- 1st assessment: November 14, 2018 at 6:30 p.m.
- 2nd assessment: December 21, 2018 at 2:30 p.m.

The ratings of each frequency are not rounded. The student who obtains in the arithmetic mean of the two assessments a rounded classification higher or equal to 10 values is considered approved.
The student who does not obtain approval by assessment or does not undergo this type of evaluation can undergo examination at the times defined in the ISEC school calendar.

Conditions for Results Improvement

Be enrolled in the exam whenever improvement results are permitted.

Date	Signature from the lecturer responsible for the course
17.09.2018	Delinda Maria Lopes Dias Rasteiro

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:__ _____

Licenciatura – BsC Engenharia Mecânica Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: **2018/2019**

Program Contents

Course Unit ENGLISH

Specialization (s) - COMMON CORE

Subject type Languages **Research Area** Mechanical Engineering / Humanities

Year 1º **Semester** 2º **ECTS** 3

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		
Total of Working Hours		78

Unaccompanied Working Hours

Activity Type	Total Hours
Study	46
Works / Group Works	1
Project	
Evaluation	3
Additional	

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	Deolinda Simões	PhD	Prof. Adjunto
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Deolinda Simões

Goals

The main objective of this subject is to focus on the English language in mechanical academic engineering contexts and further develop students' communicative language skills through topics related to this engineering field.

Skills

Understand clearly engineering academic language in mechanical engineering and language patterns in this area;
Be able to present and communicate a topic related to the field of study at a high B1 level.

Signature of Teacher:__ _____

Program Contents

1. **Language**

   Grammar revisions such as the tense system, spelling rules, question form, among other language features according to students' needs and difficulties.

2. **Technical Language**

   Sub-technical terms and common non-technical lexis, syntax, linking expressions and words, word formation (suffixes and prefixes), grammar links, phrasal verbs, expressions to describe reason and contrast and verb-noun-adjective changes.

3. **Technical Vocabulary**

   Specific technical lexis related to mechanical engineering including materials engineering, mechanisms, gears, air-conditioning and refrigeration, forces in engineering, internal combustion engine and computer science.

4. **Reading Comprehension**

   Scientific literature, graphs and tables and understanding unknown vocabulary.

5. **Listening Comprehension**

   Lectures and Interviews

6. **Writing Skill**

   Genres including description and explanation of cycles and processes, letter of presentation and translation Portuguese to English (simple sentence).

7. **Oral Skill**

   Pronunciation practice through oral drills, introducing and presenting oneself, an oral presentation about a technical topic and general class discussions.

Bibliography

The lecture notes used during lessons can be purchased at the Institute's photocopy centre.

Çengel, Yunus A. and Michael A. Boles Michael. *Thermodynamics - An Engineering Approach*. New York: McGraw-Hill, 2002.

Glendinning, Eric H. and Norman Glendinning. *Oxford English for Electrical and Mechanical Engineering.* Oxford UP, 1997.

Hall, Eugene J. *The Language of Mechanical Engineering in English*, New Jersey: Prentice-Hall, 1977.

Ibbotson, Mark. *Cambridge English for Engineering*. Cambridge UP, 2008.

McGraw-Hill. *Dictionary of Engineering*, USA: McGraw-Hill, 2003.

Myszka, David H. "Introductions to Mechanisms and Kinematics." *Machines and Mechanisms*. India: Prentice Hall, 2005.

Smith, William F. *Foundations of Materials Science and Engineering*. Singapore: McGraw-Hill, 1993.

Smith, William F. *Princípios de Ciência e Engenharia dos Materiais*. Portugal: McGraw-Hill, 1998.

Strasman, Peter G. *Rover 213 & 216 Owners Workshop Manual*. Haynes Publishing Group: Somerset, England, 1988.

Access Conditions and Attendance Excuse

Only students covered by Law in effect can be excused from attending lessons. These include firefighters in Portugal or those with working status, among others defined in the Law.

Conditions for Exam Admission

Those defined in legislation and regulations in effect.

Evaluation Method

Continuous evaluation which includes two tests worth 70%, mandatory attendance and participation worth 15% and an oral presentation worth 15% of the total mark.

There are two exam periods at the end of the semester and these are the normal exam period and the retake exam period. Students who are unable to get a passing mark through continuous evaluation can take a final exam in these periods. This final exam covers all of the material of the subject. This exam includes a written part, worth 80%, and an oral part, worth 20%. The oral part, which is an oral presentation, is mandatory.

Signature of Teacher:__ _____

Conditions for Results Improvement

Those defined in legislation and regulations in effect.

Date	Signature from the lecturer responsible for the course
January 10, 2019	

Ficha de Unidade Curricular

Unidade Curricular INGLÊS

Ramo(s) Formação Comum **Área Científica** Engenharia Mecânica / Humanidades

Natureza Curricular Disciplina Complementar / Línguas

Ano 1º **Semestre** 2º **ECTS** 3

Horas de Contacto

Tipo de Actividade	Horas Semanais	Total de Horas
Teórico		
Teórico-Prático	2	28
Prático / Laboratorial		
Orientação Tutória		
Projecto		

Horas de Trabalho não Acompanhado

Tipo de Actividade	Total de Horas
Estudo	46
Trabalhos / Trabalhos de Grupo	1
Projecto	
Avaliação	3
Outra	

Total de Horas de Trabalho 78

Docentes

Tipo de Actividade	Nome	Habilitações	Categoria
Teórico			
Teórico-Prático	Deolinda Simões	Doutoramento	Professora Adjunto
Prático e Laboratorial			
Orientação Tutória			
Projecto			

Docente Responsável Deolinda Simões

Objectivos

O objectivo desta unidade curricular é, partindo dos conhecimentos adquiridos de inglês dos alunos no meio académico e profissional, apresentar o inglês técnico-científico da área científica de Engenharia Mecânica a fim de criar uma forte base de suporte da compreensão textual e auditiva da língua em contextos académicos, bem como aperfeiçoar a expressão oral e escrita dos alunos nos contextos específicos.

Competências

É de esperar que, no final desta disciplina semestral, os estudantes sejam capazes de compreender e aplicar o conteúdo programático proposto, com mais confiança e fluência, nomeadamente apresentar oralmente um trabalho de carácter técnico, descrever uma operação / ciclo e reconhecer os padrões linguísticos característicos na linguagem técnico-científica da área de engenharia mecânica.

Conteúdos Programáticos

1. **Língua**
   Revisão da gramática e aspetos linguísticos que ofereçam dificuldades aos alunos (*The tense system*, regras ortográficas, formação da interrogativa, entre outros) em contextos da área científica de Engenharia Mecânica. Esclarecimentos pontuais de pontos gramaticais emergentes no decorrer das aulas.
2. **Linguagem técnica e académica**
   Estruturas frásicas, expressões sequenciais entre frases / ideias, prefixações e sufixações, *grammar links, phrasal verbs*, *expressions to describe*

reason and contrast , bem como as características da flexibilidade de vocabulário (verbos para substantivos, adjectivos, etc.) .

3. **Vocabulário técnico**

Temas técnicos que abrangem áreas específicas como materiais de engenharia, mecanismos, rodas dentadas, climatização, forças de engenharia, refrigeração, motor de combustão interna, estática e dinâmica, mecânica de fluidos, hidráulica, corrosão e informática.

4. **Compreensão textual**

Artigos científicos, gráficos e tabelas, descodificação de palavras não conhecidas.

5. **Compreensão auditiva**

Palestras e entrevistas.

6. **Trabalhos escritos**

Composições que incluem expressão de opiniões e resumos, cartas formais como a carta de candidatura, traduções, elaboração do CV (opcional) e descrição e explicação de funcionamento de uma operação / ciclo de um sistema.

7. **Aperfeiçoamento da expressão oral**

Uma breve apresentação dos dados pessoais, uma apresentação oral de carácter técnico, uma entrevista a um convidado, exprimir e defender opiniões, discussões e conversações pontuais.

Bibliografia

Os materiais didácticos estão disponíveis na Secção de Textos de ISEC.

Cengel, Yunus A. and Michael A. Boles Michael. *Thermodynamics - An Engineering Approach*. New York: McGraw-Hill, 2002.

Glendinning, Eric H. and Norman Glendinning. *Oxford English for Electrical and Mechanical Engineering.* Oxford UP, 1997.

Hall, Eugene J. *The Language of Mechanical Engineering in English*, New Jersey: Prentice-Hall, 1977.

Ibbotson, Mark. *Cambridge English for Engineering*. Cambridge UP, 2008.

McGraw-Hill. *Dictionary of Engineering*, USA: McGraw-Hill, 2003.

Myszka, David H. "Introductions to Mechanisms and Kinematics." *Machines and Mechanisms*. India: Prentice Hall, 2005.

Smith, William F. *Foundations of Materials Science and Engineering*. Singapore: McGraw-Hill, 1993.

Smith, William F. *Princípios de Ciência e Engenharia dos Materiais*. Portugal: McGraw-Hill, 1998.

Strasman, Peter G. *Rover 213 & 216 Owners Workshop Manual*. Haynes Publishing Group: Somerset, England, 1988.

Condições de Obtenção e Dispensa de Frequência

As condições de obtenção de frequência apenas se aplicam aos alunos que optarem para avaliação contínua (75% assiduidade mínima às aulas).

Condições de Acesso a Exame

Não tem.

Metodologia de Avaliação

O regime de avaliação de conhecimentos da disciplina funciona com duas modalidades, sendo estas de **avaliação contínua** ou por **exame final**.

1. A **avaliação contínua** consiste na realização de dois testes com notas mínimas de 7 valores (70%) em cada, na realização de uma apresentação oral de carácter técnico (15%) e na participação nas aulas (15%). Quem optar por esta forma de avaliação tem que cumprir um critério de assiduidade mínima de 75% das aulas efetivamente lecionadas. As provas têm de ser realizadas nos dias marcados. O 1º teste será na semana de 18 a 22 de Março. A data do 2º teste será na semana de 20 a 24 de Maio e as apresentações orais serão na semana de 27 a 31 de Maio. Todas as provas são realizadas durante a aula na respetiva semana.

2. A **avaliação por exame final** consiste na realização de uma prova escrita e de uma exposição oral com a ponderação de 80% e 20%, respetivamente. A exposição oral é obrigatória.

Condições de Melhoria de Classificação

Regras em vigor no REACTA, mantendo-se a ponderação das partes referidas no ponto 2 da Metodologia de Avaliação.

Data

10 de Janeiro de 2019

Assinatura do Docente Responsável pela Unidade Curricular

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Licenciatura – BsC em Engenharia Mecânica

BsC in Mechanical Engineering

Academic Year: 2018/2019

Program Contents

Course Unit MECHANICAL ENGINEERING DRAWING

Specialization (s)

Subject type Engineering sciences **Research Area** Mechanical Engineering

Year 1st **Semester** 2nd **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	2	30
Practical-Laboratory Lectures	3	45
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	51
Works / Group Works	
Project	
Evaluation	4
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	José Armando Cantador Marques	Master's Degree	Adjunct Professor
Practical-Laboratoty Lectures	José Armando Cantador Marques	Master's Degree	Adjunct Professor
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) José Armando Cantador Marques

Goals

Provide fundamental concepts that allow students: reading, understanding and interpretation of different types of drawings; represent, quote and refer to machine elements; read and enter tolerated dimensions in the drawings; specify the surface finish of the parts in the drawings; understand the importance of dimensional tolerance; understand the representation of normalized elements; distinguish the different forms of connection in mechanical constructions and proceed to their representation using their own symbolism; interpret and execute drawings of sets of parts and standard elements.
It is also intended to present all the functionalities of 3D parametric and mechanical design software with 2D drawings production capability.

Skills

Learn elaborate sketches, technical and assembly drawings, either using traditional means or by making use of latest tools for computer aided design.

Program Contents

1. Functional Dimensioning: Dimensions functional; dimensional tolerancing, geometric tolerancing; Dimensions with no indication of tolerances; adjustments; Enrollment quotas toleranced; Indication of surface states.

2. Design of connection elements and organs of machines: Key processes connecting parts; Rivets, Screws, Threaded Parts, nuts, screws, keyways, Bolts and sections; Welding, Bolts, Washers.
3. Drawing sets: Types of assembly drawings, construction drawings together; Parts Lists.
4. Parametric modeling: Sketches. Restrictions. Creation of three-dimensional models. Sets. Projections. Resources Design. Dimensioning. Assembly drawings. Welded Construction. Modeling sheet. Bolted connections. Gears. Animation. Presentations.

Bibliography

- COSTA, A. – Autodesk Inventor – Curso Completo, FCA – Editora de Informática, 2013
- SILVA, A.; RIBEIRO, C.;DIAS, J.; SOUSA, L. – Desenho Técnico Moderno, FCA – Editora de Informática, 2005
- SIMÕES MORAIS, J.M. – Desenho Técnico Básico, I Volume, Porto Editora, 1992
- SIMÕES MORAIS, J.M. – Desenho Técnico Básico, III Volume, Porto Editora, 2007
- VEIGA DA CUNHA, L. – Desenho Técnico, Fundação Calouste Gulbenkian, 2000
- Folhas de exercícios, ISEC
- Normas ISO

Access Conditions and Attendance Excuse

No conditions are laid down

Conditions for Exam Admission

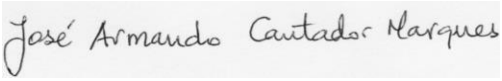
No conditions are laid down

Evaluation Method

There is continuous evaluation that consists of two tests in which students are allowed free consultation: one referring to the traditional drawing and another related to the CAD. There is the obligation to obtain a minimum score of 7.5 points in each test. The final score is a weighted average of the two tests where the part referring to the traditional has a weight of 40%.
it is expected that the test on the technical design module will be carried out on May 27th at 9:00 PM, and the test on the computer aided design module will be carried out during the last week's practical classes.
Not getting passed the tests, can hold their final exams.

Conditions for Results Improvement

The note improvement (in alternative exam) requires a global exam.

Date	**Signature from the lecturer responsible for the course**
18/01/2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature:_____

Licenciatura – BsC em Engenharia Mecânica (Português)

Licenciatura – BsC in Mechanical Enginnering (Inglês)

Academic Year: **2018 / 2019**

Program Contents

Course Unit THERMODYNAMICS

Specialization (s)

Subject type Basic Sciences **Research Area** Mechanical Engineering

Year 1º **Semester** 2º **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	97
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Carlos José de Oliveira Pereira e Jorge Alcobia	PhD	Prof. Adjunct
Theoretical-Practical Lectures	Raquel Almeida de Azevedo Faria	PhD	Prof. Adjunct
Theoretical-Practical Lectures	João Manuel Nogueira Malça de Matos Ferreira	PhD	Prof. Adjunct
Theoretical-Practical Lectures	Márcio Duarte Albino dos Santos	Master	Invited Assistant

Responsible(s) Lecturer (s) Carlos José de Oliveira Pereira e Jorge Alcobia

Goals

The main objective of this course is to give students the basic scientific training in the field of Thermal Engineering, preparing them not only to solve some problems related to thermal systems but also to easily integrate into the study of subsequent and related subjects.

Skills

The knowledge acquired in this course should contribute, in a significant way, so that the students acquire the following specific competences:
- Knowing, understanding and applying the laws of thermodynamics, including the ability to make energy balances;
- Understand the operation and be able to install, operate and maintain thermal motor and receiver machines.

Program Contents

1. Introduction
General Concepts. SI - unit system. Temperature and pressure measuring devices (absolute and relative). Thermodynamic

Signature of Teacher:_____

coordinates. Types of systems. Transformations and irreversibility. Representation of transformations.
2. Energy
Forms of energy. Transfer of energy. Work and Heat. The First Law of Thermodynamics.
3. Properties of Pure Substances
Phases of a pure substance. Phase changes. Diagrams p-T, T-h, T-v and p-v. Surface p-v-T. Use of property tables. Perfect Gases. Equations of perfect gases. Compressibility Factor. Other State Equations.
4. Energetic Analysis of Closed Systems
Balance of energy. Internal Energy, Enthalpy and Specific Heat of gases, liquids and solids.
5. Open Systems Energy Analysis
Energy of a flowing fluid. Energy balance in stationary flow systems, in uniform flow systems and in other types of open systems. Examples of the various types of open systems.
6. The Second Law of Thermodynamics
The Second Law of Thermodynamics. Principle of operation of the Thermal Machines. Yields and efficiencies. The Carnot cycle. The Carnot Principles.

Bibliography

- ÇENGEL, Yunus A.; BOLES, Michael A. – *Thermodynamics, an engineering approach*, McGraw-Hill.
- MORAN, M. J.; SHAPIRO, H. N. - *Fundamentals of Engineering Thermodynamics*, John Wiley & Sons, USA.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Exam Admission

Those provided for in the legislation and regulations in force.

Evaluation Method
1. Students will be approved in this course unit as long as they take advantage of the final exam.
2. Final examination:
2.1. Students may take the exam at the times authorized by the ISEC Presidency, on the dates determined for this purpose;
2.2. Each exam will consist of a theoretical component and a theoretical-practical component, each of the two components being the quotation of 10 values;
2.3. In the theoretical-practical component only the use of scientific calculating machine is allowed. In this component students will be able to consult the theoretical-practical formulary, as well as the tables of thermodynamic properties.
2.4. To pass the exam it is necessary that:
2.4.1. The final grade is equal to or greater than 9,5 points;
2.4.2. In none of the parts of the exam (theoretical and theoretical-practical) the classification obtained is less than 3,0 values.

Conditions for Results Improvement

Those provided for in the legislation and regulations in force.

Date	**Signature from the lecturer responsible for the course**
15-01-2019	Carlos Alcobia

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Academic Year 2018/2019

Program Contents

Course Unit FUNDAMENTALS OF MATERIALS SCIENCE

Specialization (s)

Subject type Engineenring Sciences **Research Area** Mechanical Engineering

Year 1 **Semester** 2 **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	1	14
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	72
Works / Group Works	
Project	
Evaluation	2
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Fernando António Gaspar Simões	PhD	Coordinator Prof.
Theoretical-Practical Lectures	Celestino Tavares da Veiga	Master	Assistant Prof.
Practical-Laboratoty Lectures	Celestino Tavares da Veiga	Master	Assistant Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Fernando António Gaspar Simões

Goals

This course has as main objectives to familiarize students with the different types of materials used in engineering and provide them with the acquisition of basic scientific knowledge necessary for understanding the relationship between the composition, structure and properties of materials.
Generic skills: knowledge of a diverse range of engineering materials and their classification; knowledge of the structures and characteristic properties of different classes of materials; ability to understand fundamental aspects of the relationship between the composition, structure and properties of materials.

Skills

Ability to perform tests to evaluate mechanical properties of materials, including tensile, hardness and impact, as well as to analyze and interpret the results.

Program Contents

1. Material classes and main features: Metallic; Ceramics; Polymeric Materials, Semiconductor materials, composite materials.
2. Mechanical Properties of Materials: Stress and strain, elastic and plastic deformation, tensile test, hardness testing,

fracture of materials - impact tests and fracture toughness tests. Properties of materials: physical and chemical.
3. Materials structure: Atomic structure and chemical bonding. Crystalline and amorphous solids. Crystal structure; structure of metals, ceramic and polymers.
4. Solidification and solid-state diffusion: Stages of solidification. Homogeneous and heterogeneous nucleation. Crystal growth and grain formation. Diffusion mechanisms: substitutional and interstitial diffusion.

5. Phase equilibrium diagrams: alloy, phase and microstructure definition. Solid phases types. Equilibrium diagrams of pure substances. Gibbs rule and lever rule. Equilibrium diagrams of binary systems.

Bibliography

SMITH, William F. - Princípios de Ciência e Engenharia dos Materiais, McGraw-Hill de Portugal, 1998. ISBN: 972-8298-68-4
CALLISTER, Jr.,William D. - Materials Science and Engineering: An Introduction, John Wiley & Sons, New York, 2003. ISBN: 0-471-22471-5
ASKELAND, Donald R. - The Science and Engineering of Materials, PWS Publishing, Boston, 1994. ISBN: 0-534-93423-4
DORLOT, J.M.; BAÏLOU, J.P.; MASOUNAVE, J. - Des Matériaux, Éditions de L'École Polytechnique de Montréal, 1986. ISBN: 2-553-0176-2
KURZ, W.; MERCIER, J.P.; ZAMBÉLLI, G. - Introduction à la Science des Matériaux, Presses Polytechniques et Universitaires Romandes, Lausanne, 1991. ISBN: 2-88074-216-1
BAPTISTA, João Lopes; Silva, Rui Ferreira - Diagramas de Fases, Universidade de Aveiro, 1998. ISBN: 972-8021-72-0

Access Conditions and Attendance Excuse

Conditions for Exam Admission

Evaluation Method
The assessment is made through a final exam.

Conditions for Results Improvement

Date

18/01/2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: 

Licenciatura – BSc Engenharia Mecânica

Bachelor – BSc Mechanical Engineering

Academic Year: 2018/2019

Program Contents

Course Unit MATHEMATICAL ANALYSIS II

Specialization (s) Common Formation

Subject type Basic Science **Research Area** Mathematics

Year 1st **Semester** 2nd **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratory Lectures	1	14
Tutorial Orientation	-	-
Project	-	-

Unaccompanied Working Hours

Activity Type	Total Hours
Study	83
Works / Group Works	-
Project	-
Evaluation	3
Additional	-

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Patrícia Sofia Simões Santos	PhD	Adjunct Professor
Theoretical-Practical Lectures	Patrícia Sofia Simões Santos		
Theoretical-Practical Lectures	Rui Manuel Carreira Rodrigues	PhD	Coordinator Professor
Theoretical-Practical Lectures	Cristina Maria Ribeiro Martins Pereira Caridade	PhD	Adjunct Professor
Practical-Laboratory Lectures	Rui Manuel Carreira Rodrigues		
Practical-Laboratory Lectures	Cristina Maria Ribeiro Martins Pereira Caridade		

Responsible(s) Lecturer (s) Patrícia Sofia Simões Santos

Goals

To learn and apply the basic concepts of differential and integral calculus of scalar functions of several real variables. Understand the essential concepts about numerical series and power series, and apply the results in engineering problem solving. Use graphical and algebraic calculation software (MATLAB) in the treatment of the various topics of the unit. Understand the importance of the course unit and its role as basic science and tool to support a logical and structured reasoning in the engineering areas.

Skills

- Be able to use mathematical, analytical and computational techniques in solving problems.
- Competence to understand abstract concepts, interpretation of results and their application in the resolution of engineering problems.
- Self-learning.

Program Contents

1. **Real functions of several variables and their derivatives**
   Conics and quadric surfaces. Topology concepts in IR^n. Real functions of several real variables - Domain; Graph; Contours; Limits; Continuity; Partial derivatives; Schwarz theorem; Chain rule; Directional derivative; Gradient vector and its applications. Optimization - Free and conditional extremes.

2. **Double integrals**
   Definition and geometric interpretation of double integrals. Calculus of the double integral in Cartesian and polar coordinates, and applications.

3. **Series**
   Numerical series - Sequences (revision); Definition of partial sum; Definition of numerical series; Examples (geometric series, telescopic series, Dirichlet series); Properties; Necessary condition of convergence of a series.

   Function series - Taylor series definition, convergence and examples; Fourier series definition, convergence and examples.

Bibliography

- José A. Rodrigues, *Curso de Análise Matemática – Cálculo em* IR^n, Princípia, *2008.*
- Ron Larson, Robert Hostetler, Bruce Edwards, *Calculus II*, Houghton Mifflin, 8th Ed. 2005.
- James Stewart, *Calculus: Early Transcendentals,* Cengage, 8th Ed., 2016.
- MathWorks, Getting Started with MATLAB R2018b, 2018.

Access Conditions and Attendance Excuse

NA

Conditions for Exam Admission

The one predicted in the REACTA regulation.

Evaluation Method

The evaluation is divided into two parts:

Part I - Theoretical + Theoretical-Practical component (T+TP), worth 15 values, *to be done without a calculator*;

Part II - Practice-laboratory component (PL), worth 5 values, *to be done on a computer.*

The student can choose between a final exam and the distributed evaluation that follows.

Distributed evaluation – A test about the PL component (MATLAB), worth 5 values on a computer, *in the last week of classes*. In the exam the student must do the Part I that worth 15 values, about the component T+TP.

The student is approved when the classification is greater or equal than 9.5 values.

Conditions for Results Improvement

The classification improvement is done according to the REACTA regulation.

Date
21/01/2019

Signature from the lecturer responsible for the course

Signature of Teacher: Helder Sousa Domingos

Instituto Superior de Engenharia de Coimbra

www.isec.pt

Licenciatura – BsC **Engenharia Mecânica** (Português)

Licenciatura – BsC **Mechanical Engineering** (Inglês)

Academic Year: **2018/2019**

Program Contents

Course Unit APPLIED PHYSICS

Specialization (s) COMMON BRANCH

Subject type **Research Area** Physics

Year 1 **Semester** 2 **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	1	14
Tutorial Orientation	0	0
Project	0	0

Unaccompanied Working Hours

Activity Type	Total Hours
Study	60
Works / Group Works	12
Project	0
Evaluation	2
Additional	0

Total of Working Hours **130**

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Helder Sousa Domingos	PhD.	Invited Adjunct. Prof.
Theoretical-Practical Lectures	Helder Sousa Domingos	PhD.	Invited Adjunct. Prof.
Practical-Laboratoty Lectures	Victor José Dias de Almeida Magalhães	MSc.	Adjunct. Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) **Helder Sousa Domingos**

Goals

Concepts in Kinematics and Dynamics of the Rigid Body are presented and developed, illustrated with examples in the context of real life applications. The final objectives are; to be able to understand, apply and conceive gears and machines involving Rigid Body motion. Namely:

a) Knowledge of the laws of Physics that apply to the motion of rigid bodies.
b) Ability to understand gears and other machines involving rigid bodies.
c) Ability to apply the knowledge to real life problems.

Skills

Abilty to analyse the motion of gears formed by rigid bodies.

Signature of Teacher: _____

Program Contents

1. KINEMATICS OF RIGID BODIES

Definition of rigid body and limits to the practical application of the concept
Angular velocity for a rigid body
Distribution of the velocity of the points in the rigid body
Distribution of the acceleration of the points in the rigid body
Translation motion
Rotation motion
General motion
Relative vectors: position, velocity and aceleration
Centre of rotation and and instantaneous centre of rotation
Analysis of mechanical gears with fixed, sliding and non-sliding joints

2. DYNAMICS OF THE ROGID BODY

Centre of mass and centre of gravity for a rigid body
Momentum of a force
Translation motion
Moment of inertia
Rotation arround the centre of mass
Steiner's Theorem.
Rotation of excentric gears
General motion

3. WORK AND ENERGY OF THE RIGID BODY

Kinetic energy of the rigid body
Definition of work
Work of a force
Work of a binary
Work of conservative forces: potential energy
Kinetic energy theorem
Applications with gears
Power associated with a force
Power associated with a binay

Bibliography

- Bedford & Fowler, Dynamics, Engineering Mechanics, Prentice Hall, 5th edition, 2008
- James Merian, - Dinâmica, LTC - Livros Técnicos e Científicos, 1994
- Ferdinand Singer- Mecânica para Engenheiros - Dinâmica, Editora Harper & Row do Brasil, 1982
- Russell Hibbeler, Principles of Dynamics, Prentice Hall, 10th Edition, 2005

Access Conditions and Attendance Excuse

Does not apply.

Signature of Teacher:_____

Conditions for Exam Admission

To have access to the final exam, the students must obtain approval from the laboratorial component (minimum of 2 in 4 points).

Students covered by the statute of the student worker (Law nº07/2009, Law no. 59/2008 and regulation of the status of ISEC student worker) who, due to their working hours, can not attend laboratory classes, will have to combine with the lecturer of the practical laboratory classes, an appropriate time for the practical work.

The grade obtained in the laboratory component is valid for any of the examination seasons of the academic year in which it was obtained.

Evaluation Method

The laboratory part of the subject is obligatory and amounts to four practical works in four practicals. Students can have a fifth practical in case they have missed one of the others or if they want to repeat one of them. The students will have to hand in a minimum o three reports from the practicals carried out. These must be handed in at the end of the practical without exception.

Each practical will be marked 1 to 4 and a total score of under 2 will prevent the student from getting a pass on the subject. In case it is equal or superior to 2 in a minimum of 3 practicals approval is calculated using $C=E\times0.8+P\geq9,5$ where E is the score of the final exam, where the final exam result is expressed in a score from 0 to 20, and the practicals in a score from 0 to 4. If approval is not obtained the classification will be C if $C < 9,00$ or 9 if $C \geq 9,00$.

The exams can be carried out with the aid of an A4 sheet with arbitrary content.

Conditions for Results Improvement

Those that are in force in ISEC, with no improvement in the practical component.

Date

21/01/2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical engineering (Inglês)

Academic Year: **2018/2019**

Program Contents

Course Unit APPLIED MECHANICS

Specialization (s)

Subject type Engineering Sciences **Research Area** Mechanical engineering

Year 1º **Semester** 1º **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Ricardo Nuno Francisco do Carmo	PhD	Assistant professor
Theoretical-Practical Lectures	Raquel Almeida de Azevedo Faria	PhD	Assistant professor
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Ricardo Nuno Francisco do Carmo

Goals

The goal of this course unit is transmit to the students the fundamental concepts and tools in the scope of physics applied to Mechanical Engineering, namely, in the static field. It is intended that the content taught will be useful for others course units, namely, the Strength of Materials and Machine Organs.

Skills

This course unit contributes, mainly, to students adquire the following specific skills: understand the concepts and procedures involved in the selection, design and assembly of organs of machines and structural elements, as well as design reticulated structures.

Program Contents

1. Systems of Forces

Introduction. Types of forces: definitions and units. Principles of static. Moment and coordinates of a force. Moment of a

force in relation to a point. Variation of the reduction center. Moment of a force relatively to an axis. Binaries/equivalent couples. Physical moment concept. Systems of forces: properties and coordinates. Variation of the reduction center. Varignon's theorem.

2. Equilibrium of Rigid Bodies
Equations of equilibrium. Free body diagrams. Types of connections and reactions. Balance of systems plans. Equations of equilibrium. Equilibrium of three-dimensional systems.

3. Plane Reticulated Systems - trusses
Spatial reticulated structures. Notion of reticulated system. Classification of reticulated systems. Determination of the staticity of a system. Internal, external and general staticity. Triangulated systems. Resolution of plane reticulated systems, trusses. Method of the nodes. Ritter's method. Description and applications of the method. Excess bars.

4. Friction
Introduction. Angles of friction. Coefficients of friction. Laws of dry friction. Wedges. Screws of square thread. Radial bearings – axle friction. Axial bearings - disc friction. Rolling resistance - wheels friction. Friction on belts/thongs.

5. Mass Geometry
Centers of gravity. Center of gravity of a two-dimensional body. Centers of gravity of areas and lines. Center of gravity of composite areas. Theorems of Guldinus-Pappus. Centers of gravity of volumes. Moments of Inertia - Definition. Radius of gyration of an area. Transposition of parallel axes - Steiner's theorem. Moments of inertia of an area and of composite surfaces. Products of Inertia. Principal axes and principal moments of inertia. Mohr's circle for moments and products of inertia. Moments and products of inertia of a body.

Bibliography

- CUNHA TORRES, J. M. – Mecânica I, Textos Pedagógicos, ISEC, 1999.
- BRANCO R. S. – Problemas de Mecânica Aplicada, ISEC, 2008.
- BEER, F., JOHNSTON, R. Jr., EISENBERG, E. - Mecânica Vectorial para Engenheiros - Estática (7.ª edição), McGraw-Hill, Portugal, 2006. ISBN 804-45-2.
- MERIAM, J. - Estática (2.ª edição), LTC - Livros Técnicos e Científicos, 1994.
- MUVDI, B., AL-KHAFAJI, A., McNABB J. -Statics for Engineers, Springer-Verlag, New York, 1997, ISBN 0-387-94779-5.
- BEDFORD, A., FOWLER, W. T. – Engineering Mechanics-Stactics, Addison-Wesley, 1997.

Access Conditions and Attendance Excuse

Not applicable.

Conditions for Exam Admission

All students enrolled in the course are admitted to the exam.

Evaluation Method

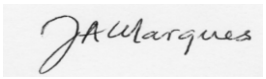
The evaluation of this course unit is carried out through a written test at the end of the semester. This test includes two components, a theoretical and a theoretical-practical component, corresponding to 30% and 70% of the final grade, respectively. The exam is without consultation and the use of a calculating machine is authorized.

Conditions for Results Improvement

The improvement of the classification can only be done by exame.

Date	**Signature from the lecturer responsible for the course**
14/09/2018	Ricardo Nuno F. do Casmo

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: 

Licenciatura – BsC em Engenharia Mecânica

BsC in Mechanical Engineering

Academic Year: 2018/2019

Program Contents

Course Unit INTRODUCTION TO PROGRAMMING

Specialization (s)

Subject type Basic sciences **Research Area** Mechanical Engineering

Year 1st **Semester** 1st **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	1	14
Practical-Laboratory Lectures	3	42
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	71
Works / Group Works	
Project	
Evaluation	3
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	José Armando Cantador Marques	Master´s Degree	Adjunct Professor
Theoretical-Practical Lectures			
Ptactical-Laboratory Lectures	António Mauel de Morais Grade Raquel Almeida de Azevedo Faria	Mestrado Phd	Adjunct Professor Assistant Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) José Armando Cantador Marques

Goals

Apprehend the concept of algorithm. Create and to code algorithms in a high level language. Understand and to know how to apply the concepts of modularity and structured programming. Mastering the syntax of the language taught and to know implement, analyze and debug programs in that language.

Skills

Ability to use computer science as an analysis and resolution tool of problems of Mechanical Engineering.

Program Contents

Algorithms
2. The work environment of Matlab; Command Window; Code Editor.
3. M-Files: Scripts and functions.
4. Variables.
5. Numbers.
6. Predefined functions usual.
7. Expressions.
8. Control instructions: Conditional statements – If and Switch Case; Loops – For and While; Arrays: Vectors;

Bidimensional arrays; manipulation of arrays; Operations with arrays.
9. Functions : Structured programming ; Internal and external functions ; Structure of a function ; Local and global variables.
10. Importing and exporting data.
11. Graphics.

Bibliography

- Vagner Morais, Cláudio Vieira, Matlab 7 & 6 Curso Completo, Ed. FCA, 2013;
- José Vieira, Matlab num Instante, University of Aveiro, 2004;
- Amos Gilat, Matlab com Aplicações em Engenharia, Ed. Artmed S. A., 2006;
- Jon Chapman, Matlab Programming for Engineers, 4e, Thomson Engineering, 2008;
- José Cantador Marques, Sebenta de Introdução à Programação, ISEC, 2010.

Access Conditions and Attendance Excuse

No conditions are laid down

Conditions for Exam Admission

No conditions are laid down

Evaluation Method

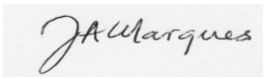
This course has an evaluation process distributed during the academic period, consisting of 2 programming tests. The student's approval in the distributed evaluation exempts the student from the final exam. The arithmetic mean of the tests must be equal to or greater than 9.5 / 20 values and in none of them the grade may be less than 7.5 / 20 values. If any of these requirements are not met, or the student is absent or gives up on one of the tests, he will be evaluated by final exam, at the various times scheduled, where he must obtain a grade of 9.5 / 20 or higher. In the case of passing the distributed assessment, the final grade will be the arithmetic mean of the grades of the two tests.
We propose that the tests take place: 1st Test - November 7 at 5:30 PM, and the 2nd Test - December 19 at 5:30 PM.
In the tests and in the exams tests are not authorized elements of consultation or the use of equipment.

Conditions for Results Improvement

The note improvement (in alternative exam) requires a global exam.

Date	Signature from the lecturer responsible for the course
16/09/2018	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: 

Licenciatura – BsC em Engenharia Mecânica

BsC in Mechanical Engineering

Academic Year: 2018/2019

Program Contents

Course Unit TECHNICAL DRAWING

Specialization (s)

Subject type Engineering sciences **Research Area** Mechanical Engineering

Year 1st **Semester** 1st **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	2	28
Practical-Laboratory Lectures	2	28
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	70
Works / Group Works	
Project	
Evaluation	4
Additional	

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	Carlos Miguel de Campos Pinto Borges	Master's Degree	Assistant Prof.
Practical-Laboratoty Lectures	Carlos Miguel de Campos Pinto Borges	Master's Degree	Assistant Prof.
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) José Armando Cantador Marques

Goals

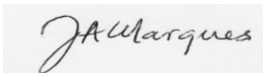
Provide fundamental concepts that allow students to reading, understanding, interpretation and implementation of technical drawings and diagrams, in orthogonal projections and axonometric perspectives. It is also intended that, the students learn the main international standards of tecnical drawing, as well as the latest tools for computer aided drafting in 2D.

Skills

Learn elaborate sketches and technical drawings, either using traditional means or by making use of latest tools for computer aided design in 2D.

Program Contents

1. Basics : Technical drawing standards, types of lines, Drawing Sheets, title blocks, borders, part lists; Scales.
2. Orthogonal projections : European and American Method ; Selection of views ; Partial, private, local and auxiliary Views; Freehand drawing.
3. Cuts and sections: Conventional Interpretation; Cut Plans; Views and partial cuts; Elements that do not draw cut; Sections.
4. Dimensioning: Elements of dimensioning; Dimension insert; Dimensioning criteria.

Signature of Teacher: 

5. Perspectives: Types; Drawing of isometric perspective; Circumference perspective.
6. 2D Modeling with a computer aided design (CAD) system: user interface; constraints; drawing and editing; hatching; dimensioning; blocks.

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Access Conditions and Attendance Excuse

No conditions are laid down

Conditions for Exam Admission

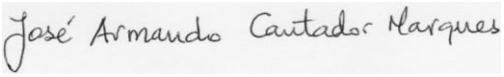
No conditions are laid down

Evaluation Method

Continuous assessment consists of two tests, which are done during the practical classes at the end of each of the two modules: Technical Design (70% of classes) and 2D Computer Assisted Design (30% of classes). The weighted average of the tests must be equal to or greater than 9.5 / 20 values, and in none of them the grade may be less than 7.5 / 20 values. If any of these requirements are not met, the student will be evaluated by final exam, where he will have to obtain a weighted grade of 9.5 / 20 points or more, and a mark of more than 7.5 / 20 values in each of the modules.
We propose that the tests take place: 1st Test - November 22 at 2:30 PM, and the 2nd Test - December 21 at 11:30 AM.
In normal and alternative exams, the student will only have to make the module (s) in which it obtained a mark lower than 9,5 / 20 values.
In the tests of the Technical Drawing module, no elements of consultation or use of equipment are allowed; the tests of the Computer Assisted Design module are carried out with the help of a computer, and the consultation elements (books or personal notes) that the student is supposed to take, although not allowed, use of portable information storage devices .

Conditions for Results Improvement

The note improvement (in alternative exam) requires a global exam.

Date	**Signature from the lecturer responsible for the course**
16/09/2018	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: José Sousa

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: **2018 / 2019**

Program Contents

Course Unit CHEMISTRY

Specialization (s)

Subject type Base Sciences **Research Area** Chemical

Year 1 **Semester** 1 **ECTS** 4

Working Hours 104

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	1	14
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		
Total of Working Hours		42

Unaccompanied Working Hours

Activity Type	Total Hours
Study	58
Works / Group Works	
Project	
Evaluation	4
Additional	
	62

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	José Manuel Matias Vieira de Sousa	PhD.	Professor Adjunto
Theoretical-Practical Lectures	José Manuel Matias Vieira de Sousa	PhD.	Professor Adjunto
Theoretical-Practical Lectures	Ana Patrícia Simões Polido	Master	Assistant
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) José Manuel Matias Vieira de Sousa

Goals

The objectives set for the subject of chemistry relate to its key role, general and pedagogical support. The approach and development is based on the specific level of knowledge of the students, in view of their applicability to the study of the mechanical engineering. It is intended to provide the students an understanding of the fundamentals of chemistry that underlie the transformation and characterization of matter and the structures it forms.

Skills

- Solve simple physic-chemical problems using the appropriate form,
- Identify, interpret and communicate the relationship between the microstructure and the properties of the materials.
- View, interpret and equate physical-chemical problems involving homogeneous or heterogeneous systems.
- Predicting the direction of the evolution of chemical systems based on thermodynamic data.
- to interpret and communicate the mechanisms involved in the deterioration of metals by electrochemical processes.
- Complementary and consolidate the knowledge of the subjects covered in the discipline, being able to access new knowledge using library materials, databases.

Signature of Teacher: José Sousa

Program Contents

1. Electronic Structure of the Atoms and Periodic Table

Electromagnetic radiation and interaction with matter. Planck's quantum theory.
Photoelectric effect. Bohr theory of the hydrogen atom. Electron nature duality - De Broglie principle. Heisenberg's Principle of Uncertainty. Quantum Mechanics. Quantum numbers. Atomic orbital.
Electronic configuration - Aufbau principle, Pauli's exclusion principle and Hund's rule.
Development of the Periodic Table. Periodic classification of the elements.
Periodic variation of physical properties - nuclear charge, atomic radius, ionic radius.
Ionization energy, Electron affinity. Variation of the chemical properties of the elements.

2. Chemical Bonding and Molecular Structure

Ionic, metallic and covalent bonds.
Lewis structure. Concept of resonance. Exceptions to the octet rule.
Molecular geometry.
Dipole moments. Valence bond theory.

3. Intermolecular Forces

Molecular Kinetic Theory of Liquids and Solids.
Intermolecular forces - dipole-dipole, ion-dipole, London dispersion, and hydrogen bond forces.
Properties of liquids - surface tension, viscosity.
Phase changes - liquid-vapour equilibria; Liquid-solid and solid-vapour.

4. Chemical Reactions

Chemical equations: writing and balancing.
Stoichiometric calculations. Limiting Reactants and Reaction Yield.
Properties of aqueous solutions - electrolytes versus non-electrolytes.
Three main types of reactions - precipitation, acid-base and oxidation-reduction.
Physical properties of solutions. Effect of temperature on solubility.
Effect of pressure on gas solubility. Colligative properties.

5. Properties of the Gases

Pressure of the gas.
The Gases Law - Boyle's Law, Charles and Gay-Lussac's Law, Avogadro's Law.
Ideal gas equation.
Dalton's Law of Partial Pressures.
Kinetic theory of gases.
Deviation from ideal gas behaviour.

6. Chemical Equilibrium

Equilibrium constant.
Expressions for the equilibrium constants - homogeneous and heterogeneous equilibrium.
Factors that affect the chemical equilibrium - Le Châtelier principle, variations in concentration, volume and pressure.
Equilibrium involving little soluble salts - constant of the solubility, prediction of precipitate formation.
Effect of the common ion in the solubility of salts.

7. Thermodynamics

Introduction to thermodynamics.
First law of thermodynamics - work and heat
Enthalpy of chemical reactions - enthalpy, enthalpy of reactions, thermochemical equations.
Specific heat and heat capacity.
Spontaneous Processes. Entropy. Second law of thermodynamics - variation of entropy of the system, entropy variation in the vicinity of the system. Third law of thermodynamics. Gibbs free energy.

8. Electrochemistry

Extension of the oxidation-reduction reactions.
Galvanic Cells. Reference electrode and standard potential reduction.
Spontaneity of oxidation-reduction reactions.
Effect of the concentration on the electromotive force of the cell - Nernst equation.
Batteries. Corrosion. Electrolysis.

Signature of Teacher: José Sousa

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- KOTZ, J.C. ; TREICHEL, P. Jr. – *Chemistry and Chemical Reactivity ;* Saunders College Publishing, 1999. ISBN 0-03-023762-9

- ATKINS, P.; JONES, L. – Chemistry - Molecules, Matter and Change Principles: The Quest for Insight, W.F. Freeman and Company, 3ª edição New York 1997. ISBN: 0-7167-2832-X

- KOTZ, J.C. ; PURCEL, P. Jr. – *Chemistry and Chemical Reactivity ;* Saunders College Publishing, 1991 ISBN 0-03-047562-7

- ATKINS, P.; - *The Elements of Physical Chemistry, Oxford University Press, 3ª edição UK 2001. ISBN: 019 879290 5~*

Access Conditions and Attendance Excuse

The conditions defined in the REACTA

Conditions for Exam Admission

There are no restrictions on access to the exam.

Evaluation Method

Students, ordinary and student-workers, should choose one of the evaluation methodologies:
A) Distributed evaluation
This evaluation methodology will consist of two tests in the first semester, quoted for 20 values. The 1st and the 2nd test tests will be carried out in the weeks of 12 to 16 of November and in 17 to 21 of December 2018, respectively. Students who opt for this method of evaluation must have to obtain a minimum of 75% of lessons attendance until reach each test. The completion of the 2nd test by students is subject to a minimum of 7 points in the 1st test.
The Final Classification of the Curricular Unit will result from the following equation: C = 0,5 × T1 + 0,5 × T2, where T1 is the classification obtained in the 1st test, T2 the classification obtained in the 2nd test.

B) Final Evaluation
This evaluation methodology will consist of a Global Exam in the Normal Season and will have a 100% quotation. The student who does not obtain approval in the Final Evaluation can obtain it by taking the Resource Exam. To obtain approval for the Chemistry Unit, students will have to obtain a final grade equal to or greater than 10 value (from 0 to 20).
Conditions for Results Improvement

Conditions for Results Improvement

According with the REACTA.

Date

14/09/2018

Signature from the lecturer responsible for the course

José Manuel Matias Vieira de Sousa

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher:

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Academic Year **2018/2019**

Program Contents

Course Unit LINEAR ALGEBRA

Specialization (s)

Subject type Basic Sciences **Research Area** Mathematic

Year 1º **Semester** 1º **ECTS** 5

Working Hours

Activity Type	Working Hours Per Week	Total28 Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures	0	0
Tutorial Orientation	0	0
Project	0	0

Unaccompanied Working Hours

Activity Type	Total Hours
Study	62
Works / Group Works	8.5
Project	0
Evaluation	3.5
Additional	0

Total of Working Hours 130

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Cristina M. Ribeiro Martins Pereira Caridade	PhD	Adjunct Professor
Theoretical-Practical Lectures	Nuno Filipe Jorge Lavado	PhD	Adjunct Professor
Practical-Laboratoty Lectures			
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Cristina M. Ribeiro Martins Pereira Caridade

Goals

The main aims of this course unit are:

- Perform basic matrix operations.
- Compute matrix determinants, eigenvalues and eigenvectors.
- Understand and apply concepts related to vector spaces and linear transformations.
- Solve and interpret linear systems using matrix theory.
- Understand the importance of linear algebra and analytic geometry in computer science and informatics engineering.
- Recognize the importance of the algorithms in linear algebra.
- Solve real problems which are modelled by matrices and systems.

Skills

At the end of this course unit the learner is expected to be able:

- Develop algorithms using a logical and structured reasoning.
- Solving base problem on mathematics.
- Compare, with criticism, the results obtained by analytical means with the ones obtained by computational means.
- Select appropriately the accessible information (from monographs, textbooks, web …).
- Expose, using documents, the solution problems in a clear and simple way.
- Explain the concepts and solution problems in an appropriated way.
- Solve practical problems with autonomy using, not only the subjects treated in the class, but also other related topics.

Program Contents

1. Complex Numbers (revisions)

2. Systems of linear equations and matrices
- Application of the study of systems of linear equations in solving some problems usually related to Mechanical Engineering.
- Matrix concept.
- Special matrices (row matrix, column matrix, triangular matrix, diagonal matrix, scalar matrix, identity matrix, transposed matrix and conjugate matrix).
- Operations with matrices and some properties: addition of matrices, scalar multiplication and multiplication of matrices.
- Invertible matrices.
- Matrix notation of a system of linear equations.
- Characteristic of a matrix. Calculation of the characteristic by the Gauss elimination method.
- Resolution of linear systems by Gauss elimination method.
- Systems with parameters. Discussion of systems with parameters.
- Inverse matrix. Calculation of the inverse matrix by the Gauss-Jordan method.

3. Vector spaces
- Introduction of the concept of vector space.
- Vector spaces: definition and elementary properties.
- The real vector space.
- Vector subspaces. Classification and characterization of subspaces.
- Subspace construction: linear combination; linear expansion; subspace generated by a set of vectors; space of finite dimension; intersection, sum and subspace meeting.
- Linear dependence and independence.
- Base of a vector space. Dimension of a vector space. Change of base.
- Line spacing; space of columns and null space of an array.

4. Determinants
- Introduction of the notion of determinant.
- Second order determinant: definition and properties.
- Third-order determinant: definition using first line development; one of the lines - "matrix of signals". Rule of Sarrus.
- Determinant of order n; definition.
- Minor, complementary minor and algebraic complement. Laplace's theorem and its generalization. Characteristic of a matrix and order of minors.
- Calculation of the determinant of a matrix through the determinant of a triangular matrix obtained by elimination of Gauss.
- Applications of the determinants: Adjoint matrix and inverse matrix; systems of linear equations. Cramer's Rule.

5. Eigenvalue and Eigenvector
- Introduction of the concept of eigenvalue and eigenvector of a linear application.
- Definition of eigenvalue of a linear application T, eigenvector of T associated with an eigenvalue and space of T associated with an eigenvalue.
- Diagonal matrix representation of a linear application. Concept of diagonalizable matrix and matrix diagonalization.
- Characteristic polynomial and characteristic equation of a matrix. Cayley-Hamilton theorem and some applications.

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LUÍS T. MAGALHÃES – *Álgebra Linear como introdução à Matemática Aplicada, Texto Editora, lisboa 1990.*

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C. SILVA RIBEIRO, LUIZETE E SÉRGIO SILVA REIS - Álgebra Linear. Exercícios e Aplicações, MCGraw Hill. Lisboa 1990.

M. RACHIDE ABDULMAGIDE – Lições Teórico-Práticas de Álgebra Linear, Contraponto, porto 1990.

F. R: DIAS AGUDO – Introdução à Álgebra Linear e Geometria Analítica, Escolar Editora, Lisboa 1972.

ANTÓNIO MONTEIRO – Matrizes, Coleção Dashofer, Learning & Higher Education, 2010.

ANTÓNIO MONTEIRO – Álgebra Linear – Espaços vetoriais e transformações lineares,

Coleção Dashofer, Learning & Higher Education, 2010.

Access Conditions and Attendance Excuse

Not Applicable.

Conditions for Exam Admission

All students enrolled in this course have access to the first and second exam call.

Evaluation Method

Students, at the beginning of the year, will opt for a distributed evaluation or a final exam evaluation. The distributed evaluation will be done through two tests and a practical work distributed as follows:

	1st Test	2nd Test	Practical work
Contents	Complex Numbers, Systems of linear equations and matrices, Vector spaces	Determinants, Eigenvalue and Eigenvector.	
Marks	8,0	8,0	4,0
Minimum	No minima	3,0	No minima
Date	November 11 to 17 (during practical classes)	Date of first examination	**Submit:** until 12/31/2018 **Presentation:** exam support week

If the student does not obtain the minimums in the second test, or the sum of the marks obtained in the two tests and in the practical work, is less than 9.5 values, the student will have to make the second examination call. The second exam call will be 20 values and the student will have to obtain a mark of 9.5 or higher.

Students who have chosen a final exam evaluation at the beginning of the year will not have to do the practical work in Matlab. For these students the first and second exam call will be 20 values. The student will have to obtain a grade higher or equal to 9.5 values.

Conditions for Results Improvement

The conditions of results improvement are those that are forecast in the "Regulation of Frequency, Evaluation of Knowledge and Transition of Year" (REFRACTA).

Date **Signature from the lecturer responsible for the course**

September 11, 2018

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: 

Licenciatura – BsC Engenharia Mecânica
Licenciatura – BsC Mechanical Engineering

Academic Year: **2018/2019**

Program Contents

Course Unit MATHEMATICAL ANALYSIS I
Specialization (s) Common formation

Subject type Basic Science **Research Area** Mathematics

Year 1st **Semester** 1st **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratory Lectures	1	14
Tutorial Orientation	-	-
Project	-	-

Unaccompanied Working Hours

Activity Type	Total Hours
Study	83
Works / Group Works	-
Project	-
Evaluation	3
Additional	-

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	Patrícia Sofia Simões Santos	PhD	Adjunct Professor
Theoretical-Practical Lectures	Patrícia Sofia Simões Santos	PhD	
Practical-Laboratory Lectures	Patrícia Sofia Simões Santos	PhD	

Responsible(s) Lecturer (s) Patrícia Sofia Simões Santos

Goals

Comprehension and use of the differential and integral calculus on IR to find the solution of academic problems and problems in engineering. In theoretical lectures is made an exposition of concepts and results about the topics of the course unit program, while in theoretical-practical lectures the main goal is analysis and resolution of exercises by the student about the topics presented in the theoretical-lectures, with the guidance of the teacher. In practical-laboratory lectures is given the numerical methods component; after a brief exposition of the methods the student is asked to solve problems with the support of a graphing calculator.

Skills

- Solve and interpret real problems with an increasing autonomy.
- Find and select relevant information from different sources such as textbooks and the web.

Program Contents

1. **Real valued functions on IR –** Revision of exponential, logarithmic and trigonometric functions. Elementary functions: hyperbolic functions; inverse trigonometric function.
2. **Differential calculus on IR –** Revision of derivatives. Theorems of Rolle, Lagrange and Cauchy. Indeterminate forms and L'Hôpital rule. Increment and differential. Taylor polynomial and error.
3. **Primitives (antiderivatives) -** Definition and properties. Techniques of calculus of primitives.
4. **Integral calculus on IR -** Definition of Riemann integral (definite integral), and properties. Fundamental theorems of integral calculus on IR. Brief revision about conics. Applications to the calculus of areas, curves length and volumes. Indefinite integral. Improper integrals.

5. **Introduction to the study of ordinary differential equations** - Definition of differential equation. Cauchy problem. Ordinary differential equations of 1st order: separable; linear; changing of variables in an ordinary differential equation.
6. **Component of numerical methods -** Introduction to the theory of errors. Numerical methods for computing the solution of a nonlinear equation. Polynomial interpolation. Numerical integration. Numerical methods to solve ordinary differential equations of 1st order – Euler method.

Bibliography

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Access Conditions and Attendance Excuse

NA

Conditions for Exam Admission

The one predicted in the REACTA regulation.

Evaluation Method

The exam has two parts. One of the parts worth 6 values and evaluates the numerical methods component, the student can use a graphing calculator only in this part of the evaluation. The other part of the exam worth 14 values and evaluates the other subjects in the program of the unit.

The student can choose between a final exam and the distributed evaluation that follows.

Distributed evaluation – In the last week of classes of the semester, the student can do a test about the numerical methods component that worth 6 values. In the exam the student must do the part that worth 14 values about the other subjects in the program of the unit.

The student is approved when the sum of the marks obtained in the parts is equal or greater than 9.5 values.

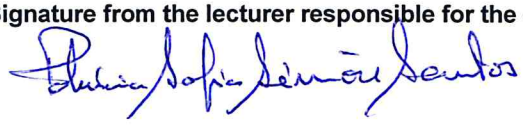
Conditions for Results Improvement

The results improvement is done according to the REACTA regulation.

Date

13-09-2018

Signature from the lecturer responsible for the course



Signature of Teacher:

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: 2018 / 2019

Program Contents

Course Unit NEW ENGINE TECHNOLOGIES

Specialization (s) Mechanical Engineering

Subject type AUTOMOTIVE ENGINEERING **Research Area** MECHANICAL ENGINEERING

Year 3rd **Semester** 2nd **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures	1	14
Practical-Laboratoty Lectures	2	28
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	20
Works / Group Works	40
Project	
Evaluation	2
Additional	

Total of Working Hours 104

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	António Santos Simões	PhD	Adjunct Professor
Practical-Laboratoty Lectures	António Santos Simões	PhD	Adjunct Professor
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) António Santos Simões

Goals

A-General goals:

To understand and to know to integrate, recent technological innovations in the sense of facilitating an easy integration of the graduates in the labor market of automobile companies, including road transports companies, manufacturers, parts makers, and/or industries linked to the automobile sectors.

B-Specific goals:
1-Capacity to identify, to analyze and to solve problems with new engine technologies used in the automobile traction, as well as to build and to justify the fault diagnosis and the implementation of new solutions in the ambit of engines preparation.
2-Capacity to pick up, to select and to interpret the more important information in view to fundament the solutions in discussion and the emitted judgments. It must to include in the analysis the important social, scientific and ethical aspects.
3- Capacity to interpret experimental results and to develop experiences of implementation of new engine technologies.

Skills

To know, to understand the operation, to know to operate and to know to select different engine types in the ambit of the new technologies.
To have capacity, to install, to operate and to carry out a maintenance program in engines with new technologies.
To know to use instrumentation to measure variables and to control engines.
To understand the relationships between engine components functions and the materials characteristics and properties.
To know to use new technological processes in the engine systems manufacture and repair.
To know to apply new fault detection techniques in engines.

Program Contents

1. New technologies in conventional engines:
   1.1 Variable valve train systems
   1.2 EGR systems
   1.3 Synchronization between EGR systems and variable valve train systems (Valvetrónic and others)
   1.4 Fuel direct injection systems (Diesel and gasoline)
   1.5 Pneumatic valves
   1.6 Variable compression engines
   1.7 HCCI engines
   1.8 Other new technologies and new materials used in the engines production
2. Engine supercharging systems:
   a. Volumetric compressor
   b. Turbo-charger
   c. Twin-turbo or bi-turbo, twin-scroll and tri-turbo-charger. Series and parallel turbo-chargers
   d. Volumetric compressor and turbo-charger
3. New technology in the engines preparation
4. Performance prediction in engine simulation software
5. Wankel rotative engine
6. Alternative energy in vehicles:
   6.1 – Hybrid electric vehicles. 6.2 – Alternative fuels vehicles: Biodiesel; Methanol; Ethanol; Hydrogen. 6.3 – Fuel Cell vehicles.
7. Fuels and synthetic lubricating oils
8. New engine control technologies
   8.1 Engine command and control unit. 8.2 Engine fault detection: diagnose equipment of automotive repair shop.
9. On-Board Diagnostic systems (OBD)
10. Technologies of information in vehicles
    10.1 - GPS. 10.2 - Auto diagnostic equipment
11. Gaseous effluents and noise formation and fuel consumption mitigation:
    11.1 – Energy efficiency of engines. 11.2 - Internal friction reduction of engines. 11.3 - Optimization technologies of the engine operation points. 11.4 – Impacts of the fuel direct injection technologies (Diesel and gasoline) in the pollutant emissions. 11.5 – Supercharging impacts in gasoline direct injection engine performance and pollutant formation.
12. Escape emissions treatment and noise reduction solutions:
    12.1 – Catalysts development. 12.2 – Development of a diesel particulate filter. 12.3 – Noise reduction technologies.

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- Service de la Commission Européenne (2000): “Auto Oil II Programme”, October 2000

Access Conditions and Attendance Excuse

To obtain attendance, students must have a minimum of 80% attendance in the theoretical-practical classes and laboratory classes.

Conditions for Exam Admission

Unrestricted for student students, associative leaders, firefighters, students classified in other situations provided for by law or in a situation of justified absence due to illness or support to the family, provided duly proven.
With a minimum attendance of 80% of attendance in relation to the total hours of classes of the curricular unit, in the remaining cases. However, repeating students who have obtained, in previous school years, a minimum frequency of 80% attendance in the total hours of classes of the course unit, are exempt from fulfilling this requirement.
Only those students who submit the works mentioned in the following section "Evaluation Methodologies" will be admitted to the final test and / or final exams until April 30, 2019 at 23:59h.

Evaluation Method

Students will often be assessed on a continuous basis in class, by writing and discussing a group / report work, from the scope of new engine technologies, in Word format, using the Times New Roman font, size 12, and a minimum of 25 pages filled with descriptive text and images, without counting the cover, index and bibliographical references, including a chapter on the maintenance of equipment associated with the new technology described, written in Portuguese and English. The bibliography will have to mention at least 2 books. The defense of the report will occur until the last week of classes, through presentation synthesized in document, PowerPoint format, with a minimum of 20 slides. The continuous assessment component contributes 50% to the final classification of the curricular unit. The remaining 50% report on a final 2-hour evaluation with 20 questions in the discipline, in which at least half of them are of the multiple-choice type, to be held in the last week of the semester beginning May 27, 2019. In the written tests, no query elements or any other computer equipment may be used. Also mobile phones should be disconnected and deposited on the teacher's desk.

Student students and associative leaders who have not obtained frequency and who wish to take advantage of them will have to undergo, in addition to the final assessment, a theoretical-practical and laboratory test of 3 hours, with questions for development, on the subjects worked during the continuous evaluation.

The approval in the course unit is conditioned to obtain a minimum grade of 8 values in the written test of evaluation (test or final exam).

Conditions for Results Improvement

All students may require grading improvement.
However, students who are able to obtain a grade of more than 17 values will have to undergo, in addition to the tests specified above, an oral assessment test.

Date 2019-01-16

Signature from the lecturer responsible for the course

António Santos Simões
(Professor Adjunto)

Instituto S e Engenharia de Coimbra
ww.isec.pt

Signature of Teacher: _____

Licenciatura em Engenharia Mecânica

BSc in Mechanical Engineering

Academic Year: **2018/2019**

Program Contents

Course AIR CONDITIONING PLANTS

Specia n (s)

Subjec Specialty sciences - optional **Research Area** Mechanical Engineering

Year **Semester** 2 **ECTS** 4

Workin s

Activity	**Working Hours Per Week**	**Total Hours**
Theoret tures		
Theoret ctical Lectures	1	14
Practica atoty Lectures	2	28
Tutorial tion		
Project		
Total o ng Hours		104

Unaccompanied Working Hours

Activity Type	**Total Hours**
Study	39
Works / Group Works	20
Project	
Evaluation	3
Additional	

Lecture

Activity	**Name**	**Qualifications**	**Category**
Theoret tures			
Theoret ctical Lectures	Gilberto Cordeiro Vaz	PhD	Coordinator Prof.
	Anabela Duarte de Carvalho	PhD	Adjunct Prof.
Practica atoty Lectures	Gilberto Cordeiro Vaz	PhD	Coordinator Prof.
	Anabela Duarte de Carvalho	PhD	Adjunct Prof.
Tutorial tion			
Project			

Respo s) Lecturer (s) Gilberto Cordeiro Vaz

Goals

The ai s course is to complement the training in the area of air conditioning systems, analyzing their specific feature pplications, giving more emphasis to practical aspects. It is intended that students acquire the necessary knowle calculate the fundamental elements of air conditioning plants and select the main equipment and also know the res fundamentals of installation, operation and maintenance.

Skills

This co ntributes mainly to the acquisition by the students of the following specific skills:
- Desig eting, installation, management and maintenance of air conditioning and renewable energy facilities.

Progra tents

1. Air C ning Systems
   Clas n and description of air conditioning systems. Relevant factors at design, selection and operation of air conditi ants.
2. Equi
   Cen pment. Auxiliary equipment. Accessories. Valves. Control, monitoring and technical management equipment.

3. Systems operation and maintenance
   Technical management of buildings. Maintenance and operation management. Energy management.
4. Air conditioning systems integrating renewable energies
   Solar energy. Biomass. Geothermal energy.

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- Carvalho, A.D.. – Instalações de Climatização – Apontamentos, 2019.

Access Conditions and Attendance Excuse

Conditions for Exam Admission

Evaluation Method

The assessment of the curricular unit is composed of two parts:

1) Written test (to be held at the end of the classes period) or final exam, weighing 10/20 values;
2) Written report of the proposed work (to be delivered three weeks before the end of the classes period) and presentation and discussion, weighing 10/20 values.

To obtain approval in the course unit a grade higher than 9.5/20 values and a minimum grade of 8/20 values in the test or final exam is required.

Conditions for Results Improvement

Only the written component assessed in test/exam can be improved.

Date

21.01.2019

Signature from the lecturer responsible for the course

Licenciatura – BsC Engenharia Mecânica

Licenciatura – BsC Mechanical Engineering

Program Contents

Course Unit MANUFACTURE OF MOLDS

Specialization (s)

Subject type Specialty Discipline **Research Area** Mechanical Engineering

Year 3.º **Semester** 2.º **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	-	-
Theoretical-Practical Lectures	1	14
Practical-Laboratory Lectures	2	28
Tutorial Orientation	-	-
Project	-	-

Total of Working Hours 104

Unaccompanied Working Hours

Activity Type	Total Hours
Study	39
Works / Group Works	20
Project	-
Evaluation	3
Additional	-

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures	Pedro Miguel Soares Ferreira	PhD	Adjunct Professor
Practical-Laboratoty Lectures	Pedro Miguel Soares Ferreira	PhD	Adjunct Professor
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) Pedro Miguel Soares Ferreira

Goals

- Identify the main types of molds used in the industry.
- To Know the injection cycle of thermoplastics and the main parameters of the process, from the molds design perspective.
- To know the main machining processes applied in the manufacture of molds and to establish the relation between the geometry and the most appropriate processes to obtain them.
- Know how to select the most suitable materials and heat treatments to be applied in thermoplastic injection molds.
- Know all the functional systems of thermoplastic injection molds and the main standard elements on the market.
- Know how to apply the specific rules for the project, design and manufacture of a simple mold.

Skills

- Know how to draw drawings and technical drawings, making use of the latest tools of computer aided design.
- Know the properties and fields of use of a wide diversity of engineering materials.
- Know and know how to use technological processes of manufacture, including systems of computer aided manufacture.
- Understand the concepts and procedures involved in the selection and dimensioning of machine parts and structural elements.
- To be able to identify, analyze and solve problems, as well as to build and substantiate the arguments of the proposed solution.
- Ability to plan captivities in space and time, identifying and managing the resources needed to achieve them.
- Ability to develop teamwork.

Program Contents

1. Introduction to the manufacture of molds

Definition of mold and history of molds in Portugal.

Application of molds in industry: Molds for the production of glass parts; molds for forming ceramic materials; molds for injection molding and molds for the production of polymeric parts.

2. Injection of thermoplastics and respective injection molds

Molding cycle and variables to be adjusted in the injector control system.

Closing force and closing unit; Typical injection molding conditions for different thermoplastics.

Most common defects in injected parts.

Injection mold planning.

Typology and classification of injection molds: i) solid or structured molds; ii) 2 or 3 plate molds; III) molds of cold or hot channels; iv) other types of molds.

3. Materials and hardening of materials for thermoplastic injection molds

Properties required for the molds and service life of a mold.

Steels, copper alloys and aluminum alloys use in the molds. Degree of polishing.

Tensions, deformations and cracks of the molds. Design rules to avoid cracking.

Thermal treatments and surface coating for hardening of materials**.**

4. Manufacturing processes applied to molds

Milling, turning, drilling, electrical discharge machining and grinding.

Application of CAD / CAM systems to the manufacture of molds.

5. Functional systems of thermoplastic injection molds: Molding zones, guiding and locking.

Mold tolerance and contraction of thermoplastics.

Centering: accessories, alignment and guidance.

Finishing and assembly of molds.

6. Functional systems of thermoplastic injection molds: feeding system and exhaust systems.

Feed systems with cold channels: feeder and attacks.

Feed system with insulated channels and hot runner feeding system.

Exhaust system

7. Functional systems of thermoplastic injection molds: Temperature control systems.

General rules for temperature control.

Water channels in core and cavities.

Temperature control circuit accessories: bolts and cap plugs, seals and connections.

8. Functional systems of thermoplastic injection molds: Extraction systems.

Simple extraction.

Extraction with counter-exits.

Extraction with movements.

Other types of extraction.

9. Use of Computer Applications in the Design of Molds.

Using Mold Tools and Plastics modules from SolidWorks® Software.

Use of the MasterCAM® Software in the manufacture of molds.

Bibliography

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- Moldes para plásticos, Francesco Provenza, São Paulo, escola Pro-tec, 1982.
- Moldes, Cunhos e Cortantes, Vaz, Editora Lopes da Silva, 1987.
- Injection Molding Handbook – 3rd Edition, Dominick V. Rosato, Donald V. Rosato e Marlene G. Rosato, Kluwer Academic Publishers.

Access Conditions and Attendance Excuse

In the case of students who have demonstrated experience in mold making, they may, if they wish, offer themselves to an evaluation carried out by a work defined by the teacher.

Conditions for Exam Admission

Have done group work or individual work in the case of students enrolled under special statutes, in the current school year or in a previous school year.

Evaluation Method

- The assessment of knowledge comprises the following components:

  i) A frequency to be taken in the last week of classes or final exam, covering the contents taught in class.

  ii) An individual work or in groups of 2 students, to be developed during the classes, including the report and one preparation of the work be carried out in the penultimate week of classes, for all the students of the discipline. The deadline for delivery of the report will be until the Friday before the penultimate week of classes (17/05/2019).
- The final grade will be calculated based on the following weighting: Frequency or final exam 40% (8 points) and work group 60% (12 points). The approval in the course unit requires a final classification of 10 values and is conditioned to obtain a minimum grade of 6 values (in 20 values) in the frequency or in the final exam.

- Students enrolled under special statutes, in particular student workers, if they are unable to attend classes and perform group work, in addition to taking the final exam, must deliver and discuss an individual work, to be defined by the person in charge of curricular unit. The justification of the intention to carry out individual work must be communicated to the teacher responsible for the course unit in the first 2 weeks of classes. After this period, it is considered that the students will undergo the evaluation defined for ordinary students.
- In cases where the requirements for the individual work report or performance have been carried in previous school years, the evaluation will only cover the performance of the exam, quoted for 20 values

Conditions for Results Improvement

Have done group work or individual work in the case of students enrolled under special statutes, in the current school year or in a previous school year.

For grade improvement, group work will be considered in the final grade if it was completed in the current school year. For the case that the work has been carried out in previous school year to the school year that the student is requesting the grade improvement, the evaluation will only comprise the examination test, quoted for 20 values.

Date	**Signature from the lecturer responsible for the course**
15/01/2019	

Signature of Teacher:

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Licenciatura – BsC em Engenharia Mecânica

BsC in Mechanical Engineering

Academic Year: **2018 / 2019**

Program Contents

Course Unit PROJECT

Specialization (s)

Subject type Specialty Curricular Unit **Research Area** Mechanical Engineering

Year 3rd **Semester** 2nd **ECTS** 7

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures		
Theoretical-Practical Lectures		
Practical-Laboratory Lectures		
Tutorial Orientation		
Project	4	56

Unaccompanied Working Hours

Activity Type	Total Hours
Study	24
Works / Group Works	
Project	100
Evaluation	2
Additional	

Total of Working Hours 182

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures			
Practical-Laboratory Lectures			
Tutorial Orientation			
Project	Luís Manuel Ferreira Roseiro	PhD	Coordinator Professor
	António Manuel de Morais Grade	MSc	Adjunct Professor
	Gilberto Cordeiro Vaz	PhD	Coordinator Professor
	Vítor Manuel Maranha Lopes	MSc	Assistant

Responsible(s) Lecturer (s) Luís Manuel Ferreira Roseiro
António Manuel de Morais Grade

Goals

This curricular unit aims to develop students' ability to apply the knowledge acquired throughout the course. The unit also stimulates the capacity for analysis and critical thinking of students as well as their skills in organization, communication and teamwork. Wherever possible, the project work is carried out in collaboration with companies or other entities outside the school, looking for its implementation in a real context.

Skills

This course contributes to the achievement of the following competences: Know how to apply the knowledge and ability to understand; To be able to identify, analyze and solve problems, as well as to build and support the argumentation of the proposed solution; Ability to collect, select and interpret the relevant information to justify the recommended solutions and the judgments issued; Have ability to plan activities in space and time, identifying and managing the resources needed to achieve them; Have ability to integrate recent technological innovations in its area of professional intervention; Be able to transmit information, ideas, problems and solutions, in a clear and objective way; Be able to develop teamwork.

Program Contents

Elaboration of a project work, concentrating on topics that include several areas of Mechanical Engineering and correspond to concrete cases, involving the study, calculation and dimensioning of devices, mechanisms, equipment or installations. Students are acquainted with the design, development and implementation phases of a project, also taking into account their economic cost.

Methodology: The students are usually divided into groups of two elements, but is possible to have individually elaborated works or groups of three students, if justifiable. Each group will be given a statement with a topic previously defined by the advisory teacher in conjunction with the entities associated with the project, if this is the case. Each group will be accompanied and guided by a teacher of the curricular unit. Given the more or less wide nature of the topic, in terms of engineering areas, students may be guided by more than one teacher of the curricular unit, always with a responsible one. The groups should preferably use the classes to carry out their projects and to analyze and discuss specific problems of the same with the teachers. Teachers will be able to use some classes for the presentation of topics common to the various groups, such as the methodology of elaboration of the project, the structure of the report, norms and regulations, use of calculation tools, among others. Students are encouraged to carry out bibliographic research. The use of computer applications or automatic calculation programs, existing or to be developed by the students, is valued for the calculation and dimensioning of the project support elements. If it is relevant to the work in development, the experimentation and the construction of functional prototypes are also valued.

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- EN 13480 - Metallic Industrial Piping, CEN, 2002
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- EN ISO 5349 1/2- Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration, Part I / II
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Access Conditions and Attendance Excuse

N.A.

Conditions for Exam Admission

N.A.

Evaluation Method

The assessment of knowledge is based on a set of factors considered important in the context of the skills to be acquired during the course unit, namely:
• The student's motivation and participation in the development of the work;
• The mid-term analysis of the work carried out;
• The quality of the project report;
• The presentation and final discussion of the project.
Each group will deliver two copies of the final report, accompanied by two CDR / DVD / PenDrive with written report and supporting documentation (drawings, programs, ...). The sending of the report in pdf format should also be done through an e-mail addressed to the teachers in the area.
The final delivery will be made until the deadlines established at the beginning of the semester. The presentation and discussion of the project will be carried out before a jury with at least 2 teachers, in oral public. The presentation should be 10 to 15 minutes and the discussion of the entire project 1 hour. Although all the students in the group have to know the whole project, each of the students can be responsible for different parts of the project, presenting and defending its component in the final discussion. The final classification is therefore individual. The project should be carried out, mainly, during the period of classes, so the groups should use the classes for this purpose.
In the middle of the academic semester, there will be an in-depth follow-up procedure, which will be implemented as follows:
Work in the production area: a) Delivery of an interim report; b) Presentation of the work already done, before the teachers of this area and all the other students, with a duration of 3 minutes;
Work in the thermal area: In a scheduled class with minimum objectives pre-established with students, that should be completed in the middle of the semester (such as report structure, relevant legislation, installation scheme, installation operation, and so on), the teachers will make the state of progress with all working groups, analyzing the work already done and the attendance of each group. If there are groups that have failed to meet the minimum objectives, teachers will seek to identify the causes and difficulties of these groups and to follow up them even more frequently.

Conditions for Results Improvement

Date	**Signature from the lecturer responsible for the course**
21.01.2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature: 

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Engineering (Inglês)

Academic Year: 2018 / 2019

Program Contents

Course Unit THERMAL MACHINES II LAB

Specialization (s) Not applicable

Subject type Specialty Sciences **Research Area** MECHANICAL ENGINEERING

Year 3 **Semester** 2 **ECTS** 6

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	0	
Theoretical-Practical Lectures	0	
Practical-Laboratory Lectures	4	56
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	64
Works / Group Works	32
Project	
Evaluation	4
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures			
Theoretical-Practical Lectures			
Practical-Laboratory Lectures	João Carlos Antunes Ferreira Mendes	PhD	Prof. Coordenador
	Gilberto Cordeiro Vaz	PhD	Prof. Coordenador
	Avelino Virgílio Fernandes Monteiro de Oliveira	PhD	Prof. Adjunto
	Carlos José de Oliveira Pereira e Jorge Alcobia	PhD	Prof. Adjunto
	António Santos Simões	PhD	Prof. Adjunto
	Maria Luísa Ingrês Pais Vaz	MSc	Prof. Adj. Convidado
	Carlos Miguel de Campos Pinto Borges	MSc	Assistente Convidado
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) João Carlos Antunes Ferreira Mendes

Goals

Laboratory curricular unit aiming at the application of the concepts studied in theoretical and theoretical-practical classes, namely in the disciplines of Thermodynamics, Fluid Mechanics, Hydraulic Machines, Thermal Equipment and Processes, Heat Transmission, Alternative Machines and Air Conditioning and Refrigeration.The curricular unit is divided into four parts corresponding to the laboratories where the practical work is carried out.

Skills

Competencies to be acquired: Knowing, understanding and knowing how to apply: the laws of mechanics to incompressible fluids, the laws of thermodynamics and the transmission of heat, including the ability to perform thermal balances. Know, understand the operation and know how to select the different types of turbomachinery. To be able to size, install, operate and maintain fluid networks, air conditioning and refrigeration systems. Understand the operation and be able to model, install, operate and maintain internal combustion engines. Know and know how to use instrumentation of measurement and control. Develop the ability to work as a team.

Lecturer's signature:_____

Program Contents

1. Thermal Systems - Characterization of a section of the Laboratory installation and calculation of heat losses. Determination of the thermal efficiency and heat losses of a pyrotubular boiler. Determination of heat output and efficiency of a heat exchanger.
2. Hydraulic Machines - Determination of pressure losses in pipes and fittings. Determination of useful lifting height, absorbed power and efficiency of electric pumps / fans. Association of bombs. Determination of useful drop, effective power and yield of Francis, Kaplan and Pelton turbines.
3. Climatization - Simulation of the psychrometric corrections of the air, in applications of humidification, heating and cooling; Thermal balances of the operated transformations. Tests of the following types: simple and humidified heating; simple cooling, with cooling down to the dew point and final temperature corrections; humidifications.
4. Alternative Machines - Analysis of the compression and sealing of motors. Analysis of electrical and electronic ignition systems in SI engines. Analysis of oscillograms. Analysis of exhaust gases and interpretation of results. Determination of characteristic curves of an internal combustion engine. Modeling of an internal combustion engine.

Bibliography

Constant bibliography of each of the curricular units that originate the proposed practical work and manuals of procedures, the four laboratories and the respective equipment.

Access Conditions and Attendance Excuse

Operation only by continuous evaluation. There is no final exam in this curricular unit.

Conditions for Exam Admission

Not applicable.

Evaluation Method

Group work. Experimental works designed so that the autonomy of the student increases with the course of the classes.
There are two evaluation moments that occupy two classes. The assessment class occurs after all students have attended two laboratories.
The final grade obtained in the course unit results from the arithmetic mean of the final classifications obtained in each of the laboratories. In each laboratory, the (individual) classification is determined by the weighted average of the classification obtained [class performance (30%) and written report / oral discussion (70%)].
The approval in the course unit is conditional on obtaining a positive classification in all laboratories.

Conditions for Results Improvement

Those provided in the legislation.

Date

21/01/2019

Signature from the lecturer responsible for the course

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Rúbrica Docente: _____

Licenciatura em Engenharia Mecânica

Ano Lectivo 2018/2019

Ficha de Unidade Curricular

Unidade Curricular ORGANIZAÇÃO E GESTÃO

Ramo(s)

Área Científica ENGENHARIA E GESTÃO INDUSTRIAL

Natureza Curricular Obrigatória

Ano 3º **Semestre** 2º **ECTS** 4

Horas de Contacto

Tipo de Actividade	Horas Semanais	Total de Horas
Teórico	2	28
Teórico-Prático	2	28
Prático / Laboratorial		
Orientação Tutória		
Projecto		

Horas de Trabalho não Acompanhado

Tipo de Actividade	Total de Horas
Estudo	48
Trabalhos / Trabalhos de Grupo	
Projecto	
Avaliação	
Outra	

Total de Horas de Trabalho 104

Docentes

Tipo de Actividade	Nome	Habilitações	Categoria
Teórico Módulo 1	Alexandre Miguel d'Orey de Gouveia e Melo	mestrado	Prof. Adjunto
Teórico-Prático Módulo1	Alexandre Miguel d'Orey de Gouveia e Melo	mestrado	Prof. Adjunto
Teórico Módulo 2	David José Rocha Domingues	mestrado	Prof. Adjunto
Teórico-Prático Módulo2	David José Rocha Domingues	mestrado	Prof. Adjunto

Docente Responsável Alexandre Miguel d'Orey de Gouveia e Melo
David José Rocha Domingues

Objectivos

Compreender os princípios básicos de organização e gestão de empresas e organizações, desde o nível estratégico até ao operacional nas múltiplas vertentes, criando um domínio comum de conhecimento entre os engenheiros e os gestores

Competências

No final desta unidade curricular os alunos deverão ser capazes de:
Compreender a influência das envolventes económicas, sociais, tecnológicas e políticas sobre as organizações e sobre os seus gestores. Entender a importância da competitividade e da ética empresarial e utilizar ferramentas e saberes que permitam exercer a gestão, no contexto da cultura da empresa e numa perspectiva empresarial aberta à inovação e à mudança.
Identificar os diferentes horizontes de planeamento das operações e os procedimentos a aplicar em cada caso. Deve prever necessidades, planear e escalar recursos, assegurando o cumprimento de metas e optimizando as operações. Deve aplicar as técnicas de planeamento e controlo de projectos. Deve conhecer as distintas filosofias de gestão da produção. Genericamente, pretendem-se desenvolver as capacidades de análise e resolução de problemas, aplicando os conhecimentos adquiridos

Conteúdos Programáticos

Módulo 1- Organização e Gestão

As organizações e as empresas - A Gestão;
As organizações e o meio envolvente, o planeamento e o ciclo de vida dos produtos.
As demonstrações financeiras no âmbito da gestão empresarial.
Fundamentos para análise e gestão das empresas, indicadores económico-financeiros e rácios fundamentais da gestão.
Análise financeira e de viabilidade de projectos de investimento.

Módulo 2- Gestão das Operações

1. PLANEAMENTO E PROGRAMAÇÃO DE OPERAÇÕES
Horizontes de planeamento: estratégico, agregado e de curto prazo
O Shop-floor control e as rotas de produção.
Escalonamento em ambientes intermitentes com Heurísticas
2. PROGRAMAÇÃO E GESTÃO DE MATERIAIS-Procura Dependente
Procura Dependente e estrutura de produto
Planeamento de Necessidades de Materiais MRP e Planeamento de Capacidades CRP
3. PROGRAMAÇÃO E GESTÃO DE MATERIAIS-Procura Independente
Gestão de inventário, funções e classificação ABC, custos em gestão de stocks
Modelos determinísticos de aprovisionamento com procura contínua.
Modelos estocásticos e Stock de Segurança
Modelos de ponto de Encomenda e modelos de revisão cíclica
O Ciclo de aprovisionamento
4 PLANEAMENTO E CONTROLO DE PROJECTOS
Características e condicionantes de um projecto
Técnicas de planeamento e controlo: redes e determinação do caminho crítico, CPM e PERT.
5. NOVAS FILOSOFIAS DE PRODUÇÃO
A produção em massa versus a produção Lean
As Ferramentas Lean (JIT, 5S, SMED)

Bibliografia

Mod 1

LISBOA, J. [et al.] , (2004), "Introdução à Gestão das Organizações", editora Vida Económica,

ROBBINS, Stephen P.; COULTER, Mary, "Management", Prentice-Hall, 6th ed. [658 ROB]

SEBASTIÃO TEIXEIRA, (1998),"Gestão das Organizações", Alfragide ,McGraw-Hill

MARQUES PINTO, C.A. [et.al.] (2009)."Fundamentos de Gestão", 2ª Ed.Lisboa, Editorial Presença

Mod 2

ROLDÃO, V.S. , RIBEIR, J.S.; Gestão das Operações-Uma abordagem Integrada; Ed. Monitor, 2007

LISBOA,J. V., GOMES,C.F.; Gestão de Operações; Vida Económica; 2ªEd, 2008

REIS,L; Manual da Gestão de Stocks- Teoria e prática; Editorial Presença, 2008

PINTO, J.P., Gestão de Operações na Indústria e nos Serviços, 3ªed, Lidel, 2010

ROLDÃO, V. S. (2013), Gestão de Projectos- Abordagem Instrumental ao Planeamento, Org. e Controlo" 4ª ed, Ed. Monitor.

STEVENSON, W. J. (2009). Operations Management (12th Edition). New York: MacGraw-Hill Irwin.

Condições de Obtenção e Dispensa de Frequência

Nos termos regulamentares

Condições de Acesso a Exame

Todos os alunos regularmente inscritos nesta UC

Metodologia de Avaliação

Avaliação por exame:

» A aprovação no exame está condicionada a resultado mínimo de 40% em cada um dos módulos e um resultado mínimo de 50% no global da prova de exame.

Condições de Melhoria de Classificação

Por exame, nos termos regulamentares

Data	Assinatura do Docente Responsável pela Unidade Curricular
21 de Janeiro de 2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Signature of Teacher: _____

Licenciatura – BsC Engenharia Mecânica (Português)

Licenciatura – BsC Mechanical Enginnering (Inglês)

Academic Year: 2018/2019

Program Contents

Course Unit ORGANIZATION AND MANAGEMENT

Specialization (s)

Subject type **Research Area** Enginnering and Industrial Management

Year 3rd **Semester** 2nd **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	48
Works / Group Works	
Project	
Evaluation	
Additional	

Total of Working Hours 104

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures Module 1	Alexandre Miguel d'Orey de Gouveia e Melo	MSc	Adj.Professor
Theoretical-Pratical Lectures Módule 1	Alexandre Miguel d'Orey de Gouveia e Melo	MSC	Adj. Professor
Theoretical Lectures Módule 2	David José Rocha Domingues	MSc	Adj.Professor
Theoretical-Pratical Lectures Module 2	David José Rocha Domingues	MSc	Adj.Professor

Responsible(s) Lecturer (s) Alexandre Miguel d'Orey de Gouveia e Melo
David José Rocha Domingues

Goals

The objectives are to understand the basic principles of organization and management of companies and organizations, from the strategic level to the operational level in the multiple aspects, creating a common domain of knowledge between engineers and managers

Skills

At the end of this course students should be able to:
Understand the influence of economic, social, technological and political environments on organizations and their managers.

Understand the importance of competitiveness and business ethics and use tools and know-how that allow management to be carried out in the context of company culture and in a business perspective that is open to innovation and change.
Identify the different planning horizons of the operations and the procedures to be applied in each case.
Anticipate needs, plan and scale resources, ensuring compliance with goals and optimizing operations.
Apply project planning and control techniques.
Know the different philosophies of production management.
Generally, the aim is to develop problem-solving skills by applying the knowledge acquired

Program Contents

Module 1- Organization and Management
Organizations and companies - The Management function;
Organizations and the environment, planning and product lifecycle.
The financial statements in the scope of business management.
Fundamentals for analysis and management of companies, economic and financial indicators and fundamental management ratios.
Financial analysis and economic viability of investment projects.

Module 2- Operations Management
1. PLANNING AND PROGRAMMING OF OPERATIONS
Planning horizons: strategic, aggregate and short-term.
Shop-floor control and production routing.
Scheduling in Intermittent Environments with Heuristics.
2. PROGRAMMING AND MANAGEMENT OF MATERIALS-Dependent demand
Dependent demand and Product Structure-BOM
Material Requirements Planning MRP and Capacity Planning CRP
3. PROGRAMMING AND MANAGEMENT OF MATERIALS-Independent Demand
Inventory management, functions and ABC classification, inventory management costs
Deterministic models of supply with continuous demand.
Stochastic Models and Safety Stock
Reorder Point and periodic models
The Supply Cycle
4 PROJECT PLANNING AND CONTROL
Characteristics and constraints of a project
Planning and control techniques: networks and critical path determination, CPM and PERT.
5. NEW PRODUCTION PHILOSOPHIES
Mass production vs. Lean production
Lean Tools (JIT, 5S, SMED)

Bibliography

Mod 1
LISBOA, J. [et al.] , (2004), "Introdução à Gestão das Organizações", editora Vida Económica,
ROBBINS, Stephen P.; COULTER, Mary, "Management", Prentice-Hall, 6th ed. [658 ROB]
SEBASTIÃO TEIXEIRA, (1998),"Gestão das Organizações", Alfragide ,McGraw-Hill
MARQUES PINTO, C.A. [et.al.] (2009)."Fundamentos de Gestão", 2ª Ed.Lisboa, Editorial Presença

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ROLDÃO, V.S. , RIBEIR, J.S.; Gestão das Operações-Uma abordagem Integrada; Ed. Monitor, 2007
LISBOA,J. V., GOMES,C.F.; Gestão de Operações; Vida Económica; 2ªEd, 2008
REIS,L; Manual da Gestão de Stocks- Teoria e prática; Editorial Presença, 2008
PINTO, J.P., Gestão de Operações na Indústria e nos Serviços, 3ªed, Lidel, 2010
ROLDÃO, V. S. (2013), Gestão de Projectos- Abordagem Instrumental ao Planeamento, Org. e Controlo" 4ª ed, Ed. Monitor.
STEVENSON, W. J. (2009). Operations Management (12th Edition). New York: MacGraw-Hill Irwin

Signature of Teacher:_____

Access Conditions and Attendance Excuse
according regulatory terms

Conditions for Exam Admission

All students regularly enrolled in this UC

Evaluation Method

Assessment by examination:
»The passing of the exam is subject to a minimum result of 40% in each of the modules and a minimum result of 50% in the overall exam.

Conditions for Results Improvement

By exam, according regulatory terms

Date	**Signature from the lecturer responsible for the course**
21st January 2019	

Instituto Superior de Engenharia de Coimbra
www.isec.pt

Lecturer's signature:

Licenciatura – BSc Engenharia Mecânica

Licenciatura – BSc Mechanical Engineering

Academic Year: *2018/2019*

Program Contents

Course Unit INDUSTRIAL MAINTENANCE

Specialization (s)

Subject type Engineering **Research Area** Industrial Engineering and Management

Year 3 **Semester** 2 **ECTS** 4

Working Hours

Activity Type	Working Hours Per Week	Total Hours
Theoretical Lectures	2	28
Theoretical-Practical Lectures	2	28
Practical-Laboratoty Lectures		
Tutorial Orientation		
Project		

Unaccompanied Working Hours

Activity Type	Total Hours
Study	70
Works / Group Works	24
Project	
Evaluation	6
Additional	

Total of Working Hours 156

Lecturer

Activity Type	Name	Qualifications	Category
Theoretical Lectures	José Manuel Torres Farinha	PhD	Prof. Coordinator Principal
Theoretical-Practical Lectures	José Manuel Torres Farinha	PhD	Prof. Coordinator Principal
Practical-Laboratoty Lectures	José Manuel Torres Farinha	PhD	Prof. Coordinator Principal
Tutorial Orientation			
Project			

Responsible(s) Lecturer (s) José Manuel Torres Farinha

Goals

At the end of the Course Unit, the student must have acquired knowledge on:

- The concept of Maintenance and its evolution, as well as the concepts associated;
- The organization and management of a maintenance department of an industrial company, of services, hospital, hospitality, and others, where the role of equipment and facilities is relevant;
- The programming, accompaniment and control of the maintenance interventions;
- The use of techniques and methods of maintenance planning;
- The identification and application of some techniques of condition monitoring maintenance;
- The functioning of the information systems for maintenance management;
- The KPI and the elaboration of a cockpit chart;
- The management methodologies of the maintenance activity;
- The main concepts and applications of the Vibration Analysis.

Skills

The abilities that the student will have to acquire in this unit course are the following ones:

- To know how to act in a maintenance department, namely in the preparation and control of the Working Orders, planned and non-planned;
- To know dialoguing with the several departments of the company that interact with the maintenance department;
- To know implementing a cockpit chart to aid the maintenance management and the company management;
- To know asking for, by self-initiative, the real solutions for the real problems of the maintenance;
- To know applying the management techniques to the real problems of the maintenance activity.

Lecturer's signature: _____

Program Contents

1. **Framework and Maintenance Organization**
   The Maintenance Concept and associated concepts. The interdisciplinary of the maintenance. The maintenance organization.
2. **Assets Organization**
   Definition of the structure of the Facilities and Equipment. Codification of the Facilities and Equipment.
3. **Types of Maintenance Works**
   Planned Maintenance Works. Non-Planned Maintenance Works. Works for maintenance improvement of facilities and equipment. Other types of Works.
4. **Maintenance Planning**
   Types of planned maintenance. Methods Function. The Five Levels of Planning. Algorithms for planning.
5. **Maintenance Resources**
   Human resources. Spare parts. Tools.
6. **Reliability**
   Basic concepts of reliability. Serial and parallel Systems. FMECA analysis.
7. **Vibration Analysis**
   Fourier series. Average and effective value. Spectral analysis. Applications.
8. **Information Systems for Maintenance**
   Importance of the information systems to the maintenance activity. Structure and functioning of an information system.
9. **Maintenance Costs**
   Direct and indirect Costs. Costs Optimization. Cost of Ownership of an Equipment. Cost of the Life Cycle of an Equipment.
10. **Maintenance Standards**
    NP 4492/2010 and related Norms: NP 4483:2009; NP EN 13269:2007; NP EN 13306:2007; NP EN 13460:2009; NP EN 15341:2009; CEN/TR 15628:2007.
11. **Maintenance Indicators**
    Elaboration of KPI. The KPI Norm.
12. **Maintenance management methodologies**
    TPM (Total Productive Maintenance). Lean maintenance. 5S. PDCA Cycle. 6 Sigma. A3 method. GUT Matrix. Ishikawa Diagram. Brainstorming. SWOT Analysis.

Bibliography

- FARINHA, J. M. T. (2018): "Asset Maintenance Engineering Methodologies". CRC Press; 1 edition (May 29, 2018). English. Printed in USA. ISBN-10: 1138035890. ISBN-13: 978-1138035898
- FARINHA, J. M. T. (2011) - *Manutenção – A Terologia e as Novas Ferramentas de Gestão.* MONITOR, Lisboa, Portugal. ISBN 978-972-9413-82-7.
- FARINHA, J. M. T. (1997) - *Manutenção das Instalações e Equipamentos Hospitalares - Uma Abordagem Terológica*, Livraria Minerva, Coimbra, 1997. ISBN: 972-8318-16-2.
- FERREIRA, Luís Andrade (1998) - *Uma Introdução à Manutenção*, Publindústria, Porto. ISBN: 972-95794-4-X
- Singiresu S. Rao (2004): *Mechanical Vibrations*. Prentice Hall ISBN 978-0-13-212819-3 (978-0-13-212819-3.
- Standard NP 4492:2010 and supporting Standards: NP 4483:2009 - NP EN 13269:2007 - NP EN 13306:2001 - NP EN ISO 9000:2015 - NP EN 13460:2009 - NP EN 15341:2009 - CEN/TR 15628:2007.

Access Conditions and Attendance Excuse

- According to the evaluation methodology and the general rules of ISEC.

Conditions for Exam Admission

- According to the evaluation methodology and the general rules of ISEC.

Evaluation Method

- The evaluation will be done by Final exam in the form of written test with a maximum duration of three hours.

Conditions for Results Improvement

- According to the evaluation methodology and the general rules of ISEC.

Date
11.01.2019

Signature from the lecturer responsible for the course