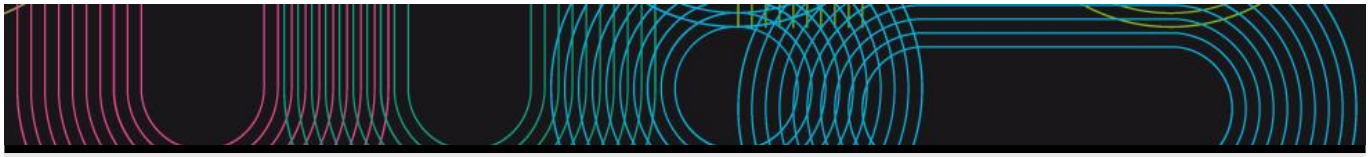

(*)Escola de Enxeñaría Industrial

Information
For additional information about the centre and its degres visit the centre's website https://eei.uvigo.es/

Degree in Industrial Technologies Engineering

Subjects

Year 3rd

Code	Name	Quadmester	Total Cr.
V12G363V01501	Applied electrotechnics	1st	6
V12G363V01502	Materials engineering	1st	6
V12G363V01503	Physics 3	1st	6
V12G363V01504	Hydraulic turbomachines	1st	6
V12G363V01505	Specialized mathematics	1st	6
V12G363V01602	Machine design and testing	2nd	6
V12G363V01603	Elasticity and additional topics in mechanics of materials	2nd	6
V12G363V01604	Manufacturing engineering	2nd	6
V12G363V01605	Electrical machines	2nd	6
V12G363V01606	Chemical technology	2nd	6

IDENTIFYING DATA				
Applied electrotechnics				
Subject	Applied electrotechnics			
Code	V12G363V01501			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language				
Department				
Coordinator	Novo Ramos, Bernardino			
Lecturers	Novo Ramos, Bernardino			
E-mail	bnovo@uvigo.es			
Web				
General description	The objective of Applied Electrotechnic is to complete the training of the students of the Industrial Technologies Degree in what is related with Three-phase Systems and Power Transformers. This subject will provide specific tools to analyse and evaluate the behaviour of the most usual electrical installations under balanced and unbalanced situations. The subject is conceived also, to provide the necessary knowledge and competencies to be able to follow some subjects in the 3rd and 4rd years of the Degree. The students have to be familiar with subjects like Basics of Theory of Circuits and Electric Machines and Calculus I and II because some of the information provided in these subjects will be necessary to follow Applied Electrotechnic, without and extra effort			

Competencies
Code

Learning outcomes	
Expected results from this subject	Training and Learning Results
(*)6. Mostrar habilidades sociales para entender a las familias y hacerse entender por ellas	

Contents	
Topic	
UNIT I: 3-PHASE CIRCUITS, POWER MEASUREMENTS AND REACTIVE POWER COMPENSATION. This Unit will allow the student to understand how to analyse 3-phase circuits under either balanced or unbalanced conditions Initially the unit covers the basic concepts for the analysis of balanced circuits. It continues analyising unbalanced circuits, the different methods to measure the electrical powers and the compensation of the reactive power.	Introduction: Generators, loads and 3-phase circuits Balanced 3-phase circuits. Voltages and currents. Conversion of 3-phase sources and loads. Analysis of balanced 3-phase circuits. Powers in balanced 3-phase circuits. Compensation. Analysis of unbalanced 3-phase circuits.
UNIT II: TRANSFORMERS This Unit will allow the student to learn about the constructive characteristics of the transformers, to determine its characteristic parameters and to understand the machine main properties and its utilization in the electrical systems.	Analogies between electric and magnetic circuits. Introduction to the transformers: constructive aspects. The ideal transformer. Operation of the real transformer. Equivalent circuit of the single-phase transformer real: e.m.f's and voltages. No-load and in short-circuit tests of the transformer. Voltage drops , losses and performance of a transformer. Autotransformers. 3-phasetransformers: Constitution, conection diagrams and tests. Instrument transformers.

Planning			
	Class hours	Hours outside the classroom	Total hours

Lecturing	20	60	80
Problem solving	9	18	27
Collaborative Learning	9	9	18
Laboratory practical	9	9	18
Essay questions exam	7	0	7

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	The usual lecture
Problem solving	The professor will guide the first steps of the alumni in order to show them how to analyse diferent problems/sytuations and how to solve them
Collaborative Learning	Once taght how to solve a "generalistic problem" the alumni will heve to create groups to find out the solutions to same proposed problems related with the subject. They will be requested to collaborate in order to hand the professor the proper solution at the end
Laboratory practical	Experimental solving of of proposed lab tests, realization of measurements and presentation of results.

Personalized assistance

Methodologies	Description
Laboratory practical	The doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed
Lecturing	he doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed
Problem solving	he doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	It will cover 40% of the mark of the second part assesment	20	
Problem solving	It will cover 100% of the mark of the first part assesment It will cover 40% of the mark of the second part assesment	70	
Laboratory practical	incluided in the second part theory test. They will be valued as a 10% of the final mark	10	

Other comments on the Evaluation

Continuous assessment (100%):

At the end of each Part (I & II) the student will perform a test that will be scored from 0 to 10 points. The passing mark is 5. The test will cover theoretical issues and practical exercisesIn each Part the student can reach 50% of the final mark. The passed partial tests are released from the corresponding part in the final exam.
For the students who pass all tests, the final mark will be the average of the marks of the partial tests.
Students who fail any or all partial tests, will have take a final exam whrere she/he will be graded from 0 to 10 points.
To pass the subject it is necessary to achieve a minimum grade of 3 points in each part and an avereage mark bigger than 5.
Students approved by partial tests can modify (maybe improve) their mark by presenting to the final exam.
The professors will indicate the dates and places of publication of marks and revisions

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Electrical machines/V12G363V01605

Subjects that are recommended to be taken simultaneously

Physics: Physics 2/V12G363V01202
Mathematics: Calculus 2 and differential equations/V12G363V01204

Subjects that it is recommended to have taken before

Basics of circuit analysis and electrical machines/V12G363V01302

Other comments

Requirements: To enrol in this subject is necessary either to had surpassed or to be enrolled in all the subjects of the previous courses of the one where this subject is summoned

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information

IDENTIFYING DATA				
Materials engineering				
Subject	Materials engineering			
Code	V12G363V01502			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	English			
Department				
Coordinator	Collazo Fernández, Antonio Díaz Fernández, Belén			
Lecturers	Collazo Fernández, Antonio Díaz Fernández, Belén			
E-mail	acollazo@uvigo.es belenchi@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This subject combines the scientific fundamentals that prove the relation structure-properties-performance with technological aspects such as the manufacturing processes and the service conditions.			

Competencies
Code

Learning outcomes	
Expected results from this subject	Training and Learning Results

Contents	
Topic	
Mechanical behavior of materials Properties of materials obtained by casting, molding and injection Properties of materials obtained by plastic and viscoelastic deformation Processing of metal powders Modification of properties by heat treatments, thermochemical treatments and thermomechanical treatments Welding processes and weldability Construction materials Tool materials	Plastic deformation Sheet-metal forming processes Casting and casting defects Fractography
Laboratory contents	Mechanical properties tests Non-destructive testing Metalography Hardenablity tests

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	33	66	99
Problem solving	7	7	14
Seminars	3	3	6
Laboratory practical	10	10	20
Mentored work	0	11	11
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentations given by the lecturer of the main contents of the subject

Problem solving	Proposal of a set of problems/exercises that students must resolve by themselves. Guidelines, required formulas and common routines will be given in the classroom. Some problem will be resolved at the classroom, by the lecturer or by a student.
Seminars	Additional explanations to solve the main difficulties about the subject contents
Laboratory practical	Activities for application of the theoretical knowledge to particular situations and for the acquisition of basic skills and procedures related to the subject. Students will use the laboratories with the suitable equipment and devices.
Mentored work	Students, individually or in group, elaborate a document or presentation about some important topic related to the subject. Student can be asked to prepare a seminar, a short research, a summary of a document or conference...

Personalized assistance

Methodologies	Description
Mentored work	Personalized attention, the lecturer will guide the preparation of the project. Any difficulty/doubt will be attended. Independently on the teaching modality, this support can be provided electronically (email, videoconference, FAITIC forum ...) after being formally requested.
Seminars	Personalized attention, time devoted to help students with any difficulty or doubt. Independently on the teaching modality, this support can be provided electronically (email, videoconference, FAITIC forum ...) after being formally requested.

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	The assessment will be completed with a written exam of short questions, tests or exercises. The purpose is to assess the level of knowledge achieved along the course.	60	
Laboratory practical	The laboratory activities will be assessed through the students attendance and participation, preparation of reports or visits to local companies.	25	
Mentored work	It will be assessed by the handed reports and/or the exhibition in the classroom of the prepared project.	15	

Other comments on the Evaluation

The continuous assessment will be followed during the teaching period of the subject according to the criteria established in the previous section. In the final exam, a minimum mark of 4 out of 10 is required in the own written exam to pass the subject. The date of the exam will be fixed by the school and can be checked at http://eei.uvigo.es. In case this minimum mark was not achieved, the whole mark will be that corresponding to the continuous assessment, this means that the mark of the final exam will not be added to the whole mark.

Students have the right to renounce to the continuous assessment system. This option must be asked officially. In this situation, the final exam will include the totality of the contents of the subject, and its qualification is 100%.

In the SECOND ATTEMPT (exam in July): The qualification obtained from the continuous assessment will be kept, unless the student request to be cancelled in due course. In this situation, the totality of the contents of the subject (those given in the classroom and in the laboratory) will be included in this final exam and the student could achieved 100% of the qualification. The date of the exam will be fixed by the school and can be checked at http://eei.uvigo.es.

EXTRAORDINARY CALL: the exam (questions, tests and/or exercises) will include the totality fo the contents and the qualification will be 100%.

Ethical commitment: student is expected to show an ethical behavior. In the case a non ethical behavior is detected (copy, plagiarism, use of forbidden electronic devices, or others), the student will failed with a qualification of 0%.

Sources of information

Basic Bibliography

Kalpakjian, S. and Schmid, S. R.,, **Manufacturing Engineering and Technology**, Pearson/Prentice Hall,

Mikell P. Groover, **Fundamentals of Modern Manufacturing: Materials, Processes, and Systems**, John Wiley & Sons,

Dieter, G. E., **MECHANICAL METALURGY**, McGraw-Hill Book Company,

Complementary Bibliography

Reina Gómez, M., **Soldadura de los aceros, aplicaciones.**, Gráficas Lormo,

Sindo Kou, **Welding Metallurgy**, John Wiley & Sons,

Krauss, G., **Steels: Heat Treatment and Processing Principles**, ASM International,

Brooks, CH., **Principles of the Surface Treatment of Steels.**, Inc. Lancaster,
Randall, M. G., **Sintering: Theory and Practice**, John Wiley & Sons,
Beeley, P., **Foundry Tecnology**, Butterworth-Heineman, Ltd.,

Recommendations

Subjects that are recommended to be taken simultaneously

Manufacturing engineering/V12G363V01604

Subjects that it is recommended to have taken before

Materials science and technology/V12G363V01301
Fundamentals of manufacturing systems and technologies/V12G363V01402
Mechanics of materials/V12G363V01404

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Methodologies
They will be adapted to the telematic tools available for the lectures. Modifications in the provided information given through FaiTIC, email or Campus Remoto will be eventually done as well.

* Non-attendance mechanisms for student attention (tutoring)
The tutoring could be given in person (provided that the health measures are guaranteed) or telematic (e-mail, Campus Remoto or FaiTIC forums) under the modality of previous agreement. A methodological adaptation will be made to students at risk, providing them with additional specific information, if it is proven that they cannot access the contents in a conventional way.

=== ADAPTATION OF THE TESTS ===

Those tests that are already being carried out telematically will be maintained and, as far as possible, the on-site tests will be maintained, adapting them to the current health regulations. The tests will be carried out in person, unless the Rector's Resolution indicates that they should be carried out in a non-presential manner, using the several tools available to the teaching staff. Those tests that cannot be carried out by telematic means will be replaced by others (guided autonomous work, etc.)

* Modification in the continuous assessment.

Continuous assessment [Previous Weight 40%] [Proposed Weight 60%]

IDENTIFYING DATA				
Physics 3				
Subject	Physics 3			
Code	V12G363V01503			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	López Vázquez, José Carlos			
Lecturers	López Vázquez, José Carlos			
E-mail	jclopez@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	The main goals of Physics III are: a) To get a deeper understanding of the physical foundations of engineering, specifically those related to electromagnetic and wave phenomena. b) To introduce the use of mathematical tools, in particular vector analysis and differential equations and their associated boundary value problems, within the framework of problems and models in Physics. c) To combine theoretical education and a practical engineering approach, stressing the relevance of fundamentals to deal with problem analysis and synthesis of solutions in real-life situations. d) To relate the topics in electromagnetism and wave phenomena fundamentals to the contents of other more technological subjects included in the curriculum for the Degree. The topics of Physics III are, essentially, an introduction to wave phenomena in general (three units) and the study of classical electromagnetism using an axiomatic approach employing a mathematical treatment based on differential vector operators (four units).			

Competencies	
Code	
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
C2	CE2 Understanding and mastering the basics of the general laws of mechanics, thermodynamics, waves and electromagnetic fields, as well as their application for solving engineering problems.
D10	CT10 Self learning and work.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
To know and to understand the physical foundations of electricity and magnetism as well as of vibrations and waves.	B10	C2	
To know and to be able to apply, in simple cases, vector analysis and differential equations of mathematical physics, as problem solving tools within the framework of fundamentals of physics.	B10	C2	
To be able to establish efficient strategies and procedures for solving problems in fundamentals of physics related to industrial technologies.	B10	C2	
To be able to implement specific solutions in the laboratory to experimental problems in fundamentals of physics.	B10	C2	D10

Contents	
Topic	
I.1. WAVE MOTION	1.1. Wave phenomena 1.2. Fundamental characteristics of waves 1.3. The wave equation 1.4. Plane waves 1.5. Wavefront and wavevector 1.6. Cylindrical and spherical waves 1.7. Longitudinal and transverse waves 1.8. Huygens' principle 1.9. Reflection and refraction of waves

I.2. MECHANICAL WAVES	2.1. The nature of mechanical waves 2.2. Longitudinal waves in thin rods 2.3. Longitudinal waves in springs 2.4. Transverse waves in strings 2.5. Power flow and intensity of a wave 2.6. Longitudinal waves in fluids
I.3. DESCRIPTION OF PHYSICAL QUANTITIES BY MEANS OF VECTOR ANALYSIS	3.1. Differential of arc of a curve 3.2. Scalar fields 3.3. Directional derivative 3.4. Gradient 3.5. Vector fields 3.6. Flux of a vector field 3.7. Solenoidal fields 3.8. Divergence of a vector field 3.9. Ostrogradski-Gauss' theorem or divergence theorem 3.10. Divergence of a solenoidal field 3.11. Circulation of a vector field 3.12. Rotation or curl of a vector field 3.13. Stokes' theorem 3.14. Conservative fields
II.1. GENERAL EQUATIONS OF ELECTROMAGNETISM	1.1. Definition of electric and magnetic fields 1.2. Field sources: macroscopic electric charges and currents 1.3. Relations among fields E and B and their sources: Maxwell's equations 1.4. Free charge 1.5. Polarization charge 1.6. Electric current 1.7. Polarization current 1.8. Magnetization current 1.9. Maxwell's equations in function of fields E, D, B, and H 1.10. Boundary conditions for electromagnetic fields 1.11. Electrodynamic potentials 1.12. The energy law of the electromagnetic field
II.2. TIME-INDEPENDENT FIELDS: ELECTROSTATICS, STEADY ELECTRIC CURRENT AND MAGNETOSTATICS	2.1. Fundamental equations of electrostatics 2.2. Electric dipole 2.3. Fundamental equations for steady electric current 2.4. Equations including media properties 2.5. Electrical resistance 2.6. Joule's law 2.7. Electromotive forces and generators 2.8. Potential distribution in a resistor 2.9. Fundamental equations of magnetostatics 2.10. Equations including media properties 2.11. Magnetic forces 2.12. Magnetic circuit 2.13. Magnetic dipole
II.3. ELECTROMAGNETIC INDUCTION AND QUASISTATIC FIELDS	3.1. Electromagnetism in moving media 3.2. Galilean transformation of electric and magnetic fields 3.3. Electromotive force around a circuit 3.4. Faraday's law of electromagnetic induction 3.5. Definition of quasistatic fields 3.6. Self-inductance and mutual inductance 3.7. Magnetic energy
II.4. ELECTROMAGNETIC WAVES	4.1. Wave equations for fields E and H 4.2. E.M. monochromatic plane waves in lossless media 4.3. E.M. monochromatic plane waves in lossy media 4.4. Incidence of a plane wave on an interface between two perfect dielectrics 4.5. Incidence of a plane wave on an interface between a perfect dielectric and a conductor
III.1 LABS: STRUCTURED ACTIVITY SESSIONS	1.1 Structured activity sessions: - Experimental data processing (approximate quantities, measurement of physical magnitudes, error estimation) - Adequate operation with basic measurement instruments (flex-meter, micrometer, multimeter (analog and digital), oscilloscope) - Laboratory experiments with mechanical or electromagnetic waves (emission and reception of ultrasonic waves, microwaves or light waves, standing waves along one direction, Michelson interferometer)

III.2 LABS: UNSTRUCTURED ACTIVITY (OPEN LAB) SESSIONS	2.1. Unstructured activity (open lab) sessions: - A practical problem, formulated with basic initial data, will be assigned to each working team. Then, under the teacher's supervision, each team must analyze the problem, select a possible solution and carry it out in the lab - For the open lab problems, diversity of topics and experimental techniques are considered within the field of wave and electromagnetic phenomena, in particular, electric current conduction and electromagnetic induction in quasi-static regime - As a reference, some open lab problems that can be proposed are: measuring the electric field on a weakly conducting sheet, numerical solution of the Laplace equation, measuring the self-inductance of a coil or a solenoid, measuring the mutual inductance of two coils or two solenoids - As an option, the open lab session may be replaced by a well-documented piece of work reporting some topic/technique/process/device related to science or technology where wave or electromagnetic phenomena play an essential role. The report must include a model of the problem, clearly identifying the relevant quantities and physical laws

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	30	50
Problem solving	11.5	30.5	42
Laboratory practical	18	18	36
Essay questions exam	2	0	2
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	0	18	18

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	The main topics of the subject are introduced by the teacher using projected presentations and the blackboard, emphasizing the theoretical basis and fundamentals and stressing the critical or key points. Eventually, demonstrative experiments or audiovisual material could be employed
Problem solving	Academic problems related to the topics of the subject are formulated and worked out at the blackboard by the teacher or the students. By practicing standard schemes, formulas or algorithms and by analyzing the results the student must develop adequate skills to be able to obtain the correct solution to the problem on his/her own at the end of the course
Laboratory practical	Activities for applying the knowledge to particular situations and for developing basic and procedural skills related to the subject. These activities will be held in specific rooms with specialized equipment (hardware and computer labs)

Personalized assistance

Methodologies	Description
Lecturing	In office hours
Laboratory practical	In office hours
Problem solving	In office hours

Assessment

	Description	Qualification	Training and Learning Results
Essay questions exam	Test that include open questions on a topic. Students should develop, relate, organize and present knowledge on the subject in an argued response	50	B10 C2
Problem and/or exercise solving	Test in which the student must solve a series of problems and/or exercises in a time/conditions set by the teacher	40	B10 C2 D10
Report of practices, practicum and external practices	Each team should write a report on the activities carried out. The report must include the developed tasks and procedures, the obtained results or taken observations, as well as a detailed description of the data processing and analysis	10	B10 C2 D10

Other comments on the Evaluation

1. CONTINUOUS ASSESSMENT

CONTINUOUS ASSESSMENT TESTS (40%)

- Mark A0 (20%) will be obtained from essay questions exams on topics of Parts I and II

- Mark L0 (20%) will be obtained from a problem solving exam on topics of Part III.1 (10%) and from the open lab report (or the topic report) corresponding to Part III.2 (10%). Only students that have regularly attended the lab sessions can obtain the mark L0

FINAL EXAM (60%)

- It is held in the December-January call

- Mark T1 (30%) will be obtained from an essay questions exam on topics of Parts I and II

- Mark P1 (30%) will be obtained from a problem solving exam on topics of Parts I and II

GLOBAL MARK

- The global mark G1 is obtained as

$$G1 = T1 + P1 + L0 + A0$$

- To pass the course, a student must obtain a global mark G1 equal to or higher than 5

2. END-TERM ASSESSMENT

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

- It is held on the same date as the final exam in the December-January call

- Mark A1 (20%) will be obtained from essay questions exams on topics of Parts I and II

- Mark L1 (20%) will be obtained from a problem solving exam on topics of Part III.1

GLOBAL MARK

- In this case the global mark G1 is obtained as

$$G1 = T1 + P1 + L1 + A1$$

- To pass the course, a student must obtain a global mark G1 equal to or higher than 5

- A student that had previously obtained marks L0 or A0 (or both) would choose between:

a) answering the exam(s) corresponding to mark L1 and/or mark A1, in such a way that the new mark L1 replaces L0 and/or the new mark A1 replaces A0

b) holding mark L0 and/or mark A0 instead of answering the exam(s) corresponding to mark L1 and/or mark A1, respectively

3. ASSESSMENT IN THE SECOND CALL (JUNE-JULY)

FINAL EXAM (60%)

- It is held in the June-July call

- Mark T2 (30%) will be obtained from an essay questions exam on topics of Parts I and II

- Mark P2 (30%) will be obtained from a problem solving exam on topics of Parts I and II

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

- It is held on the same date as the final exam in the June-July call

- Mark A2 (20%) will be obtained from essay questions exams on topics of Parts I and II

- Mark L2 (20%) will be obtained from a problem solving exam on topics of Part III.1

GLOBAL MARK

- In this case the global mark G2 is obtained as

$$G2 = T2 + P2 + L2 + A2$$

- To pass the course, a student must obtain a global mark G2 equal to or higher than 5

- A student that had previously obtained marks L0, L1, A0 or A1 would choose between:

a) answering the exam(s) corresponding to mark L2 and/or mark A2, in such a way that the new mark L2 and/or the new mark A2 will replace the marks of the same type (L0 or L1 and/or A0 or A1, respectively)

b) holding the most recent marks of each type (L0 or L1 and/or A0 or A1) instead of answering the exam(s) corresponding to mark L2 and/or mark A2, respectively

4. NOTATION FOR MARKS

- L = the latest mark among L0, L1 and L2

- A = the latest mark among A0, A1 and A2

- T = T1 in December-January call (1st edition) or T2 in June-July call (2nd edition)

- P = P1 in December-January call (1st edition) or P2 in June-July call (2nd edition)

- G = G1 in December-January call (1st edition) or G2 in June-July call (2nd edition)

- In any of the calls the global mark G is obtained as

$$G = T + P + L + A$$

- To pass the course, a student must obtain a global mark G equal to or higher than 5

5. SUPPLEMENTARY ASSESSMENT RULES

- Presentation of DNI or any other identification document is compulsory during tests and exams

- Resources and material that can be used in the tests and final exams:

a) In problem solving exams on topics of parts I and II (corresponding to marks P1 and P2) it is allowed to employ notes about theory adequately bound (this includes both the Department lecture notes on the subject and the handwritten notes of the student, exclusively about theory), one textbook and one mathematics handbook (Bronshtein or similar). It is forbidden the user of any workbooks or collections of worked out problems

b) In any other case, the use of any additional resources is forbidden

c) Students should not possess or use any electronic device during the tests and exams, unless specifically authorised to do so. The mere fact that a student carries an unauthorised electronic device into the examination room will result in failing the subject in the present academic year and the global mark will be "suspenso (0.0)"

- The tests and exams will be jointly defined and assessed by the teaching team of the subject

- The global mark for students not attending the final exam will be "non presentado"

- The dates for the final exams at each call will be assigned by the board of directors of the School of Industrial Engineering (E.E.I.)

- The exams corresponding to the end-of-degree call, as well as any exam held on date and time other than the dates and times stated by the E.E.I. for official exams, could have a different format than the one described above. Nevertheless, each mark (L, A, T and P) will hold its value to calculate the global mark G

- The date and hours for revision of marks and tests and exams results will be announced in advance. Revision out of this date and hours will be possible only if a reasonable reason for non-attendance is documented

6. ETHICAL COMMITMENT

Every student is expected to follow an appropriate ethical behaviour. In the case that unethical conduct is detected (copy, plagiarism, utilisation of unauthorised electronic devices, or others), it will be considered that the student does not fulfil the necessary requirements to pass the subject. In this case, the global mark in the present academic year will be "suspenso (0.0)"

Sources of information

Basic Bibliography

J. L. Fernández, M. J. Pérez-Amor, **Guía para la resolución de problemas de electromagnetismo. Compendio de teoría**, Reverté, 2012

J. L. Fernández, M. J. Pérez-Amor, **Guía para la resolución de problemas de electromagnetismo. Problemas resueltos**, Reverté, 2012

M. Alonso y E. J. Finn, **Física**, Addison-Wesley Iberoamericana, 2000

M. Alonso and E. J. Finn, **Physics**, Pearson, 1992

Complementary Bibliography

M. R. Spiegel, **Análisis vectorial**, McGraw-Hill, serie Schaum, 2011

M. R. Spiegel, **Schaum's Outline of Vector Analysis**, McGraw-Hill, Schaum's Outline Series, 2009

D. K. Cheng, **Fundamentos de electromagnetismo para ingeniería**, Addison-Wesley, 1997

D. K. Cheng, **Fundamentals of Engineering Electromagnetics**, Prentice Hall, 1993

J. A. Edminister, **Electromagnetismo**, McGraw-Hill, serie Schaum, 1992

J. A. Edminister, M. Nahvi, **Schaum's Outline of Electromagnetics**, McGraw-Hill, Schaum's Outline Series, 2013

I. Bronshtein, **Manual de matemáticas para ingenieros y estudiantes**, MIR 1982, MIR-Rubiños 1993,

I. N. Bronshtein, K. A. Semendyayeb, **Handbook of Mathematics**, Springer, 2007

M. R. Spiegel, **Fórmulas y tablas de matemática aplicada**, McGraw-Hill, serie Schaum, 2014

M. R. Spiegel, S. Lipschutz, J. Liu, **Schaum's Outline of Mathematical Handbook of Formulas and Tables**, McGraw-Hill, Schaum's Outline Series, 2011

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Algebra and statistics/V12G360V01103
Mathematics: Calculus 1/V12G360V01104
Mathematics: Calculus 2 and differential equations/V12G360V01204

Other comments

Requirements: To register in this subject, it is mandatory to have been registered or to be registered in all the subjects corresponding to the first and second years of the curriculum of the Degree in Industrial Technologies Engineering

In particular, it is highly recommended reviewing the topics in Physics and Mathematics included within the subjects that should have been passed previously

In the event of discrepancy, the Spanish version of this syllabus prevails

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

* Teaching methodologies modified
All the methodologies (lecturing, problem solving and laboratory practical): in the blended learning regime face-to-face classroom activities will be combined with on-line lecturing through the virtual campus (□Campus Remoto□), using FAITIC platform as an additional support. In the distance learning regime only online lecturing will take place through virtual

campus (Campus Remoto), using FAITIC platform as an additional support as well. To guarantee the access of the students to the materials and resources of the course other methodologies and media could be implemented if needed.

In particular, for the laboratory practical in the blended learning regime the operation of experimental devices by the students and the associated data acquisition activities could suffer major restrictions (due to the reduced effective capacity of the laboratory classroom, the mandatory use of personal protective equipment, the implementation of special hygiene measures and other factors). For these reasons, these activities will be mostly replaced by demonstrations developed by the lecturer in a session face-to-face with part of the students in a laboratory group. These demonstrations could be followed online by the rest of the students of the same group. Data processing and analysis are greatly independent of the operation of experimental devices and can be developed outside of the laboratory classroom (in another classroom, at home, etc..). In the distance learning regime, the laboratory practical will be developed entirely online and the operation of experimental devices and data acquisition activities will be completely replaced by demonstrations developed by the lecturer that could be followed online by the students. These demonstration could be complemented by other specific audiovisual materials.

* Non-attendance mechanisms for student attention (tutoring)
Office hours and tutoring could be developed both face-to-face (provided that the health safety can be guaranteed using personal protective equipment) or online, by using asynchronous media (email, forum, etc..) or by making an appointment (videoconference).

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]
The weights of the continuous assessment classroom (A-20%) and laboratory (L-20%) tests and the theory (T-30%) and problems (P-30%) final exams are kept unchanged. However, more flexibility could be introduced in the type of questions that can be employed in each part as detailed below.

Continuous assessment test, part A, weight 20%. Type of assessment: essay questions.
=>
Continuous assessment test, part A, weight 20%. Type of assessment: objective questions, problem and/or exercise solving and essay questions.

Continuous assessment test, part L, weight 20%. Type of assessment: problem and/or exercise solving (10%) and report (10%).
=>
Continuous assessment test, part L, weight 20%. Type of assessment: problem and/or exercise solving and objective questions (10%) and report (10%).

Final exam, part P, weight 30%. Type of assessment: problem and/or exercise solving.
=>
Final exam, part P, weight 30%. Type of assessment: problem and/or exercise solving and objective questions.

Final exam, part T, weight 30%. Type of assessment: essay questions.
=>
Final exam, part T, weight 30%. Type of assessment: objective questions and essay questions.

* New tests

* Additional Information

IDENTIFYING DATA				
Hydraulic turbomachines				
Subject	Hydraulic turbomachines			
Code	V12G363V01504			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language				
Department				
Coordinator	Meis Fernández, Marcos			
Lecturers	Meis Fernández, Marcos			
E-mail	mmeis@uvigo.es			
Web				
General description	This syllabus presents information the Hydraulic Turbomachines course that belongs to the 3rd year of the degree in Industrial Technologies Engineering, 2020-2021, in accordance to the marked guidelines by the European Space of Upper Education. This is a first course in Hydraulic Turbomachines, focusing on the topics that are relevant to Industrial Technologies Engineering applications. The course is intended to acquire essential knowledge about the fundamental principles and performance of Hydraulic Turbomachines, studying the main parts of a turbomachines and their classification, the application of fundamental Euler□s theorem, and the performance of both turbines and pumps with different arrangements in hydroelectric power plants and pumps stations, respectively. Finally, some brief comments are explained to acquire fundamental knowledge of fans, airfoils and positive displacement machines			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
C8	CE8 Knowledge of the basic principles of fluid mechanics and their application to solving problems in the field of engineering. Calculation of pipes, channels and fluid systems.
C25	CE25 Applied knowledge of the basics of fluidmechanics systems and machines.
D2	CT2 Problems resolution.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Understand fundamentals of hydraulic machines	B3	C8 C25	D2 D9 D10
Acquire skills for sizing pumps facilities and fluid machines	B3	C8 C25	D2 D9 D10

Contents	
Topic	
1.- Introduction	1.- Turbomachinery. Classification 2.- Hydraulic turbomachines 3.- Applications to the Industry 4.- General specifications
2.- Transfer of Energy	1.- Equation of conservation of the energy 2.- Hydraulic turbomachines applications 3.- Dimensionless parameters 4.- Power and efficiencies
3.- Similarity and Characteristic Curves	1.- Similarity in hydraulic turbomachines 2.- Practical application of similarity laws 3.- Comparison of hydraulic turbomachines 4.- Characteristic curves in hydraulic pumps 5.- Characteristic curves in hydraulic turbines 6.- Dimensionless coefficients. Specific speed and specific power

4.- Transfer of Work	1.- Fundamental equation of hydraulic turbomachinery: Euler's equations. Expressions 2.- One-dimensional (ideal) theory of hydraulic turbomachinery 3.- Two-dimensional (ideal) theory of hydraulic turbomachinery 4.- Real flow. Losses 5.- Cavitation in HTM
5.- Fluids machines of low pressure rise	1.-Classification 2.- Fans. Characteristic curves 3.- Wind turbines. Classification - Disk actuator theory.Betz's limit - Fundamentals Theory of Airfols. NACA Airfoils - Blade element theory - Characteristic curves
6.- Positive displacement machines and hydraulic transmissions	1.- Types and classification 2.- Alternative and rotatory pumps. 3.- Hydraulic engines of positive displacement 4.- Transmissions and hydraulic couplings
Laboratory sessions	1. Introduction to the pneumatic systems: - detailed description of the pneumatic systems and his components. -Basic circuits. -Problems resolutions 2. Resolution of problems of of hydraulic turbomachines 3. Hydraulic turbines - Hill chart Francis Turbine 4. Resolution of problems of Positive displacemetn machines

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Laboratory practical	6	7	13
Problem solving	12	18	30
Essay questions exam	3	0	3
Problem and/or exercise solving	0	12	12
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Readings solution of problems
Laboratory practical	Practices of pneumatic (see description in contents) Practices of HTM (see description in contents)
Problem solving	Calculation methods and techniques Interpretation of results Practical cases

Personalized assistance	
Methodologies	**Description**
Problem solving	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students
Lecturing	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students
Laboratory practical	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students

Assessment		
	Description	Qualification Training and Learning Results

Essay questions exam	Proof written that it will be able to consist of: - theoretical questions - practical questions - Resolution of exercises/problems - Short covering of a topic	80	B3	C8	D2 D9 D10
Problem and/or exercise solving	Resolution of exercises proposed, including: -Short reports/exercises proposed	20	B3	C8	D2 D9 D10
(*)	-	-			

Other comments on the Evaluation

Continuous evaluation: represents 20% of the grade, which consists of solving some proposed exercises. Except official renounce of the student, the course is followed under continuous assessment mode.

Continuous assessment grading is not saved year after year

Final exam (first call): 80% of the total mark, which consists of theoretical question, practical questions, resolution of exercises/problems or short covering of a topic

July final exam (second call): represents 100% of the grade (continous evaluation is not considered)

Ethical Commitment: In case of noticing a non ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices,and others) it will be considered that the student does not gather the necessaryrequirements to pass the course. In this case, the global qualification iof the present academic course will be failed (0.0)

Sources of information

Basic Bibliography

Viedma A., Zamora B., **Teoría y Problemas de máquinas hidráulicas**, 3º Ed., Horacio Escarabajal Editores., 2008
Mataix, C., **Turbomáquinas Hidráulicas**, Editorial ICAI, 1975
Mataix, C., **Mecánica de Fluidos y Máquinas Hidráulicas**, Editorial del Castillo S.A., 1986
Srinivasan, K.M., **rotodynamic Pumps**, New Age International Publishers, 2008

Complementary Bibliography

Hernández Krahe, J. M, **Mecánica de Fluidos y Máquinas Hidráulicas.**, UNED, 1998
Krivchenko, G, **Hydraulic Machines: Turbines and Pumps**, 2ª ed., Lewis, 1994
Creus, A., **Neumática e Hidráulica.**, Marcombo Ed., 2011
Karassik, I. J., **Pump Handbook**, 2ª ed., Nueva York, McGraw-Hill., 1986

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Calculus 2 and differential equations/V12G360V01204
Fluid mechanics/V12G360V01403

Other comments

Recommends to the student:
Attend to class
Spend the hours outside the classroom studying the subject

Contingency plan

Description

EXCEPTIONAL PLANNING
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishesan extraordinary planning that will be activated when the administrations and the institution itself determine it, consideringsafety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee,at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well inadvance) by the students and teachers through the standardized tool.

ADAPTATION OF THE METHODOLOGIES

Teaching methodologies maintained: Lecturing and tutoring. In any case, if it is needed, they will be substituted by distance learning, using CAMPUS REMOTO or any other available platform

Teaching methodologies modified: Laboratory. This will be substituted by explanatory videos or additional teaching material to explain the different topics

Non-attendance mechanisms for student attention (tutoring): Telematic technology will be used, such as CAMPUS REMOTO or any other available platform, to get in contact with the students

Modifications (if applicable) of the contents: None

Additional bibliography to facilitate self-learning: None

Other modifications: Assessment criteria does not change.

ADAPTATION OF THE TESTS
If it is needed, final exam will be substituted by 2 or 3 continuous evaluation tests. These tests can comprise test questions (true or false or several choices) or exercise to solve through Faitic or Campus Remoto in a limited period of time

IDENTIFYING DATA				
Matemáticas da especialidade				
Subject	Matemáticas da especialidade			
Code	V12G363V01505			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language				
Department	Matemática aplicada I			
Coordinator	Vidal Vázquez, Ricardo			
Lecturers	Vidal Vázquez, Ricardo			
E-mail	rvidal@uvigo.es			
Web				
General description				

Competencias
Code

Resultados de aprendizaxe	
Expected results from this subject	Training and Learning Results

Contidos	
Topic	
Tema 1. Resolución de ecuacións non lineais	1. Métodos directos, de bisección e de punto fixo. 2. Métodos de linealización.
Tema 2. Ampliación de ecuacións diferenciais	1. Métodos numéricos de Euler e Runge-Kutta.
Tema 3. Variable complexa	1. O corpo dos números complexos 2.Funcións holomorfas 3. Integración complexa 4. Series de potencias 5. Series de Laurent 6.Teorema de los residuos 7. Transformada z
Tema 4. Análise de Fourier e Transformadas integrais	1. Espazos con produto escalar 2. Sistemas ortonormales completos 3. Series de Fourier trigonométricas 4. Problemas de Sturm-Liouville 5. Transformada de Fourier 6. Transformada de Laplace 7. Aplicacións

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	31	62	93
Prácticas con apoio das TIC	18	27	45
Exame de preguntas de desenvolvemento	3	3	6
Resolución de problemas e/ou exercicios	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Exposición da teoría. Translación de problemas técnicos a modelos matemáticos.
Prácticas con apoio das TIC	Técnicas de cálculo e programación, presentación e interpretación de solucións.

Atención personalizada

Methodologies	Description
Lección maxistral	O profesor atenderá as dúbidas e preguntas do alumnado.
Prácticas con apoio das TIC	O profesor atenderá as dúbidas e preguntas do alumnado.

Avaliación

	Description	Qualification	Training and Learning Results
Exame de preguntas de desenvolvemento	Realizarase un exame final de resolución de problemas na aula informática onde se poderán utilizar os programas preparados polo alumno, sobre os contidos de toda a materia.	60	
Resolución de problemas e/ou exercicios	Avaliación continua: Asistencia as clases teóricas e practicas. Presentación dunha worksheet en Sage cos traballos propostos ó alumno.	40	

Other comments on the Evaluation

Para os alumnos que renuncien á avaliación continua o examen final suporá o 100% da nota.

A avaliación dos alumnos en segunda convocatoria consistirá nun exame sobre os contidos da totalidade da materia, que suporá o 100% da nota.

COMPROMISO ÉTICO:

"Esperase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamiento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) se considerará que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a calificación global no presente curso académico será de suspenso (0.0)."

Bibliografía. Fontes de información

Basic Bibliography

E. Corbacho, **Matemáticas de la Especialidad**, Curso 2014-2015,

F. De Arriba, E. Corbacho, MC. Somoza, R. Vidal, **Implementación e desenvolvemento de aulas de matemáticas avanzadas en Sage**, 978-84-8158-796-8, 2018

F. De Arriba, A. Castejón, E. Corbacho, MC. Somoza, R. Vidal, **Implementacióne e desenvolvemento de aulas de xeometría euclídea e diferencial en Sage**, 978-84-8158-845-3, 2020

M.R. Spiegel, **Análisis de Fourier. Teoría y problemas**,

M. Crouzeix , A.L. Mignot, **Analyse numérique des équations différentielles**,

Complementary Bibliography

P.G. Ciarlet, **Introduction à l'analyse numérique matricielle et à l'optimisation**,

H. Rinhard, **Éléments de mathematiques du signal**,

D.G Zill, **Ecuaciones diferenciales con aplicaciones de modelado**,

Recomendacións

Subjects that it is recommended to have taken before

Matemáticas: Álxebra e estatística/V12G360V01103
Matemáticas: Cálculo I/V12G360V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G360V01204

Other comments

Requisitos:
Para matricularse nesta materia é necesario superar ou ben estar matriculado de todas as materias dos cursos inferiores ao curso no que está situada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
Se a situación sanitaria o requiere,
- A actividade docente realizaráse a través de Campus Remoto, utilizando tamén a plataforma de teledocencia FAITIC como reforzo, todo elo sen perxuicio de poder utilizar medidas complementarias que garanticen a accesibilidade dos

IDENTIFYING DATA				
Machine design and testing				
Subject	Machine design and testing			
Code	V12G363V01602			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Segade Robleda, Abraham Casarejos Ruiz, Enrique			
Lecturers	Casarejos Ruiz, Enrique Segade Robleda, Abraham			
E-mail	asegade@uvigo.es e.casarejos@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This subject is intended to allow the students to apply the fundamentals of Mechanism and Machines Theory to the design of machines as well as the necessary knowledge, comprehension, and application of these concepts concerning to the field of Mechanical engineering. It also provides the students with the most important concepts related to the design of machines. The students will know and apply analysis methods for the design of machines by applying analytical methods or/and through the effective use of simulation software.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
C13	CE13 Knowledge of the principles of the theory of machines and mechanisms.
C26	CE26 Knowledge and abilities to calculate, design and test machines.
D2	CT2 Problems resolution.
D9	CT9 Apply knowledge.
D16	CT16 Critical thinking.
D20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Knowledge of calculation methods applied in Mechanical design.	B3 B4 B5	C13 C26	D2 D9 D16
Knowledge and design capabilities applied in mechanical power transmissions.	B6	C13 C26	D2 D9 D16 D20
Knowledge of the fundamental laws applied in the study of machine elements.	B11	C13 C26	D2 D9 D16 D20
Calculation capabilities and analysis applied for different machine components.	B3 B11	C13 C26	D2 D9 D16

Contents

Topic	
Mechanical design	1. Design vs. static loads 2. Design vs. dynamic loads
Power Transmissions	3. Introduction to power transmission systems 4. Gears (spur, bevel, and worm gears) 5. Axles and shafts
Machine elements	6. Clutches and brakes 7. Bolted joints and power screws 8. Plain and ball bearings

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	23	19.5	42.5
Problem solving	9	30	39
Laboratory practical	18	47	65
Objective questions exam	3.5	0	3.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Lectures about the topics of the subject
Problem solving	Discussion of exercises
Laboratory practical	Practical sessions including specific material and software tools.

Personalized assistance	
Methodologies	**Description**
Lecturing	Group or individual tutorial sessions will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers
Problem solving	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.
Laboratory practical	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.

Assessment					
	Description	Qualification	Training and Learning Results		
Laboratory practical	Attendance and participation as well as practices reports, papers, and tests will be rated. However, to be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points. Learning outcomes: all will be graded	20		C13 C26	D2 D9 D16 D20
Objective questions exam	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded	80	B3 B4 B5 B6 B11	C13 C26	D2 D9 D16

Other comments on the Evaluation

Students must achieve 5 points (*) or higher grade to pass the subject, following these rules:

- Laboratory Practical.
    - Students are required to attend and utilized the laboratory/Computer room. Practices reports, papers, and tests for each practice session as well as proposed works/papers from tutorials will be evaluated and graded with a maximum of 2 points. This grade will be kept for the second term in the student's evaluation records (July). To be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points.
    - For those students who have been officially granted the right to waive their continued evaluation, there will be a mandatory final test where they will be able to get a maximum grade of 2 points. However, an advanced request must be made to the professor to prepare the necessary materials for this test.

- Objective question exam. It will be graded in a test that have a minimum grade of 8 points.

(*) Grades are calculated using a system of numerical qualification from 0 to 10 points conforming to the Spanish current legislation (RD 1125/2003, 5 September; BOE 18 September).Ethical commitment: An adequate ethical behaviour of the student is expected at all times. In case an unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, and others); the student will be considered unfit to meet the necessary requirements to pass the subject. In this case, the overall qualification in the current academic year will be a Fail grade (0.0).

The use of any electronic devices during tests is completely forbidden unless is specified and authorized. The fact of introducing unauthorized electronic devices in the examination room will be considered reason enough to fail the subject in the current academic year and the overall qualification will be a Fail grade (0.0).

Sources of information

Basic Bibliography

Norton, R., **Machine Design. An Integrated Approach**, Pearson, 2012

Shigley, J.E, **Mechanical Engineering Design**, 9ª edición, Mc Graw Hill, 2012

Norton, R., **Diseño de Máquinas. Un Enfoque Integrado**, Pearson, 2012

Shigley, J.E, **Diseño de en Ingeniería Mecánica**, 9ª edición, Mc Graw Hill, 2012

Complementary Bibliography

Mott, Robert L., **Machine Elements in Mechanical Design**, Pearson, 2006

Lombard, M, **Solidworks 2013 Bible**, Wiley, 2013

Hamrock, Bernard J, et al., **Fundamental Machine Elements**, Mc Graw Hill, 2000

Mott, Robert L., **Diseño de elementos de máquinas**, Pearson, 2006

Hamrock, Bernard J, et al., **Elementos de Máquinas**, Mc Graw Hill, 2000

Recommendations

Subjects that it is recommended to have taken before

Materials science and technology/V12G360V01301
Mechanics of materials/V12G360V01404
Mechanism and machine theory/V12G360V01303

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

In the event that attendance to classes become legally entirely or partially limited, the measures set on place will be:

1. To guarantee the necessary means, namely personal computer or internet access, to every enrolled student so they can follow the distance learning classes, appropriately. Therefore, to apply the appropriate solutions, any student who does not have any of these means should inform the course coordinator.

2. To inform students of the different measures adopted, the department will use the platform, Faitic.

3. On top of that, in the case of cancelation of face-to-face classes, the teaching guide will show the next modifications:

A. Competences. They will not be modified.
B. Learning outcomes. They will not be modified.
C. Contents. They will not be modified.
D. Planning. It will not be modified.

E. Methodology. It will be modified:
Lecturing and Problem solving. They will require the employment of electronic means (virtual classroom of the Remote Campus or others).

Laboratory Practices. The department will provide every student access to CAD and FEM software, so that they can carry out the practices remotely instead of from the Mechanical Engineering laboratory. The professor will supervise these practices using electronic means (virtual classroom of the Remote Campus or others).

F. Tutoring Lessons. They will be carried out by previously arranged electronic means (e-mail, faitic forums or virtual classroom at campus remote,).

G. Assessment. Assessment methodologies/test will not be modified: Laboratory practical and Essay questions exam. Description, qualification, and competences, they will not be modified. All exams will use electronic means (virtual classroom of the Remote Campus or others); the department will publish in advance the specific rules for each test in the platform, Faitic. According to attendance at the virtual practice sessions, the professor will compute and validate each practice attendance on virtual classroom of the Remote Campus.
Partial tests for the evaluation of specific contests of the subject can be proposed. Once again, the professor will publish in advance the rules concerning each test in the platform, Faitic.

H. Bibliography. Besides the bibliographical references found in this guide, the documentation provided at Faitic, and the problem bulletins and previous exams, the professor might facilitate additional notes, videos, web-references, and others, so that students can appropriately follow the course during the non-face-to-face classes.

This guide can be modified following Rectoral rules.

IDENTIFYING DATA				
Elasticity and additional topics in mechanics of materials				
Subject	Elasticity and additional topics in mechanics of materials			
Code	V12G363V01603			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Comesaña Piñeiro, Rafael			
Lecturers	Comesaña Piñeiro, Rafael Riveiro Rodríguez, Antonio			
E-mail	racomesana@uvigo.es			
Web				
General description	This course will study the fundamentals of elasticity and deepen the study of mechanics of materials in order to be able to apply their knowledge to the actual behavior of solids (structures , machinery and resistant elements in general). This course, along with mechanics of materials course, is a holder of more specialized subjects whose object is the mechanical design.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
C14	CE14 Knowledge and use of the principles of strength of materials.
D2	CT2 Problems resolution.
D5	CT5 Information Management.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Knowledge of the foundations of the elasticity theory	B3	C14	
Further deepening on mechanics of materials and stress analysis	B3 B4	C14	D2 D10
Knowledge of deformations in beams and shafts	B3 B4	C14	D2 D9
Ability to apply the knowledge of elasticity and mechanics of materials, and to analyze the mechanical performance of machines, structures, and general structural elements	B4	C14	D2 D5 D9
Ability to take decisions about suitable material, shape and dimensions for a structural element subjected to a specific load	B4	C14	D2 D5 D9 D17
Knowledge of different solving methods for structural problems and ability to choose the most suitable method for each specific problem	B4	C14	D2 D5 D9

Contents
Topic

Fundamentals of elasticity	Introduction to the theory of elasticity Stress analysis of elastic solids Strain Stress-strain relationships Two-dimensional elasticity
Criteria of failure	Saint-Venant's failure criterion Tresca's failure criterion Von-Mises' failure criterion Safety coefficient
Bending	Non uniform bending: Shear stresses. Zhuravski expression Principal stresses. Stress trajectories Bending and axial load: Normal stresses. Neutral axis Eccentric axial loads Kern of the cross-section Beams of different materials
Bending. Statically indeterminate beams	General method Settlements in fixed supports Continuous beams Simplifications in symmetric and antisymmetric beams
Torsion	Definition Coulomb's fundamental theory Static torque diagrams Stress and angle of twist Statically indeterminate problems
Combined loads	Definition Bending and torsion loaded circular shafts Shear center Stress and strain calculation in plane-spatial structures
Strain energy and energy methods	Strain energy: Axial load/shearing loads/bending/torsion/general expression. Clapeyron's theorem Indirect and direct work Maxwell-Betti Reciprocal Theorem. Applications. Castigliano's theorem. Mohr's integrals. Applications. Principle of virtual works.
Trusses	Definition and general comments Degree of indeterminacy Analytical method of force calculation Pinned joint displacement determination External indeterminacy and internal indeterminacy
Structures with rigid joint connections	Definition Joint stiffness factor and distribution factor Degree of indeterminacy. Analysis by the stiffness method.
Moving loads	Influence lines. Definition and general properties.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Previous studies	0	6	6
Lecturing	13	26	39
Problem solving	18	22	40
Laboratory practical	18	4	22
Autonomous problem solving	0	15	15
Problem and/or exercise solving	2	17.5	19.5
Self-assessment	0	5	5
Laboratory practice	1	2	3

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Introductory activities	Introduction to the subject: Course aims, expected learning outcomes, course syllabus, teaching methods, assessments and grading policy.

Previous studies	Student previous activities to lectures. The students will receive detailed instructions to complete and send certain exercises before lectures/laboratory sessions. The purpose of this assessment is to optimize the session outcome. The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide.
Lecturing	The contents of the subject will be presented in a organized way. Special emphasis will be put on the fundamentals of the subject and on the most troublesome points. To improve the comprehension, the contents of the next lectures will be announced on Tema platform on a weekly basis.
Problem solving	Each week will devote a time to the resolution by part of the student of exercises or problems proposed, related with the content studied in each moment.
Laboratory practical	Application of theory concepts to laboratory collaborative works.
Autonomous problem solving	The students will be supplied with exercises and problems to solve, the solutions will be provided for level self-evaluation.

Personalized assistance

Methodologies	Description
Autonomous problem solving	The lecturers are at disposal of the students during office hours to solve any question related to the subject contents. The students will be able to verify if the completed assignments are correct and to identify the mistakes of miscalculations. The detailed schedule will be provided to the students at the beginning of the course through the TEMA platform. Any modification will be previously announced.

Assessment

	Description	Qualification	Training and Learning Results
Previous studies	The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide. It shall be deemed completed when a previous activity fully answer all questions.	0	D5 D9 D10 D17
Laboratory practical	Attendance and active participation in the complete laboratory lessons and practice reports will be assessed. They will be graded from 0 to 10, provided that the student gets a minimum mark in the written examination (minimum mark: 4.5/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	5	B4 C14 D2 D5 D9 D10 D17
Problem and/or exercise solving	Exam for the assessment of the module learning outcomes. The exam comprises of brief problems and/or theoretical questions. The duration and precise grading will be communicated at the beginning of the exam.	80	B3 C14 D2 B4 D9
Laboratory practice	Short exercises and conceptual tests will be taken during the course (within lecture or laboratory hours; grading from 0 to 10). The mark will be added to the exam mark, provided that the student gets a minimum mark in the written examination (minimum mark: 4.0/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	15	B3 D9

Other comments on the Evaluation

In this module the minimum required mark to pass is 5 out of 10.

The written examination of students not able to attend laboratory sessions will be graded 100% of the module mark, provided the student resigns from continuous assessment (and gets the required school approval) within the period established for that purpose. This examination will assess the subject overall competencies.

The qualification obtained in the laboratory practices in any of the two previous years (5% of the qualification) will be

preserved in the current year, provided the student requests that within an established period in the beginning of the course.

The qualification obtained in the conceptual tests in any of the two previous years (15% of the qualification) will be preserved in the current year, provided the student requests that within an established period in the beginning of the course.The rating obtained only remain within the language chosen at the time in which he studied the subject.

Comments about continuous assessment:

The handing of previous exercises (within the established period for each exercise) will modify the qualification of laboratory practices and follow-up conceptual tests as following explained:

Qualification of laboratory practices = K□(overall practice grade)/(nr of laboratory sessions)

Qualification of conceptual tests = K □(addition of tests□ grades)/(nr of tests)

K = (nr of previous exercises delivered)/(total nr of previous exercises)

Additional comments:

The absence from a laboratory session, even justified, does not lead to the repetition of the session.

The absence from a test, even justified, does not lead to the repetition of the test.

The date and place of of examinations of all calls shall be determined by the center before the start of course and will make them public .

Ethical commitment: it is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Group responsible lecturer: Groups with teaching in Spanish: Marcos García González and Adrián Pérez Riveiro.

Group with teaching in English: Rafael Comesaña and Antonio Riveiro

Reading list for the group in English:

Recommended:

- Hibbeler R.C., Mechanics of Materials, SI Edition, Prentice Hall. 9th. edition

- José Antonio González Taboada , Tensiones y deformaciones en materiales elásticos, 2a Edición, Tórculo.

- José Antonio González Taboada , Fundamentos y problemas de tensiones y deformaciones en materiales elásticos, 1ª Edición, Tórculo.

Complementary:

- Timoshenko, Goodier, Theory of elasticity, 3rd ed., (International student ed.), McGraw-Hill

- Manuel Vázquez , Resistencia de Materiales.

Sources of information

Basic Bibliography

José Antonio González Taboada, **Tensiones y deformaciones en materiales elásticos**,

José Antonio González Taboada, **Fundamentos y problemas de tensiones y deformaciones en materiales elásticos**,

Manuel Vázquez, **Resistencia de Materiales**,

Complementary Bibliography

Luis Ortiz Berrocal, **Elasticidad**,

Robert Mott, Joseph A. Untener, **Applied Strength of Materials**, 6ª, CRC Press, 2016

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mechanics of materials/V12G360V01404

Other comments

To register for this module the student must have passed or be registered for all the modules of the previous years.

The original teaching guide is written in Spanish. In case of discrepancies, shall prevail Spanish version of this guide.

Contingency plan

Description

=== EXCEPTIONAL MEASURES PLANNED ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes extraordinary planning that will be activated at the time that the administrations and the institution itself determine it based on criteria of safety, health and responsibility , and guaranteeing teaching in a non-classroom or partially classroom setting. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way by being known in advance (or well in advance) by students and teachers through the standardized tool and institutionalized teaching guides.

=== ADAPTATION OF THE METHODOLOGIES ===

An attempt will be made to ensure that the degree of presentiality in teaching guarantees the safety and health of all parties involved. In any case, the guidelines will be followed in instructions indicated by the management of the center.
In the event that there is a situation in which the teaching activities cannot be attended, neither the content nor the learning results contemplated in the subject will be affected. To this end, the following adaptations will be made.

Theory sessions:

In the event that they cannot be attended, remote classrooms, video recordings of classes, or any other means enabled by the university will be used for delivery. The contents taught will be the same.

Laboratory sessions:
The carrying out of experimental practices will be replaced by non-contact activities to solve similar problems that may require the use of specific calculation / simulation software.

Tutorials:

For the situation of non-attendance, email and, if necessary, videoconference will be used.

Evaluation:

In the event that the tests cannot be carried out in person, they will be carried out by telematic means. The number of assessment tests will not change, nor will the relative weight of each one of them in the course grade.

IDENTIFYING DATA				
Manufacturing engineering				
Subject	Manufacturing engineering			
Code	V12G363V01604			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Fenollera Bolíbar, María Inmaculada			
Lecturers	Fenollera Bolíbar, María Inmaculada			
E-mail	mfenollera@uvigo.es			
Web				
General description				

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
C20	CE20 Applied knowledge of systems and manufacturing processes, metrology and quality control.
D2	CT2 Problems resolution.
D8	CT8 Decision making.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.
D20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
- Know the technological basis and the basics of manufacturing processes	B3	C20	D2
- Understand the basics of manufacturing systems			D8
- Acquire skills for the selection of manufacturing processes and developing manufacturing planning			D9
			D10
- Develop skills for making assemblies and parts in CADCAM environments			D17
- Application of CAQ technologies			D20

Contents	
Topic	
Thematic block I: Integration of product design and manufacturing.	Chapter 0. Product and process design. Chapter 1. Manufacturing systems. Chapter 2. Additive manufacturing technologies. Chapter 3. Design for manufacturing and assembly (DFMA).
Thematic block II: Design and planning of manufacturing processes.	Chapter 4. Design and planning methodologies for manufacturing processes. Chapter 5. Selection of operations, tools, equipment and process conditions. Chapter 6. Datum references, jigs, fixtures and equipments. Chapter 7. Design and process improvement techniques.
Thematic block III: Resources of manufacturing systems.	Chapter 8. Description and structure of CNC machine tools. Chapter 9. handlers and industrial robots. Positioning systems. Maintenance. Chapter 10. Measurement and verification systems in manufacturing lines. Definition of control ranges.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2

Problem solving	18	16	34
Laboratory practical	18	0	18
Mentored work	0	60	60
Lecturing	14	14	28
Objective questions exam	2	0	2
Essay	2	0	2
Essay questions exam	2	2	4

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Introductory activities	- Introduction - Objectives - Theoretical classes - Practical classes - Assesment - Project development. Topic selection and work progress. - References
Problem solving	Development of real practical cases and exercises on the following contents 1. Plant distribution 2. Product and tools design 3. DFMA application 4. Application of dimensional, geometrical and surface finishing tolerances. 5. Sequence of manufacturing operations. 6. Setting of the conditions in manufacturing processes. 7. Calculation of cutting speeds, feeds, strengths and cutting powers in manufacturing. 8. Measurement procedures.
Laboratory practical	P1-2. PLM introduction. Product and process design. CAD software. Available software: Catia, NX, Fusion. 2 hour +2 hour P3. Part manufacturing process planning. Tooling design for product. 2 hour P4 -5 -6. Computer-aided tooling manufacturing, CAM prismatic, (Catia, NX, Fusion). 6 hour P7 -8 -9 Supervision of project development. 6 hour
Mentored work	Project (Work to make by student. It would correspond to Groups C of 5 students) Total 18*h
Lecturing	Development of the contents of the subject Proposition real cases and problems

Personalized assistance

Methodologies	Description
Mentored work	Attending Works and supervising projects (groups from among 3 and 5 people).

Assessment

	Description	Qualification	Training and Learning Results		
Objective questions exam	- Test-type questions, marks will be deducted for incorret answer. - The test can involve problem and essay type questions.	50	B3	C20	D2 D8 D9
Essay	Project development. Teamwork, creativity, self-sufficiency will be evaluated and in case of public presentation the ability for synthesis and communication	50		C20	D2 D9 D10 D17 D20
Essay questions exam	- Development of problems and/or cases.	50		C20	D2 D8 D9 D10

Other comments on the Evaluation

The evaluationconsists of:

A.-) Multiplechoice exam: It´s mandatory. The students must have a mark > 4 (0 to 10) tobe able to make averarage with part B. Value 50%

PracticalPart, The student have to choose between *B1 or *B2

B1.-)Project. Value 50%

B2.-)Essaytype questions: problems and cases. Value 50%.

The finalmark is the average mark A +B, being B= B1 or B2

Ethical commitment:The student is expected to exhibit appropriate ethical behavior. In the case ofdetecting non-ethical behaviour (copy, plagiarism, utilisation of unauthorised electronicdevices, and others), it will be considered that the student does not gather thenecessary requirements to pass the subject. In this case the globalqualification in the present academic course will be fail (0.0).

Othercomments Requirements: To enrol in this subject is necessary to have passed orbe enrolled in all the matters of the previous courses.

ethical Commitment: it expects that the present student a suitable ethical behaviour. Inthe case to detect a no ethical behaviour (copy, plagiarism, utilisation ofunauthorised electronic devices, and others) will consider that the student does not gather the necessary requirements to surpass the matter. In this case theglobal qualification in the present academic course will be of suspense (0.0).

Sources of information

Basic Bibliography

Complementary Bibliography

Pereira A., Prado T., **Notes of the subject IF**, 2015,

Pereira A., **Exercises and cases of manufacturing Engineering**, 2016,

Kalpakjian, S., **Manufacturing Engineering and Technology**, 7th ed.,

Notes of the ME subject,

Recommendations

Subjects that it is recommended to have taken before

Fundamentals of manufacturing systems and technologies/V12G360V01402

Other comments

Requirements:
To enrol in this matter is necessary to have surpassed or be enrolled of all the matters of the inferior courses to the course in which it is situated this matter.

Contingency plan

Description

=== EXCEPTIONAL MEASURES PLANNED ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes extraordinary planning that will be activated at the time that the administrations and the institution itself determine it based on safety, health and responsibility criteria. , and guaranteeing teaching in a non-classroom or partially classroom setting. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way by being known in advance (or well in advance) by students and teachers through the standardized tool and institutionalized teaching guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies that are maintained:
All. Excepting virtual clases.
* Non-face-to-face classes (tutorials):
Through virtual office on remote campus
* Additional bibliography to facilitate self-learning:
Necessary educational resources will be published on faitic platform

=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out:
They are all kept with the same weight and value
* Pending tests that are maintained:

IDENTIFYING DATA				
Electrical machines				
Subject	Electrical machines			
Code	V12G363V01605			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language				
Department				
Coordinator	Novo Ramos, Bernardino			
Lecturers	Novo Ramos, Bernardino			
E-mail	bnovo@uvigo.es			
Web				
General description				

Competencies
Code

Learning outcomes	
Expected results from this subject	Training and Learning Results

Contents	
Topic	
UNIT I: INTRODUCTION TO THE ELECTRICAL MACHINES	I-1 Electromagnetic and electro-mechanic fundamental laws. General behaviour notes: Physical arrangement of the electrical machines. Types of machines. Losses. Energy balance. Efficiency. Heating. Cooling. Rated power. Insulation types. Degrees of mechanical protection and construction types. Nameplate. I-2 Usual construction: Magnetic poles. Windings. I-3 M.M.F□s and E.M.F□s inside the machine: Fields generated with concentrated and distributed windings. Rotating magnetic field. Winding factor
UNIT II: INDUCTION MOTORS (ASYNCHRONOUS)	II-1 Three-phase induction machine Construction characteristics. Operating principles. Electrical equivalent circuit. Powers and torques. Electrical tests. Energy balance and efficiency. T-s curve. Operation modes. Starting methods and speed control. AC motor protection and control switchgear. II-2 Single-phase induction motor Construction characteristics. Operating principles. Electrical equivalent circuit. Starting methods.
UNIT III: SYNCHRONOUS MACHINES (GENERATORS)	UNIT III: SYNCHRONOUS MACHINES (GENERATORS) Construction characteristics. Operating principles. Armature reaction. Salient poles and cylindrical rotor machines. Electrical equivalent circuit. Stand-alone and grid-connected behaviours. Synchronous motor: Characteristics and uses.
UNIT IV: D.C. MOTORS. SPECIAL MACHINES	IV-1 Classic D.C. motor: Construction characteristics. Operating principles. Excitation systems. Armature reaction. Commutation. Speed control. Nameplate information. IV-2 Special machines: BLDC, Stepper Motors.

Planning			
	Class hours	Hours outside the classroom	Total hours
Problem solving	8	16	24
Laboratory practical	10	16	26
Lecturing	32.5	65	97.5

Objective questions exam	1	0	1
Problem and/or exercise solving	1.5	0	1.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Problem solving	Student will be required to work in groups to solve and present some proposed ac machines problems. This activity could be done using the "virtual office" if presentiality is not posisible due to the COVID19 University self-quarantine polilcies
Laboratory practical	Typical lab session in the Electrical Machines laoratory. They can be done online (iusing some machine simulation software) if presentiality is not posisible due to the COVID19 University self-quarantine polilcies
Lecturing	Typical lecture. Either presential or using the "virtual office" facility. The place will depend on the COVID19 University self-quarantine polilcies

Personalized assistance

Methodologies	Description
Lecturing	Course-related discussions, asking for extra help, seeking clarification of material presented in class and following up on aspects of the class you find compelling can be done during the "Office Hours". They can be presential or "virtual". The student should ask the lecturer (e-mail) in order to decide the day and the time
Problem solving	Course-related discussions, asking for extra help, seeking clarification of material presented in class and following up on aspects of the class you find compelling can be done during the "Office Hours". They can be presential or "virtual". The student should ask the lecturer (e-mail) in order to decide the day and the time

Assessment

	Description	Qualification	Training and Learning Results
Problem solving	The assessment method will be a numerical resolution of some exercises of electrical machines A minimum mark of 40% will be required in this part Part of this qualification percentage could be obtained with some continuous evaluation, depending on the lecturer. (5/40). Student will be properly informed if this option is activated.	40	
Lecturing	The assessment method will be a test, to be done individually without the use of any information source. There will be one unique test for the whole subject, and it will cover not only the theoretical lessons but the practical lab tests. A minimum mark of 40% will be required in this part Part of this qualification percentage could be obtained with some continuous evaluation in the lab lessons, depending on the lecturer. (10/60). Student will be properly informed if this option is activated.	60	

Other comments on the Evaluation

To pass the subject a minimum of 5/10 will be required (result of the sum of the 2 parts)

If the student final mark is bigger than 5, but the minimum in each part is not reached, the overall given mark will be 4.0 (FAILED)

Commitment: An student ethical behaviour is expected. If a non-ethical behaviour is detected (copying, cheating in any way, using unlicensed electronic devices, and others), it will be considered that the student does not gather the necessary requirements to pass the subject. In case of some unethical behaviour the mark will be 0.0 (FAILED) The COVID19 University policies can modify the final exam type, if we have to move to a "virtual exam". Any change will be announced properly so the students can adapt their learning processes to the new situation

Sources of information

Basic Bibliography

Complementary Bibliography

B. Novo, **Class notes**,

Any ac machines book,

Recommendations

Subjects that are recommended to be taken simultaneously

Automation and control fundamentals/V12G363V01304

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G363V01102
Physics: Physics 2/V12G363V01202
Basics of circuit analysis and electrical machines/V12G363V01302
Applied electrotechnics/V12G363V01501

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information

IDENTIFYING DATA				
Chemical technology				
Subject	Chemical technology			
Code	V12G363V01606			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Sanroman Braga, María Ángeles			
Lecturers	Rosales Villanueva, Emilio Sanroman Braga, María Ángeles			
E-mail	sanroman@uvigo.es			
Web				
General description	In this subject, students learn the basic aspects of Chemical Engineering and the fundamentals of the basic operations most employed in industry.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
C4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
D2	CT2 Problems resolution.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
To know the bases of chemical technology.	B3	C4	D9
To apply mass and energy balances to real systems.	B4	C4	D2 D9 D10 D17
To know and understand the basic aspects of mass transfer.	B3	C4	D9
To know the fundamentals of separation processes and their application to real cases.	B4	C4	D2 D9 D10 D17

Contents	
Topic	
Introduction	Chemical Engineering. Basic principles. Chemical processes. Unit conversion and calculation tools
Mass and energy balances	Mass balances for systems without chemical reaction. Mass balances for systems with chemical reaction. Energy balances
Implementation of balances into chemical reactor design	Stoichiometry. Reaction rate. Ideal reactors
Mass transfer	Introduction. Mass transfer equations: individual and global coefficients
Distillation and rectification of liquid mixtures	Vapour□liquid equilibrium. Simple distillation. Rectification. Azeotropic and extractive distillation.
Liquid-liquid extraction	Fundamentals. Binary and ternary mixtures. Factors that affect the separation. Operation by simple contact, multiple contact in direct current, multiple contact in multiple countercurrent
Other operations in chemical processes	Gas absorption. Liquid-solid extraction. Adsorption and ion exchange.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Problem solving	17	31	48
Laboratory practical	8	8	16
Problem and/or exercise solving	2	8	10
Report of practices, practicum and external practices	0	2	2
Essay questions exam	3.5	10.5	14
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Direct oral exposition of the most important contents of the subject by the lecturer.
Problem solving	The lecturer suggests various problems to the students so they can work on them at home. Then, the lecturer solves them in the seminar classes.
Laboratory practical	The students will perform some experiments in the laboratory, solving problems in seminar classes and field practices in companies related to the topics covered throughout the course. In addition, the students will evaluate different processes using simulation software. The aim of the laboratory practices is to deepen basic concepts.

Personalized assistance	
Methodologies	**Description**
Lecturing	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.
Problem solving	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.
Laboratory practical	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.

Assessment					
	Description	Qualification	Training and Learning Results		
Problem and/or exercise solving	The students will carry out various tests with problems and short-answer questions. The average mark will represent 30% of the final mark.	30	B3 B4	C4	D2 D9
Report of practices, practicum and external practices	Apart from the mark of the practice report, the lecturer will take into account the attendance as well as the attitude that the students have on the practices.	10		C4	D9 D10 D17
Essay questions exam	Theoretical-practical exam of the basic concepts and procedures related to the subject matter, in the date fixed by the Centre.	60	B3 B4	C4	D2 D9

Other comments on the Evaluation

The participation of the student in any of the evaluation systems of the subject will imply that the student effectively take the subject and its qualification.

To pass the subject, it is necessary that the student obtains a minimum of 5 points out of 10 in each of the proposed evaluation systems. In the case of students who do not attain the minimum in all evaluation systems, they will fail to achieve the pass mark, with a numerical value obtained by following the percentages of the evaluation systems described above, or equal to that obtained in the non passed part.

In July, the previous marks of the evaluation systems will be are kept if a minimum of 5 points out of 10 is achieved; therefore, the students will just have to take an essay or questions exam (theoretical-practical exam).

For students who are allowed by the School to skip the continuous assessment procedure: The qualification of these students will be formed by the mark of the essay & questions exam (90%) and the mark of the practices (10%).

Ethical commitment: The student is expected to present adequate ethical behaviour. In the event that unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, etc.), it will be considered that the student does not meet the necessary requirements to pass the subject. In that case, the overall rating in the current academic year will be □fail (0.0)□. The use of any electronic device for the assessment exams is not allowed unless explicitly authorised. The fact of introducing unauthorised electronic devices in the examination room will be considered as a reason for not to pass the

subject in the current academic year and will hold overall rating (0.0)

Sources of information

Basic Bibliography

Himmelblau, D.M., **Basic principles and calculations in chemical engineering**, 6th,

Felder, R.M. y Rousseau, R.W., **Elementary principles of chemical processes**, 3rd,

Ocón, J. y Tojo, G., **Problemas de Ingeniería Química**, 3rd,

Coulson, J.M. and others, **Chemical Engineering vol. 1 and vol 2**, 5th,

Treybal, R.E., **Mass-transfer operations**, 3rd,

Calleja, G, **Introducción a la ingeniería química**, 1ª,

Levenspiel, O., **Chemical Reaction Engineering**, 3rd,

Wankat, P.C., **Ingeniería de procesos de separación**, 2ª,

McCabe, W.L., Smith, J.C. y Harriott, P., **Unit operations of chemical engineering**, 7th,

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Calculus 1/V12G360V01104
Mathematics: Calculus 2 and differential equations/V12G360V01204
Chemistry: Chemistry/V12G360V01205

Other comments

Requirements: To enrol in this subject, it is necessary to have passed or be enrolled in every subject of inferior courses. In case of discrepancies, it will prevail the Spanish version of this document.

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes an extraordinary planning that will be activated in the moment that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in blended or distance learning mode. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance by the students and the teaching staff through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep
Lesson magistral: they will develop by means of synchronous virtual sessions that they will be able to be complemented with videos or other didactic materials.
Resolution of problems: it will be proposed to the students series of problems so that they work on them and that will be reviewed in synchronous virtual sessions.
Practices of Laboratory: it will make only by means of the evaluation of industrial chemical processes by means of the handle of a Chemical processes simulation software.
Educational Methodologies that modify
None adapt all the methodologies to the non face-to-face modality
* Mechanism non face-to-face of attention to the students tutoring.
differentiate two types of mechanisms non face-to-face of attention to the students: generals and individual.
Generals: The lecturers in the schedule established by the centre will connect in a virtual classroom to which will assist all the students and in which the lecturers will orient on the material supplied to the students or will expand concepts according to the established in the educational guide.
Individual: The lecturers will attend in their schedule of tutoring to the students in the virtual room.
* Modifications (if they proceed) of the contents to give
there are not modifications
* additional Bibliography to facilitate the self-learning
is not necessary
* Other modifications

=== ADAPTATION OF THE EVALUATION ===
* Test already made
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Pending proofs that keep
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Proofs that modify
[previous Proof] => [new Proof]

* New test

* additional Information
Vulnerable students: It will be made a methodological adaptation, facilitating them additional specific information when it is proved that they cannot have access to the contents provided by the conventional ways.

Evaluation: The systems of evaluation will be developed face to face except Resolution of the university board that indicate that they have to do innon face to face mode, making of this way through the different tools put to disposal of the teaching staff.