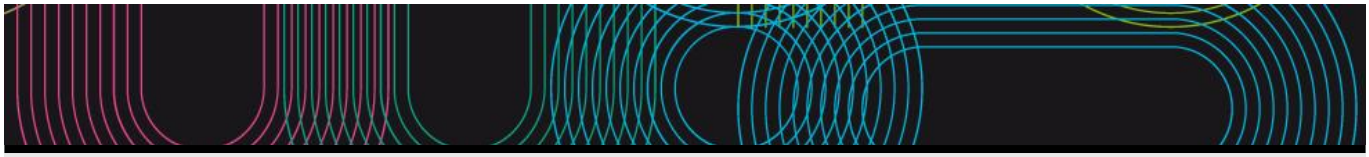

(*)Centro Universitario da Defensa da Escola Naval Militar de Marín

Grado en Ingeniería Mecánica

Subjects			
Year 5th			
Code	Name	Quadmester	Total Cr.
P52G381V01501	Technical Office	1st	6
P52G381V01502	Naval sensors	1st	6
P52G381V01503	Basics of computer networks	1st	6
P52G381V01504	Theory of the ship and shipbuilding	1st	6
P52G381V01505	Automobiles	1st	6
P52G381V01506	Complementary training	2nd	6
P52G381V01991	Final Year Dissertation	2nd	12

IDENTIFYING DATA

Technical Office

Subject	Technical Office			
Code	P52G381V01501			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	1st
Teaching language	Spanish			
Department				
Coordinator	Núñez Nieto, Xavier			
Lecturers	Núñez Nieto, Xavier Rodríguez Rodríguez, Francisco Javier			
E-mail	xnnieto@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This course, common to the industrial branch, pursues to orient the student in the acquisition of the knowledge and the skills that enable them for the handle and application of methodologies and technical tools, regarding with the organisation and management of engineering projects and another technical documentation of usual use in a Technical Office. To achieve this mentioned aims there are applied a wide approach of the units composing the course, looking for the integration of the knowledge adquired along the degree and its application by means of a methodology, organisation and management of distinct modalities of technical works, as true essence of the profession of engineer, in the frame of his attributions and fields of activity. It promotes the development of the competences of the matter by means of active and technical methodologies of collaboration. In this way, the exposed contents in theoretical classes implement in the development of the practical activities, oriented to the industrial reality of the profession, assimilating the agile and precise employment of the distinct rule of application and of the professional best practices established, supporting in the new technologies to document, elaborate, manage and present the technical documentation that correspond.			

Training and Learning Results

Code	
B1	Skills for writing, signing and developing projects in the field of industrial engineering, whose purpose is, specializing in Mechanics, construction, alteration, repair, maintenance, demolition, manufacturing, installation, assembly or operation of: structures, mechanical equipments, energy facilities, electrical systems and electronic installations and industrial plants, and manufacturing processes and automation.
B2	Ability to manage the activities object of the engineering projects described in B1.
C18	Knowledge and skills to organize and manage projects. To know the organizational structure and functions of a project office.
D2	Problems resolution.
D3	Oral and written proficiency
D5	Information Management.
D7	Ability to organize and plan.
D8	Decision making.
D9	Apply knowledge.
D10	Self learning and work.
D12	Research skills.
D14	Creativity.
D15	Objectification, identification and organization.
D17	Team working.
D20	Ability to communicate with people not expert in the field.

Expected results from this subject

Expected results from this subject	Training and Learning Results
Manage of methods, technics and tools of design, organisation and management of projects	B1 B2 C18 D3 D5 D7 D8 D9 D14 D15 D17 D20

Ability in the handle of information an communication systems in the industrial field.	B1 B2	C18	D3 D5 D7 D8 D9 D10 D14 D15 D17 D20
Ability to generate the documents of the project and other similar technical documents.	B1		D3 D5 D20
Ability in the facultative direction of projects in the field of the industrial engineering.	B2	C18	D5 D7 D8 D17 D20
Skills to communicate properly the knowledge, procedures, results of the field of the Industrial Engineering.	B1		D3 D20
ENAEE LEARNING OUTCOME: KNOWLEDGE And UNDERSTANDING: LO1.3.- Awareness of the wider multidisciplinary context of engineering (Level of achievement: Intermediate (2)).		C18	
ENAEE LEARNING OUTCOME: ENGINEERING ANALYSIS: LO2.1.- Ability to analyse complex engineering products, processes and systems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to correctly interpret the outcomes of such analyses (Level of achievement: Intermediate (2)).	B1 B2		D2 D8 D9
ENAEE LEARNING OUTCOME: ENGINEERING ANALYSIS: LO2.2.- Ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical societal, health and safety, environmental, economic and industrial constraints (level of achievement: Intermediate (2)).			D2 D8 D9 D14
ENAEE LEARNING OUTCOME: ENGINEERING DESIGN: LO3.1.- Ability to develop and design complex products (devices, artefacts, etc.), processes and systems in their field of study to meet established requirements, that can include an awareness of non-technical societal, health and safety, environmental, economic and industrial considerations; to select and apply relevant design methodologies (level of achievement: Intermediate (2)).		C18	D2 D7 D9
ENAEE LEARNING OUTCOME: ENGINEERING DESIGN: LO3.2.- Ability to design using some awareness of the forefront of their engineering specialisation (level of achievement: Intermediate (2)).	B1	C18	D7 D9
ENAEE LEARNING OUTCOME: INVESTIGATIONS: LO.4.1.- Ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, to carry out simulation and analysis in order to pursue detailed investigations and research of technical issues in their field of study (level of achievement: Intermediate (2)).		C18	D5 D12
ENAEE LEARNING OUTCOME: INVESTIGATIONS: LO4.2.- Ability to consult and apply codes of practice and safety regulations in their field of study (level of achievement: Intermediate (2)).		C18	
ENAEE LEARNING OUTCOME: ENGINEERING PRACTICE: LO5.2.- Practical skills for solving complex problems, realising complex engineering designs and conducting investigations in their field of study (level of achievement: Intermediate (2)).		C18	D2 D9 D12 D15
ENAEE LEARNING OUTCOME: ENGINEERING PRACTICE: LO5.3.- Understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations in their field of study (level of achievement: Intermediate (2)).			D8 D9
ENAEE LEARNING OUTCOME: ENGINEERING PRACTICE: LO5.4.- Ability to apply norms of engineering practice in their field of study (level of achievement: Intermediate (2)).		C18	D9
ENAEE LEARNING OUTCOME: ENGINEERING PRACTICE: LO5.5.- Awareness of non-technical - societal, health and safety, environmental, economic and industrial - implications of engineering practice (level of achievement Intermediate (2)).		C18	
ENAEE LEARNING OUTCOME: MAKING JUDGEMENTS: LO6.2.- Ability to manage complex technical or professional activities or projects in their field of study, taking responsibility for decision making (level of achievement: Intermediate (2)).	B1 B2	C18	
ENAEE LEARNING OUTCOME: COMMUNICATION AND TEAM-WORKING: LO7.1.- Ability to communicate effectively information, ideas, problems and solutions with engineering community and society at large (level of achievement: Intermediate (2)).	B1		D3 D5 D20

ENAEE LEARNING OUTCOME: COMMUNICATION AND TEAM-WORKING: LO7.2.- Ability to function effectively in a national and international context, as an individual and as a member of a team and to cooperate effectively with engineers and non-engineers (level of achievement: Intermediate (2)).	B1	D3 D5 D7 D8 D10 D17 D20

Contents	
Topic	
Unit 1. The technical office	1.1 Concept of technical office 1.2 Functions and scope of work 1.3 Departmental infrastructure 1.4 Exercise of the engineer profession 1.5 Attributions and professional competences 1.6 Professional engineering associations
Unit 2. Stages of the project	2.1 Previous study 2.2 Preliminary engineering 2.3 Detail engineering 2.4 Material execution
Unit 3. Project management	3.1 Methodology 3.2 Organisation of the project 3.3 Planning procces 3.4 Management software
Unit 4. Documents of the project	4.1 Memory 4.2 Planes 4.3 Folder of Conditions 4.4 Budget 4.5 Own entity studies 4.6 Attachments
Unit 5. Transaction and contracting	5.1 Criteria and procedure rules 5.2 Licenses, authorizations and permits 5.3 Bidding and contracting
Unit 6. Facultative direction	6.1 Protagonists in the execution of a project 6.2 Functions of the facultative direction 6.3 Obligations and responsibilities
Unit 7. Legal framework	7.1 Legislative basis and scope of the project 7.2 Specifications and technical standards 7.3 Standardization, certification and homologation 7.4 Standardization and certification entities
Laboratory: Engineering Project	Description: During the laboratory sessions, the group development of a traditional Mechanical Engineering project will be carried out, applying the knowledge acquired during the theoretical sessions, which will cover the overall content of the whole subject. This project will include all the technical documentation associated with the elaboration of its content, namely: Memory, Plans, Folder of Conditions and Budget. Objectives: Analysis of the problem, situation, conditioning characteristics and feasibility study. Preparation of the technical documentation associated with the project, including descriptive memory, measurements and calculations. Handling, scaling, plotting and folding of planes. Study and elaboration of the technical, optional, economic and legal specifications. Estimate of the material execution budget. Inclusion, when appropriate, of the pertinent own entity studies regarding the project: Health and Safety, Occupational Hygiene and Environmental Impact Assessment. Exhibition and public oral defence of the projected work. Duration: The students will have the practical laboratory sessions, under the supervision of the teachers, to carry out the development of the project, which will culminate with its defense and oral presentation.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	28	56
Laboratory practical	12	24	36
Seminars	20	17	37
Practices through ICT	6	6	12
Objective questions exam	6	0	6
Project	2	0	2
Problem and/or exercise solving	1	0	1

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

Methodologies

	Description
Lecturing	Master class. Each thematic unit will be presented by the lecturer, complemented with the comments of the students with base in the bibliography assigned or another pertinent. In these sessions, there will be explained in detail the basic theoretical contents of the program, exposing explanatory examples from which deepen in the understanding of the subject. They will be used computer presentations and the blackboard, especially to transmit information like definitions, charts and so on. Whenever is possible, there will be provided a copy of the slides to the students before the exhibition, focusing the effort of the lecturer and the student on the exposure and understanding of the knowledge. Anyway, the reproductions in paper of the slides never have to be considered like substitutes of the texts or notes, but like complementary material.
Laboratory practical	It will be proposed a project of realisation in group that will cover the knowledge and the total length of the course. For the realisation of that task there will be employed the methodology of project-based learning. It will be provided the needed material for the realisation of the work. Finally there will be carried out a public exhibition of the project.
Seminars	An intensive review course will be held, aimed at students who fail to pass the subject in the first call.
Practices through ICT	There will be proposed exercises that will be solved in group or individually. By means of this methodology and the suitable software of project management, there will be carried out diverse activities, whose final result will suppose the whole planning process corresponding to a constructive project considering all its stages. There will be proposed several activities, using the appropriate software for project management, related to the planning process of an engineering project throughout its different stages.

Personalized assistance

Methodologies	Description
Seminars	The teaching staff of the subject will answer the doubts and queries of the students in a face to face and telematic way (email, videoconference, virtual forums, etc.), during the tutoring schedule available on the website of the center.

Assessment

	Description	Qualification	Training and Learning Results		
Objective questions exam	There will be carried out two written exams with questions test type and/or of development on the theoretical sessions: One Intermediate Exam (PI) with an average weight of 20% on the grade of the course and a Final Exam (PF) with an average weight on the grade of the matter of 40%.	60	B1	C18	D5 D8 D14 D15
Project	Project report and defence by means of oral presentation.	30	B1 B2	C18	D2 D3 D5 D7 D8 D9 D10 D12 D14 D15 D17 D20

Problem and/or exercise solving	Questionnaire that will cover all the sessions in this regard.	10	B2	C18	D2 D5 D7 D8 D9 D15 D17

Other comments on the Evaluation

The final evaluation will be the sum of the punctuation awarded to each one of the before commented parts, being the Note of Final Continuous Evaluation (FCE):

FCE = 0,6 * THEORY + 0,3 * PROJECT + 0,1 * QUESTIONNAIRE

In addition to reaching a final qualification of at least 5 points on 10 (FCE ≥ 5), to surpass the matter by continuous evaluation there will be demanded some minimum requirements, that guarantee the balance between all the types of skills. These requirements are the following:

- To obtain a note of at least 4 points on 10 in the continuous evaluation final exam (PF).

In case of not surpassing the matter by continuous evaluation, the students will have to attend the ordinary examination of first call. Likewise, in the particular supposition of not to fulfil the minimum requirements established, the qualification of the continuous evaluation will be calculated as follows: FCE FINAL = min (4, FCE). On the other hand, the students that surpass the matter by continuous evaluation will be able to attend to the ordinary examination of first call to improve their qualification.

Both, in the ordinary examination of first call and the extraordinary (second call), will be evaluated all the skills of the course, including those referred to the theoretical sessions, practical, seminars and to the realisation of the group project.

ACADEMIC INTEGRITY: Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces,* **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity,** regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information

Basic Bibliography

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Santos Sabrás, Fernando, **INGENIERÍA DE PROYECTOS**, Eunsa, 2ª Edición, 2002

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Cano, J.L., **MANUAL DE GESTIÓN DE PROYECTOS**, Asociación Española de Ingeniería de Proyectos (AEIPRO), 1ª Edición, 2003

De Cos Castillo, Manuel, **TEORIA GENERAL DEL PROYECTO I: GESTIÓN DE PROYECTOS**, Síntesis, 4ª Edición, 1997

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Gómez-Senent Martínez, Eliseo; González Cruz, Mª Carmen, **TEORÍA Y METODOLOGÍA DEL PROYECTO**, Servicio de Publicación de la Universidad Politécnica de Valencia, 1ª Edición, 2008

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Serer Figueroa, Marcos, **GESTIÓN INTEGRADA DE PROYECTOS**, Ediciones UPC, 3ª Edición, 2010

Canito Lobo, José Luis, **Autodesk Inventor 2017**, Anaya, 1ª Edición,

Chatfield, Carl, Johnson, Tymothy, **MICROSOFT PROJECT 2013: STEP BY STEP**, Microsoft Press, 4ª Edición, 2013

Hervo, Corinne, **MICROSOFT OFFICE 2013: WORD, EXCEL POWERPOINT Y OUTLOOK 2013: FUNCIONES BÁSICAS**, Ediciones ENI, 1ª Edición, 2014

Leach, James A., **AUTOCAD 2016 INSTRUCTOR**, SDC Publications, 1ª Edición, 2016

Reyes Rodríguez, Antonio Manuel, **AUTOCAD 2016**, Anaya, 1ª Edición, 2015

Recommendations

Subjects that continue the syllabus

Final Year Dissertation/P52G381V01991

Subjects that it is recommended to have taken before

Graphic engineering/P52G381V01304

Other comments

For the successfull development of this subject it is recommended to possess a personal profile in which they are present the following qualities and skills:

- Capacity of written and oral understanding.
- Autonomous capacity for research and information compilation.
- Skills for the work in group.
- Basic notions related with the field of the design in the engineering, the calculation of installations and the industrial construction.

IDENTIFYING DATA				
Naval sensors				
Subject	Naval sensors			
Code	P52G381V01502			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	1st
Teaching language	Spanish			
Department				
Coordinator	Núñez Ortuño, José María			
Lecturers	Nocelo López, Rubén Núñez Ortuño, José María			
E-mail	jnunez@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This subject gets framed into the Intensification in Naval Technology, and its goal is to provide the student with a theoretical and practical training over the basic operation of radar, sonar and optoelectronic sensors in naval and terrestrial environments. Along this subject, students learn the concept of naval sensor and will acknowledge the most usual sensors in their operative environment. The main concepts for all remote sensing system will be provided, so the student understand the multidisciplinary character of this subject, applying different knowledge from previous subjects, such as radiocommunication systems, electronic circuits and filters, automatic control, electrotechnics of physics (electromagnetic fields). It will be mainly focused on radar sensors, both continuous and pulsed wave systems, analysing the parameters that limit the radar range, the probability of detection and of false alarm, the concept of radar cross section, clutter, etc. We will also analyse the basic and most common techniques for radar signal processing, most of them used in other remote sensing systems (such as sonar), emphasizing the multidisciplinary nature of the subject. The student will be able to understand the proper acoustic characterisation of the underwater environment, and the propagation issues associated, such as noise and reverberation. The architecture and characterisation of the active and passive sonar systems will also be studied, along with their acoustics tranducers. Lastly, the optical spectrum and the classification of the existing emitting sources will be analysed, understanding the operation of the distinct types of optoelectronic sensors and their main characteristics.			

Training and Learning Results	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
C30	CITN5/OPT1 To understand the principles that govern the operation of communications systems and naval sensors.
D1	Analysis and synthesis
D2	Problems resolution.
D5	Information Management.
D8	Decision making.
D9	Apply knowledge.
D10	Self learning and work.
D16	Critical thinking.

Expected results from this subject	Training and Learning Results		
To know the technological basis supporting naval sensors.	B3	C30	D1 D5 D10
To understand the basic operation of naval sensors.	B3	C30	D1 D2 D8 D9 D10 D16

ENAEE LEARNING OUTCOME: KNOWLEDGE AND UNDERSTANDING LO 1.2 Knowledge and understanding of the engineering disciplines of their specialty, at the proper level to acquire the rest of the competences of the degree, including notions of the latest advances. (level of development of this sub-learning outcome: Medium (2))	B3	
ENAEE LEARNING OUTCOME: KNOWLEDGE AND UNDERSTANDING LO 1.3 Be aware of the multidisciplinary context of engineering. (Medium (2))	C30	
ENAEE LEARNING OUTCOME: ENGINEERING ANALYSIS LO 2.2 Ability to identify, formulate and solve engineering problems within an specialty; choose and apply properly analytical methodologies; recognize the importance of social, health and safety, environmental, economic and industrial restrictions. (Medium (2))		D1 D2 D8 D9 D16
ENAEE LEARNING OUTCOME: ENGINEERING PRACTICAL APPLICATION LO 5.15.1 Understanding the applicable techniques and methods for analysis, planning and research and their limitations in the field of their specialty. (Medium (2))		D9
ENAEE LEARNING OUTCOME: ENGINEERING PRACTICAL APPLICATION LO 5.3 Application knowledge on materials, equipment and tools, technology and engineering processes and their limitations within the field of their specialty. (Medium (2))	C30	D8 D9
ENAEE LEARNING OUTCOME: CONTINUOUS EDUCATION LO 8.1 Ability to realize the need for continuous training and undertake this activity throughout their professional life on their own. (Basic (1))		D8 D10

Contents

Topic	
Chapter 1. Introduction to Naval Sensors	1.1 Basic concepts of naval sensors. 1.2 Frequency bands. 1.3 Introduction to radar systems. 1.4 Fundamental parameters of radar systems: PRF/PRI, range resolution, angular resolution, maximum non-ambiguous range, time of observation, ... 1.5 Monostatic, bistatic and multistatic radar systems 1.6 Pulsed wave and continuous wave radar systems. 1.7 Radar cross section (RCS) and simplified radar range equation. 1.8 Simplified block diagram of a radar system.
Chapter 2. Pulsed wave radar systems	2.1 Introduction 2.2 Signal-to-noise ratio and probability of detection. 2.3 Pulse integration techniques. 2.4 Attenuation losses in radar range equation: 2.4.1 Fluctuating targets. 2.4.2 Propagation losses. 2.4.3 Atmospherical losses. 2.4.4 Interferences: clutter, jamming, ... 2.5 Radar Cross Section (RCS) and stealth technologies.
Chapter 3. Continuous wave radar systems	3.1 Introduction: 3.1.1 Doppler effect. 3.1.2 Pulsed wave (PW) radar vs. continuous wave (CW) radar systems. 3.2 CW radars modulated in frequency (CWFM). 3.2.1 With sawtooth modulation (CHIRP). 3.2.2 With triangular modulation. 3.3 Radar range equation for CW radar systems. 3.4 Advantages and disadvantages of CW radar systems.
Chapter 4. Digital signal processing	4.1 Pulse compression techniques. 4.1.1 Frequency pulse compression. 4.1.2 Phase pulse compression. 4.2 MTI systems and pulse-Doppler systems. 4.3 PRF Staggering
Chapter 5. Optoelectronical sensors	5.1 Optical spectrum. 5.2 Infrared sensors (thermal, medium-IR) 5.3 Night-vision sensors (near-IR). 5.4 Optoelectronic emitters: Laser vs. LED. 5.5 Optoelectronic sensors: photodetectors. 5.6 Other sensors and applications: laser telemeter, luxometer, etc.

Chapter 6. Acoustic sensors and sonar systems	6.1 Introduction. 6.2 Acoustic oceanography. 6.3 Underwater signal propagation. 6.4 Active and passive sonar systems. 6.5 Noise and reverberation.
Chapter 7. Specific purpose radar systems	7.1 Multifunction radars. 7.2 Secondary radar (IFF). 7.3 LPI radars. 7.4 Sinthetic aperture radars (SAR).
Lab session 1: Introduction to remote sensing and radar systems	The goal of this practice is introducing the basic concepts of remote sensing and radar systems analysed in the theoretical classes. By means of short Matlab scripts, the influence of each one of the parameters in the simplified radar range equation will be illustrated. The relationship between resolution and pulse spreading for a target conformed by several primary scatterers will be analysed. Students will be able to check whether some common techniques (such as pulse integration) effectively improve the probability of detection.
Lab session 2: Pulsed wave radars (PW radars)	This practice enhances the comprehension of the operative differences between PW and CW radars, as well as their different applications and limitations. Radar simulators will be used instead real radar systems, because, on the one hand, it is neither operative nor safe to activate several of such systems within a short range, and in the second hand, simulators allow to create different tactical scenarios which could not be possible in a real environment. An overview of radar cross section concepts explained in theory will also be analysed. The dependence on the geometry of the radar cross section and radar response will be studied.
Lab session 3: Movement detector radar	This practice describes a simple CW radar system works, by means of a movement sensor. The student will set up a basic CW radar system within the laboratory, where the ability of the student to handle instrumentation equipment will also be evaluated.
Lab session 4: Digital signal processing	The goal of this practice is to help the comprehension of the digital signal processing techniques used in radar systems nowadays. It will include: MTI systems, filter banks and pulse compression techniques.
Lab session 5: Optoelectronic devices	The goal of this practice is to get the student to know about optoelectronic sensors operating either in visible or in non-visible spectrum. They will learn to operate different optoelectronic equipment, such as thermal cameras, night-vision cameras, telemeters, □ They will also learn about the primary light-emitting devices, such as LEDs or LASER.
Lab session 6: Acoustic propagation	The goal of this session is to help the student visualise the mechanisms that play a role in underwater acoustic propagation. With the aid of a computer program, the student will simulate and observe how acoustic waves propagate in multilayered media. This will enable him to analyze the performance of SONAR systems under different conditions (e.g. warm waters vs. cold waters) and identify the opportunities where submarines can go undetected. Several types of SONAR systems will be analyzed, with their strengths and weaknesses.
Lab session 7: Echo sounder	The goal of this session is to help the student understand the operation of an ultrasonic echo sounder, and the underlying physical phenomena. The student will use a scale model comprising: a computer, a pulse-echo ultrasound system, a water tank, sand and rocks to simulate the seabed, and different objects as targets. With this low-scale sonar system, the student will learn the operation of this type of equipment, as well as the interpretation of the results. The student will analyze the limitations of the system, as well as various artifacts due to the mechanisms of acoustic propagation. The student will generalize the observed results to a real system, analyzing the potential problems (or advantages) that could arise.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	42	70
Laboratory practical	14	7	21
Seminars	21	5	26
Problem and/or exercise solving	9	12	21
Problem and/or exercise solving	2	4	6
Objective questions exam	1	1	2
Essay	1	3	4

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

Methodologies

	Description
Lecturing	These sessions will be used to explain in detail the theoretical contents of the syllabus. Whiteboard and slides will be used as the basic methodology. Whenever slides are used, a copy in paper will be provided beforehand. However, slides should not be considered as a replacement for lectures, since they are only complementary material.
Laboratory practical	Lectures If necessary, a prior explanation of some particular concepts will be performed beforehand, in order to optimize the practical sessions. Laboratory practices: Students will be working in groups and the lecturer will take care of their work. The goal of these sessions is to strengthen the theoretical concepts studied in theoretical lectures. Practical sessions have a series of rules that the student must abide: - Practical sessions are compulsory and in-person classes. - Lost sessions cannot be recovered, unless justified absences.
Seminars	Some weekly hours will be dedicated to solve problems, where small groups will be encouraged. This section includes the intensive course designed for preparing the extraordinary exam.

Personalized assistance

Methodologies	Description
Seminars	Two types of tutorial actions might be distinguished: the academic tutoring and the personalized tutoring. In the academic tutoring, office hours will be at the student disposition where they can consult any doubt related with the contents, organisation and/or schedule of the subject. Tutorials can be individualized, encouraging group sessions for problem-solving hours. In the personalized tutoring, each student, individually, will be able to comment with the lecturer any problem with the subject, with the goal of finding a proper solution. Combining both types of tutorial actions, the different paces of learning will be attended through attention to diversity. Lecturers will properly assist the students through the learning process, both in-person and/or online formats (email, VTC, Moovi forums,...), and always under prior appointment.

Assessment

	Description	Qualification	Training and Learning Results		
Problem and/or exercise solving	Midterm exam: It will evaluate 30% of the theoretical knowledge of the subject. Individual, of about approximately 1 hour. Over 10 points. Can have the form of test, short questions, problems or a combination of all of them. No minimum required.	30	B3	C30	D1 D2 D5 D8 D9 D10 D16

Problem and/or exercise solving	Final term exam: It will evaluate the 40% of the theoretical knowledge of the subject. Individual, about 2-3 hours. Over 10 points. Can have the form of test, short questions, problems or a combination of all of them. A minimum of 4.0 points over 10 is required in each of the parts to be able to pass the subject.	40	B3	C30	D1 D2 D5 D8 D9 D10 D16
Objective questions exam	Laboratory exams: It will evaluate 20% of the practical knowledge of the subject, divided in 2 test of a 10%. Individual, of about 10-20 min. Over 10 points. Can have the form of test, short questions, problems or a combination of all of them. A minimum of 4.0 over 10 is required in the 20% assigned to laboratory training.	20		C30	D1 D2 D5 D8 D9 D16
Essay	Multimedia video: It will evaluate 10% of the full knowledge of the subject (theoretical and practical). Video recorded by the students, performing an easy subject-related experiment. Maximum length: 3 min. Individual, or in groups of two students. Over 10 points.	10	B3	C30	D1 D2 D9 D10

Other comments on the Evaluation

Ordinary exam:

The weight of the distinct parts in the final note of the ordinary exam (*NEO*) gets distributed as follows:

- Theory (*T*): 80%
- Practices (*L*): 20%

Theory:

Consists of:

- A single exam, of approximately 2-3 hours, to be performed within the course calendar.
- Ranked over 10 points (*T*).
- Individual.
- It can include tests, short questions and/or problems or a combination of them.

Laboratory:

Consists of:

- A single exam, of approximately 20-30 min., regarding the contents of the practical sessions.
- Ranked over 10 points (*L*).

- Individual.
- It can include tests, short questions and/or problems or a combination of them.

Final mark and minimum requirements to pass the subject:

The final mark (*NEO*) will be computed following the next equation:

NEO = 0.8 * T + 0.2 * L

A minimum of 4.0 points over 10 is required for both the L exam and the T exam. Once obtained these minimums, a minimum of 5.0 points over 10 in the total computation of *NEO* is mandatory to pass the subject.

Extraordinary exam:

The students that did not pass the subject on first convocatory must attend the second convocatory (or extraordinary exam), that will have the same structure, exam duration, percentages and minimum points required thant in the ordinary exam.

Academic integrity:

Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces,* **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity,** regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information

Basic Bibliography

Curry, G. Richard, **Radar Essentials. A concise handbook for radar design and performance analysis**, 1ª ed., Scitech Publishing Inc., 2012

Complementary Bibliography

Denny M., **Blip, Ping & Buzz. Making sense of radar and sonar**, 1ª ed., The Johns Hopkins University Press, 2007

Skolnik, Merril I., **Introduction to Radar Systems**, 3ª ed., McGraw□Hill, 2003

Eaves J., Reedy E., **Principles of Modern Radar**, 2ª ed., Springer, 2011

Marage J., Mori Y.,, **Sonars and Underwater acoustics**, 1ª ed., Wiley, 2010

Mahafza B. R., **Radar systems analysis and design using Matlab**, 3ª ed., CRC Press, 2010

Recommendations

Subjects that it is recommended to have taken before

Electronic technology/P52G381V01301
Radio-communication systems/P52G381V01408

IDENTIFYING DATA				
Basics of computer networks				
Subject	Basics of computer networks			
Code	P52G381V01503			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	1st
Teaching language	Spanish			
Department				
Coordinator	Fernández Gavilanes, Milagros			
Lecturers	Fernández García, Norberto Fernández Gavilanes, Milagros			
E-mail	mfgavilanes@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This subject is part of the Intensification in Naval Technologies, and it is sought to provide the students with training, both theoretical and practical, on the fundamental concepts of communication networks and telematic services: basis on data transmission technologies, architecture of networks and communication services, the main components of ICT infrastructures and information systems, network management and planning methods, and basic aspects of computer network security. In the final part of the subject, basic questions related to cyber defense and cybersecurity are also introduced. The classroom sessions will be used to introduce theoretical concepts, which will be complemented with different laboratory practices and problem solving during the tutoring sessions and the seminars.			

Training and Learning Results	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
C31	CITN6/OPT2 To acquire the ability to understand the concepts of network architecture, protocols and communication interfaces.
C32	CITN7/OPT3 To acquire the ability to differentiate the concepts of access and transport networks, circuit switching and packet switching networks, as well as knowledge of methods of interconnecting networks and routing.
C33	CITN8/OPT4 To know and use correctly the information systems.
D1	Analysis and synthesis
D2	Problems resolution.
D3	Oral and written proficiency
D6	Application of computer science in the field of study.
D8	Decision making.
D9	Apply knowledge.
D10	Self learning and work.

Expected results from this subject	Training and Learning Results		
Know the technological basis of telematics and data transmission.	B3	C31 C32 C33	D1 D3 D6 D9 D10
Understand the basic principles and architectures of communication networks and services.	B3	C31 C32 C33	D3 D6 D9 D10
Know the main components of ICT infrastructures.	B3	C31 C32 C33	D1 D2 D3 D6 D8 D9 D10

Know the basic security aspects of computer networks.	B3	C31 C32 C33	D1 D3 D6 D9 D10
ENAEE learning outcome: 1.- Knowledge and understanding. LO 1.3.- Be aware of the multidisciplinary context of engineering. Level of development: Adequate (2)		C31 C32 C33	
ENAEE learning outcome: 5.- Practical application of engineering. LO 5.1.- Understanding of the applicable techniques and analysis, project and research methods and their limitations in the field of their specialty. Level of development: Adequate (2)			D9
ENAEE learning outcome: 5.- Practical application of engineering. LO 5.3.- Knowledge of the application of materials, equipment and tools, technology and engineering processes and their limitations in the field of their specialty. Level of development: Adequate (2)		C31 C32 C33	D6 D9
ENAEE learning outcome: 6.- Elaboration of judgements LO 6.1- Ability to collect and interpret data and handle complex concepts within their speciality, in order to make judgements involving reflection on ethical and social issues.		C31 C32 C33	

Contents	
Topic	
Introduction, protocols and layers.	Introduction and motivation. Basic network concepts. Reference models. Standardisation bodies. History of the Internet.
Physical and link layers.	Introduction to the physical layer. Transmission media. Limit capacity of communication channels. Introduction to the link layer. Frame delimitation. Introduction to transmission errors. Detection and correction of errors.
Retransmission, multiple access and switching.	Retransmission. Random multiple access. Multiple access without contention. Switched Local Area Networks (LAN). Virtual LAN.
Packet forwarding and network connection.	Introduction to the network layer. IP protocol (v4 and v6). ARP protocol Packet fragmentation ICMP protocol Network Address Translation (NAT).
Routing.	Introduction to routing. Dijkstra's algorithm. Routing algorithms in networks. Hierarchical routing. Border Gateway Protocol (BGP).
Transport layer. Reliable transport.	Introduction to the transport layer. Connectionless protocols: User Datagram Protocol (UDP). Connection-oriented protocols: Transmission Control Protocol (TCP). - Connection establishment and release. - Reliability mechanisms. - Flow control. - Congestion control.
Quality of service.	Introduction to quality of service. Multimedia data transmission over best effort networks. Content distribution networks. Differentiated services.
Application layer.	Introduction to the application layer. Domain Name System (DNS). Hypertext Transfer Protocol (HTTP). Dynamic Host Configuration Protocol (DHCP).

Cyberdefense and cybersecurity.	Introduction to security in computer networks. Ethical-social aspects of network security. Cybersecurity risk management. Confidentiality of messages. Authenticity and integrity of messages. Security protocols: WPA, IPsec, TLS. Security software tools.
Networked information systems.	Architecture and components of an information system. Big data and cloud computing. Intelligent Systems.
Information and command and control systems in the Navy.	Intranet overview. Command and control systems. NATO Secret WAN. Naval command system. SIJE. Future of information systems. SIM.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	47	75
Laboratory practical	12	12	24
Problem solving	7	0	7
Mentored work	15	14	29
Presentation	2	2	4
Laboratory practice	3	0	3
Essay questions exam	2	0	2
Essay questions exam	6	0	6

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

Methodologies

	Description
Lecturing	Presentation by the lecturer of the contents on the subject under study, theoretical basis and guidelines of a work, exercise or project to be developed by the student.
Laboratory practical	Activities with the goal of applying knowledge to specific situations and for the acquisition of basic and procedural skills related to the subject matter of the study. They take place in special spaces with specialized equipment (laboratories, computer rooms, etc.).
Problem solving	Activity in which problems and exercises related to the course are formulated. The student must develop the appropriate or correct solutions through the exercise of routines, the application of formulas or algorithms, the application of transformation procedures of the available information and the interpretation of the results.
Mentored work	An intensive course will be developed in which the students who have not passed the course in ordinary call will work, under the supervision of the lecturer, reviewing the theoretical and practical concepts and carrying out activities, problems and exercises in preparation for the examination of the extraordinary call.

Personalized assistance

Methodologies	Description
Lecturing	The lecturers of the course will personally answer the doubts and queries of the students, both in person, according to the schedule that will be published on the center's website, and through telematic means (email, videoconference, Moovi forums, etc.) by previous appointment.
Laboratory practical	The lecturers of the course will personally answer the doubts and queries of the students, both in person, according to the schedule that will be published on the center's website, and through telematic means (email, videoconference, Moovi forums, etc.) by previous appointment.
Mentored work	The lecturers of the course will personally answer the doubts and queries of the students, both in person, according to the schedule that will be published on the center's website, and through telematic means (email, videoconference, Moovi forums, etc.) by previous appointment.
Problem solving	The lecturers of the course will personally answer the doubts and queries of the students, both in person, according to the schedule that will be published on the center's website, and through telematic means (email, videoconference, Moovi forums, etc.) by previous appointment.

Assessment

	Description	Qualification	Training and Learning Results		
Presentation	Submission and presentation of a work related to the subject matter (TL): Evaluation of the work related to the subject and their presentations (approximate date: week 13 of the semester)	15	B3	C31 C32 C33	D1 D3 D6 D8 D10
Laboratory practice	Practical examination (PL): Individual test to evaluate the knowledge acquired in the practical sessions (approximate date: week 14 of the semester). It consists of solving problems similar to those analyzed in the practical sessions.	15	B3	C31 C32 C33	D1 D2 D3 D6 D9 D10
Essay questions exam	Partial examination (PT, 30% of the grade): Written exam to evaluate the knowledge acquired in the theory sessions T1 to T6 (approximate date: week 8 of the semester). Final Exam (ET, 40% of the grade): Final written exam to evaluate the knowledge acquired in the theory sessions T1 to T11 (approximate date: week 14 of the semester). These examinations can be in the form of a multiple choice questionnaire, short answer questionnaire, problem solving, or some combination of the above.	70	B3	C31 C32 C33	D1 D2 D3 D6 D8 D9

Other comments on the Evaluation

Final mark and minimum requirements to pass the course through continuous assessment:
To ensure that the student has acquired the minimum skills in each of the aspects of the course, students will be required to achieve a minimum score of 4.0 out of 10 in the final theory exam. If we name MED_CON to the average grade for continuous assessment, which is calculated as:

MED_CON = 0.3 * PT + 0.4 * ET + 0.15 * PL + 0.15 * TL

The final continuous assessment mark (NEC) will coincide with MED_CON in the event that ET is greater than or equal to 4.0 and, otherwise, it will be calculated as:

NEC = min (4, MED_CON)

This grade (NEC) should be equal to or greater than 5 (on a scale of 10) to pass the course. The student who does not pass the course in this call must take the ordinary exam.

Final mark and minimum requirements to pass the course in the ordinary exam:
The final grade in the ordinary exam (NEO) is calculated with the following formula:

NEO = 0.7 * T + 0.3 * L

Where:

- T represents the theoretical part of the ordinary exam of the course. Individual written exam to evaluate the knowledge acquired in the theory sessions T1 to T11. It can be in the form of a multiple choice questionnaire, short answer questionnaire, problem solving, or some combination of the above.
- L represents the practical part of the ordinary exam of the course. Individual written exam to evaluate the knowledge acquired in the practical sessions of the subject. It consists of solving problems similar to those analyzed in the practical sessions and / or questions about the work presented and / or presentations.

This grade (NEO) should be equal to or greater than 5 (on a scale of 10) to pass the course. The student who does not pass the course in this call or in continuous assessment must attend the extraordinary call.

Final mark and minimum requirements to pass the course in the extraordinary exam:
The final grade in the extraordinary exam (NEE) is calculated with the following formula:

NEE = 0.7 * T + 0.3 * L

Where:

- T represents the theoretical part of the extraordinary exam of the course. Individual written exam to evaluate the knowledge acquired in the theory sessions T1 to T11. It can be in the form of a multiple choice questionnaire, short answer questionnaire, problem solving, or some combination of the above.
- L represents the practical part of the extraordinary exam of the course. Individual written exam to evaluate the knowledge acquired in the practical sessions of the subject. It consists of solving problems similar to those analyzed in the practical sessions and / or questions about the work presented and / or presentations.

This grade (NEE) should be equal to or greater than 5 (on a scale of 10) to pass the course.
ACADEMIC INTEGRITY:
Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces,* **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity,** regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information

Basic Bibliography

A. S. Tanenbaum, N. Feamster, D. Wetherall, **Computer Networks: Global Editionnal Version**, 6a edición, Prentice-Hall, 2021

J. F. Kurose , K. W. Ross, **Redes de computadoras: Un enfoque descendente**, 7a edición, Pearson Education, 2017

Complementary Bibliography

K. R. Fall, W. R. Stevens, **TCP/IP Illustrated, Volume 1: The Protocols**, 2a edición, Addison-Wesley, 2011

K. R. Fall, W. R. Stevens, **TCP/IP Illustrated, Volume 2: The Implementation**, 2a edición, Addison-Wesley, 2011

Recommendations

Other comments

In order for the student to successfully pass this subject, it is advisable to have:

- Well-developed written and oral comprehension skills.
- Ability to abstract and synthesize information.
- Skills for group work and group communication.

IDENTIFYING DATA				
Theory of the ship and shipbuilding				
Subject	Theory of the ship and shipbuilding			
Code	P52G381V01504			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	González-Cela Echevarría, Gerardo			
Lecturers	Carrasco Pena, Pedro Jesús González-Cela Echevarría, Gerardo			
E-mail	gerarcela@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This subject is placed between the specific of the intensification in naval technology, offered exclusively to students of the General Body of the Armed, whose aim is to contribute skills or specific skills to exert the destination of Official of Inner Security (*S.I.). It understands by *S.I. The group of processes, disposals, technical and material means and humans, allocated to warn, reduce and correct the effects that, on a fuselage or his endowment, derive of accidents or actions enemies. The subject has like aim, in the first place, achieve that the students know and comprise all the related with the stability of the fuselage (hydrostatic and intact stability and in failures), as well as the basic concepts related with the hydrodynamic naval (resistance to the advance and his implications) and the behaviour of the fuselage in the sea by the interaction with external factors like waves, wind or currents. Second, the subject will allow that the students purchase sufficient knowledge on the appearances of the naval construction related with the structural elements of the fuselage, his purpose, behaviour, forms of failure and his implications when these produce . This knowledge will allow to the official futures assume functions related with the survival on board of fuselages of surface and submarines. Of this form, the students graduates will be able to have the smart units for the fight, sustain them in the same and make the temporary repairs, back to the fight, necessary to keep the fuselage to the highest operative level.			

Training and Learning Results	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of Industrial Engineering in Mechanical specialty.
B6	Capacity for handling specifications, regulations and mandatory standards.
C38	CITN12/OPT8 To know the nomenclature, the basic principles of the procedures of construction and operation of ships, the basics of buoyancy and stability, the materials for its construction and structure.
C39	CITN13/OPT9 To acquire the ability to perform calculations of buoyancy and stability.
C40	CITN14/OPT10 To apply the principles of control breakdowns in order to reduce the risk of personal and material, and for decision-making in case of onboard emergencies.
D2	Problems resolution.
D8	Decision making.
D9	Apply knowledge.
D16	Critical thinking.

Expected results from this subject	Training and Learning Results		
To know the technological basis of ship construction and operation and the basic fundamentals of buoyancy and stability	B3 B6	C38	
To know the buoyancy and stability calculations of a vessel.	B4	C39	D2 D8 D9 D16
To know the principles of on-board damage control	B3 B6	C40	

LEARNING OUTCOMES ENAEE: KNOWLEDGE AND UNDERSTANDING: RA1.3.- Be aware of the multidisciplinary context of engineering (Developmental level: Adequate (2)).		C38 C39	
LEARNING OUTCOMES ENAEE: ANALYSIS IN ENGINEERING: RA2.2.- The ability to identify, formulate and solve engineering problems in their specialty; choose and apply analytical, computational and experimental methods already established; recognize the importance of social, health and safety, environmental, economic and industrial constraints (development level: Adequate (2)).	B4	C39	D2 D8 D9 D16
LEARNING OUTCOMES ENAEE: RESEARCH AND INNOVATION: RA4.2.- Ability to consult and apply codes of good practice and safety codes of their specialty (development level: Adequate (2)).	B6		
LEARNING OUTCOMES ENAEE: PRACTICAL APPLICATION OF ENGINEERING: RA5.3.- Knowledge of application of materials, equipment and tools, technology and engineering processes and their limitations in the field of their specialty (development level: Adequate (2)).		C38 C39 C40	D8 D9
LEARNING OUTCOMES ENAEE: PRACTICAL APPLICATION OF ENGINEERING: RA5.4.- Ability to apply standards of engineering practice in their specialty (development level: Adequate (2)).	B6	C40	D9

Contents	
Topic	
1. General considerations about ship theory:	1.1. Buoyancy. 1.2. Stability.
2. Hull geometry:	2.1. Shape plan. 2.2. Layout chart. 2.3. Principal coefficients. 2.4. Hydrostatic curves.
3. Transversal stability:	3.1. Initial stability. 3.2. Experiment of stability. 3.3. Accidental grounding.
4. Longitudinal stability:	4.1. Effect of the accidental grounding. 4.2. Stranded in dike. 4.3. Launching.
5. Stability in damage:	5.1. Floods. 5.2. Effects.
6. Tight subdivision:	6.1. Compartment. 6.2. Control of damages.
7. Regulation:	7.1. Classification. 7.2. IMO Rules. 7.3. Freeboard. 7.4 Tonnage.
8. CAD applications:	8.1. Naval design. 8.2. Naval construction.
9.Naval construction:	9.1. Definition. 9.2. The ship and his types. 9.3. Materials of construction.
10. General description of the hull:	10.1. Structural topology. 10.2. Structural elements. 10.3. Processes of union.
11. Structural tensions:	11.1. Calm waters.
12.Structural tensions:	12.1. Stormy waters.
13. Basic calculations of of naval structures.	13.1. Diagram of flow for calculations.
14. Peculiarities of the structures of the fuselages of war.	14.1. Special loads.
Practices:	P1: Buoyancy. P2: Transversal Stability. P3: Longitudinal Stability. P4: Breakdown practice. P5: Transverse Stability in spreadsheet. P6: Longitudinal Stability in spreadsheet. P7: Calculation of stability in damage in spreadsheet.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	28	42	70
Laboratory practical	14	28	42
Seminars	26	5	31
Problem solving	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	In these sessions, the basic theoretical contents of the program will be explained in detail, exposing explanatory examples with which to deepen the understanding of the subject. Presentations and the blackboard will be used in combination. As far as possible, a copy of the transparencies will be provided to the students prior to the presentation, focusing the effort of the teacher and the students on the presentation and understanding of the knowledge. In any case, paper reproductions of transparencies should never be considered as substitutes for texts or notes, but as complementary material.
Laboratory practical	Small participative lecture sessions. Sometimes, it will be necessary to explain certain practical concepts providing useful advice for the best use of the practical classes. Problem solving. The practices are aimed at reinforcing the theoretical concepts dealt with in the theory sessions. The didactic method to be followed in the practical classes consists of problem solving. The teacher solves a problem interacting with the students. Then the students solve problems in group and finally the students solve a problem individually that will be collected at the end of the session. Tutored laboratory practices. In practices 5 and 6 the teacher performs the practice and explains some steps and the student follows the process.
Seminars	These hours include the 15-hour intensive course that is scheduled as support for the student in their preparation for the extraordinary call. Assessment tasks
Problem solving	The teacher solves a problem by interacting with the students and solving the doubts that arise.

Personalized assistance	
Methodologies	**Description**
Problem solving	In the field of tutorial action, there are academic tutoring actions as well as personalized tutoring. In the first case, the students will have at their disposal hours of tutorials in which they can consult any doubt related to the contents, organization and of the subject, with the development of the project, etc. The tutorials can be individualized, but group tutorials will be encouraged for the resolution of problems related to the activities to be carried out in group, or simply to inform the teacher of the evolution of the collaborative work. In the personalized tutorials, each student, individually, will be able to discuss with the teacher any problem that is preventing him/her from following the course properly, in order to find some kind of solution between both of them. By combining both types of tutorial action, the aim is to compensate for the different learning rhythms through attention to diversity. The teachers of the subject will personally attend to the doubts and queries of the students, both in person, according to the schedule that will be published in the web page of the center, and through telematic means (e-mail, videoconference, Moovi forums, etc.) under the modality of previous appointment.

Assessment				
	Description	Qualification	Training and Learning Results	
Lecturing	The knowledge of theory taught in the classroom is evaluated through written tests throughout the term. The intermediate tests are short tests (1 hour) (15% c.u.) and their purpose is to evaluate the assimilation of the contents by the students, to motivate autonomous study and to identify those students who require individualized tutoring. On the other hand, the final written test is a long test (4 hours) (40%) which aims to evaluate the learning of all the theoretical contents of the course.	70	B3 C38 B4 C39 B6 C40	D2 D8 D9 D16
Laboratory practical	The evaluation of the internships (NP) is carried out by averaging the scores obtained in each of the internships, all of them with the same weight.	20	C39	D2 D9 D16
Problem solving	Participation (date: it evaluates in the seminars and in the debates in class of theory)	10		D16

Other comments on the Evaluation
The final summative evaluation of the student will be based on the sum of the score given to each of the above mentioned parts, being the continuous evaluation grade (NEC): NEC = 0.15 * PI1 + 0.15 * PI2 + 0.2 * NP + 0.4 * PF + 0.1 * CP In order to pass the course by continuous evaluation, a NEC grade equal to or higher than 5 points is required. However, some requirements will be demanded, in some of the sections, that guarantee the balance between all types of competences. These requirements are:1. To have taken the two intermediate tests and at least 6 of the 7 practical sessions.2. To obtain a grade equal to or higher than 4 points out of 10 in the final continuous evaluation test (FP).

Those students with NEC lower than 5 points or who do not meet any of the above requirements, must take the regular exam in order to pass the course. In addition, for those who do not meet the requirements, their continuous evaluation grade will be calculated as: NEC FINAL = min (4, NEC). All those students who wish to improve their grade obtained by continuous evaluation may also take the regular exam.
Both the ordinary and the extraordinary exam will evaluate all the competences of the course. Therefore, these exams will include questions related to the tasks carried out in the practicals.
ACADEMIC INTEGRITY: Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces,* **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity,** regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information

Basic Bibliography

Armada Española, **I-CP-03 Estabilidad**, Armada,

Armada Española, **I-CP-02 Control de averías**, Armada,

Complementary Bibliography

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J. Olivella Puig, **Teoría del buque. Flotabilidad y estabilidad**, UPC,

J. Olivella Puig, **Teoría del buque. Flotabilidad y estabilidad (Problemas).**, UPC,

Lewis, E. V., **Principles of naval architecture second revision: stability and strength. Volume I.**, SNAME,

Lewis, E. V., **Principles of naval architecture second revision: stability and strength. Volume II.**, SNAME,

Bonilla de la Corte, A., **Teoría del buque.**, Librería San José,

Bonilla de la Corte, A., **Construcción naval y servicios.**, Librería San José,

de Juan García Aguado, J. M., **Estática del buque.**, UDC,

de Juan García Aguado, J. M., **Principios de teoría del buque: Dinámica.**, UDC,

Bureau of Naval Personel USN, **Principles of naval engineering**, NAVPERS,

Recommendations

Other comments

It is recommended a review of basic elements studied in other subjects such as:
-Gravitation, Center of gravity, composition of centers of masses, Pappus-Guldin and Steiner theorems.
-Density, Archimedes' theorem, fundamental principle of hydrostatics, viscosity, Bernoulli's equations, continuity and Venturi effect.
-Descriptive geometry, systems of representation in the plane, projections and cuts.
-Methods of approximate integration of areas and volumes, linear regressions, trapezoidal and Simpson's rules.

IDENTIFYING DATA				
Automobiles				
Subject	Automobiles			
Code	P52G381V01505			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	1st
Teaching language	Spanish			
Department				
Coordinator	Álvarez Feijoo, Miguel Ángel			
Lecturers	Álvarez Feijoo, Miguel Ángel Casqueiro Placer, Carlos			
E-mail	alvarezfeijoo@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This guide presents relative information to the subject of Automobiles of fifth year of the Bachelor Degree in Mechanical Engineering taught in the Defense University Center at the Spanish Naval Academy, which lists the competencies that the students have to achieve, the schedule of educational activities, the contents and its temporary programming, an estimate of the work load of the student, the specific criteria for his evaluation and the bibliography recommended for a correct follow-up of the matter. The main objetive of the subject will be to develop the knowledge of the vehicular dynamics. This is an exclusive competency of this subject.			

Training and Learning Results	
Code	
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of Industrial Engineering in Mechanical specialty.
C41	CITN15/OPT11 Develop knowledge of vehicle dynamics
D1	Analysis and synthesis
D2	Problems resolution.
D3	Oral and written proficiency
D5	Information Management.
D8	Decision making.
D9	Apply knowledge.
D10	Self learning and work.
D12	Research skills.
D16	Critical thinking.
D17	Team working.
D20	Ability to communicate with people not expert in the field.

Expected results from this subject	Training and Learning Results		
To know the technological basis of the automobile vehicles	B3 B4	C41	D1 D2 D3 D5 D8 D9 D10 D12 D16 D17
ENAEE learning outcome: KNOWLEDGE and UNDERSTANDING: LO1.2.- knowledge and understanding of the mathematics and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme outcomes [Intermediate (2)].	B3		
ENAEE learning outcome: ENGINEERING ANALYSIS: LO2.2.- ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical societal, health and safety, environmental, economic and industrial constraints [Intermediate (2)].	B4		D1 D2 D8 D9 D16

ENAEE learning outcome: ENGINEERING PRACTICE: LO4.1.- ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, to carry out simulation and analysis in order to pursue detailed investigations and research of technical issues in their field of study; [Intermediate (2)].			D5
ENAEE learning outcome: ENGINEERING PRACTICE: LO5.2.- practical skills for solving complex problems, realising complex engineering designs and conducting investigations in their field of study [Intermediate (2)].	B4		D2 D9 D12 D16
ENAEE learning outcome: ENGINEERING PRACTICE: LO5.3.- understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations in their field of study [Intermediate (2)].		C41	D8 D9
ENAEE learning outcome: COMMUNICATION AND TEAM-WORKING: LO7.1.- ability to communicate effectively information, ideas, problems and solutions with engineering community and society at large [Intermediate (2)].			D1 D3 D20
ENAEE learning outcome: COMMUNICATION AND TEAM-WORKING: LO7.2.- ability to function effectively in a national and international context, as an individual and as a member of a team and to cooperate effectively with engineers and non-engineers [Intermediate (2)].			D17

Contents

Topic	
Topic 1: Introduction to the theory of the automotive vehicles. (T1)	The automotive vehicle: concept. Main requests of the automotive vehicle. The system man-machine-enviroment. Objectives and scope of the theory of the automotive vehicles.
Topic 2: Introduction to tactical vehicles. (T2)	Basic characteristics of tactical vehicles. Spanish marines' vehicles. Most common faults: diagnosis. Specific legislation of circulation.
Topic 3: Interaction between vehicle and road surface. (T3)	General characteristics of tyres. Mechanical characteristics of tyres. Longitudinal stress (traction, braking). Lateral stress (slip angle). Mathematical models. Rolling characteristics of chain vehicles.
Topic 4: Longitudinal dynamics: perfomances. (T4)	Resistance to movement. Basic equation of longitudinal motion. Maximum tractive effort limited by adhesion. Motor and transmission characteristics. Prediction of the performance of a vehicle.
Topic 5: The powertrain. (T5)	The internal combustion engine. Types of transmissions. Transmission components. The manual gearbox. Automatic gearboxes. Homokinetic joints. The differential, function and types. Differential lock. Reducer gearbox.
Topic 6: Braking of automotive vehicles. (T6)	Moment and forces of the braking process. Adhesion condition: optimal braking. Braking process. Braking system.
Topic 7: Vehicle lateral dynamics. (T7)	Steering geometry. Low speed manoeuvrability.Tipping and skid speed limit. Directional steady-state vehicle behavior. Load influence.
Topic 8: Suspension system. (T8)	Vibrations, vehicle and human effects. Suspension system: mathematical model. Kinematics of suspension. Suspension systems: elastic elements (spring, torsion bars, leaf springs) and dampers. Pneumatic suspension. Influence of suspension on the vehicle dynamic behaviour. Kinematics of suspension and tyre behaviour. Suspension set up.
Topic 9: Driving techniques. (T9)	Driver position. Use of hands. The vision. Specific off road driving techniques. Sand, mud and snow driving.
Topic 10: Vehicle recovery. (T10)	Theory of levers and pulleys: levers of first, second and third genus. Practical examples. Pulleys, forces and tensions. Pulley friction and resistance. Vehicle recovery: definition. Recovery steps. Traction recovery. Forces to consider. Recovery machines: mechanical advantage. Resistance according to the terrain and according to the slope. Recovery of overturned vehicles: forces to consider. Anchors. Exceptional traction and anchoring methods. Expedited methods of hoisting. Traction recovery practices: with return and without return. Practices of anchors: from bar to sand. IM recovery means. Capabilities of the vehicle winches in service of the IM: Hummer, Pegaso 7323 and Iveco 257M trucks. Anchors for towing, recovery and hoisting of the main IM vehicles: Hummer, Pegaso 7323 and Iveco 257M trucks, AAV, CCM M-60, Piranha III. Car M-88 and AAVR: crane and winch capabilities. General description of the M-88 car crane: limitations. Overview of the AAVR Truck Crane: Limitations.

Topic 11: Safety systems. (T11)	Active and passive safety. Driving assistance systems: traction and stability control, ABS. Influence of driving technique. Passive safety: deformable structures, safety cell, seat belts, airbag.
Topic 12: Alternative powertrains. (T12)	The fuel cell. Hybrid vehicles. Electric vehicles. Hydrogen propulsion systems.
Practical sessions 1 and 2 (2 sessions, 4 hours). Vehicle monitoring. (PL1 y PL2)	Use of Data Acquisition Systems (DAS) in the automobile: installation of hardware, configuration, reading and interpretation of data. The student will give a report about the work done and / or will answer a questionnaire.
Practical sessions 3 and 4 (2 sessions, 4 hours). Calculation of perfomances and braking characteristics (PL4)	Analysis and prediction of vehicle performance using software. Analysis and prediction of the braking performance of the vehicle using software. The student will give a report with the results and / or will answer a questionnaire.
Practical sessions 5, 6 and 7 (3 sessions, 6 hours). Lateral dynamics. (PL5, PL6 and PL7)	Analysis and prediction of lateral dynamic behavior of the vehicle using software. The student will give a report with the results and / or will answer a questionnaire.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	22	47
Problem solving	7	14	21
Mentored work	3	6	9
Practices through ICT	12	10.6	22.6
Laboratory practical	2	1.4	3.4
Seminars	15	10	25
Autonomous problem solving	11	11	22

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

Methodologies

	Description
Lecturing	In these sessions, the basic theoretical contents of the program will be explained in detail, explaining examples with which to deepen the understanding of the subject. Computer presentations and blackboard will be used, especially to convey information such as definitions, graphs, etc. The content of these classes will be complemented with notes and the slides will also be available for the student.
Problem solving	Since the tutorial action is treated as a group support action to the student's learning process, the tutorials will preferably be conducted in seminars and in the form of small group meetings, with problem solving, exercises or case studies.
Mentored work	It is intended to motivate the student in the research activity, and to foster personal relationships by sharing problems and solutions. In order to acquire certain competences it is necessary to propose activities based on the use of active methodologies. Part of the theoretical content should be developed and / or applied to practical cases treated in group and presented in class, for which part of the time devoted to theoretical classes will be allocated.
Practices through ICT	Analysis and prediction of lateral and longitudinal dynamic behavior of the vehicle using software. The student will deliver reports with the results and / or answer questionnaires. The didactic method to follow in the delivery of practical classes is that the lecturer supervises the work done by the students. The laboratory practices are aimed at strengthening the theoretical concepts addressed in the sessions in the classroom.
Laboratory practical	The didactic method to follow in the delivery of practical classes is that the lecturer supervises the work done by the students. The laboratory practices are aimed at strengthening the theoretical concepts addressed in the sessions in the classroom.
Seminars	Intensive course of 15 hours stop those students that suspended the subject in first call, previous to the examination in second call. Group tutoring with lecturer.
Autonomous problem solving	Employed in the assessment tests in order to verify the abilities acquired by the student.

Personalized assistance

Methodologies	Description
Problem solving	Student solves exercises or practical cases with lecturer help. In the personalized tutoring, each student, individually, can discuss with the lecturer any problem related to their learning achievements in the subject. The lecturer will personally solve the questions of the students both in person, according to the tutoring schedule published on the web page of the CUD-ENM, as well as through telematic means (email, videoconference, Moovi forums, etc.) with previous appointment.

Seminars	Group tutorials with the subject lecturer. In the personalized tutoring, each student, individually, can discuss with the lecturer any problem related to their learning achievements in the subject. The lecturer will personally solve the questions of the students both in person, according to the tutoring schedule published on the web page of the CUD-ENM, as well as through telematic means (email, videoconference, Moovi forums, etc.) with previous appointment.

Assessment

	Description	Qualification	Training and Learning Results	
Mentored work	The student will carry out a research work (TI) about a case proposed by the lecturer and will deal with issues related to topics 11 and 12. The work will be scored from 0 to 10 according to their content and defense, following the rubric provided at the time of assigning the topics to the students	15	B3 B4	D1 D2 D3 D5 D8 D9 D10 D16 D17
Practices through ICT	The evaluation of the practical part (NP) will be made from the reports or questionnaires corresponding to each one (a total of 4-5), with a total value of 10 points.	15	B3 B4	D1 D2 D3 D5 D8 D9 D10 D16 D17 D20
Autonomous problem solving	Two theoretical and practical tests of continuous evaluation (15% each) will be carried out at the end of blocks or parts 2 and 3. Their evaluation will be carried out on 10 points each. The Continuous Assessment Final Test (with a 40% weight) will be carried out in the evaluation week and will be valued at 10 points. It will be necessary to obtain a grade higher or equal to 4 points out of 10 in the final exam of continuous evaluation in order to qualify for the one approved by continuous assessment.	70	B3 B4	D1 D2 D3 D5 D8 D9 D16

Other comments on the Evaluation

The final mark of continuous assessment (NEC) shall be calculated as follows:

$NEC = 0.15 \cdot P1 + 0.15 \cdot P2 + 0.15 \cdot TI + 0.15 \cdot NP + 0.4 \cdot PF$

The student must submit to the regular examination of all the contents of the subject, which will represent 100% of the grade, in the following cases:

- The final grade of continuous assessment (NEC) is less than 5.
- The non-delivery of research work.
- The non-execution or delivery of the memory of practices, unless it is exempted for good cause.
- Obtain a grade below 4 points out of 10 on the final continuous assessment exam.

The continuous evaluation note in case of not fulfilling some of the last four previous requirements will be obtained by the expression: NECS = min (4, NEC)

In any case, the student who has passed the continuous assessment, will have the possibility to submit to the regular exam to improve his/her grade.

ACADEMIC INTEGRITY: Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces,* **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity,** regardless of the percentage of importance that the test in question had in

the overall continuous assessment and independently of other disciplinary actions that may be applied.

Sources of information
Basic Bibliography
Luque, P, **Ingeniería del Automóvil. Sistemas y comportamiento dinámico**, Ed. Paraninfo, 2004
Complementary Bibliography
Arias-Paz, M., **Motocicletas**, Ed. Dossat,
Bosch, **Manual de la Técnica del Automóvil**, Ed. Reverté,
Cascajosa, Manuel, **Ingeniería de vehículos : sistemas y cálculos**, Ed. Tebar,
Técnica de recuperación de vehículos de ruedas, Escuela de Aplicación de Infantería de Marina,
Conducción Todo-Terreno y Recuperación de vehículos, Escuela de Infantería de Marina.,
Manual de Características de los Vehículos de Infantería de Marina, Junta Táctica de Infantería de Marina.,
Guía del conductor militar (OR6-002), Estado Mayor del Ejército de Tierra.,

Recommendations

Other comments

Proper development of the subject requires that the student has competencies in the field of differential calculus, vector and kinematic computation and dynamics of the point and the solid.

IDENTIFYING DATA				
Complementary training				
Subject	Complementary training			
Code	P52G381V01506			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	2nd
Teaching language				
Department				
Coordinator	Barragáns Martínez, Ana Belén			
Lecturers	Barragáns Martínez, Ana Belén			
E-mail	belen@cud.uvigo.es			

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Final Year Dissertation				
Subject	Final Year Dissertation			
Code	P52G381V01991			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	12	Mandatory	5th	2nd
Teaching language	Spanish English			
Department				
Coordinator	Núñez Nieto, Xavier			
Lecturers	Núñez Nieto, Xavier			
E-mail	xnnieto@cud.uvigo.es			
Web	http://cud.uvigo.es/trabajos-fin-de-grado/			
General description	The Final Year Project (TFG) forms part, like module, of the curriculum of the Mechanical Engineering Bachelor Degree. It is an original and personal work that each student will make under lecturer supervision, allowing him/her to show in an integrated way the acquisition of the formative contents and the competences associated to the degree. With this work the student applies the knowledges adquired during his/her training, so much of the module of specific mechanical technology as of other fields of knowledge related with the mechanical engineering necessary to carry out the TFG, which reflects its multidisciplinary character. Moreover, it is pretended that the student adquire or reinforce some capacities that allow him/her to project, design and develop complex products, processes and systems of the speciality; have consciousness of the social appearances, of health and security, environmental, economic and industrial; select and apply methods of appropriate project; and look for solutions from a technical point of view as well as its implementation and adequation to the environment. Its definition and contents are explained more extensively in the regulations for the completion of the Final Year Project approved by Centre Board, in its first version, in session celebrated on 2/9/2014, and whose updated content is shown in the website of CUD-ENM, in the section dedicated to the TFG (Studies Section -> Mechanical Engineering Degree ->Student -> Final Year Project).			

Training and Learning Results	
Code	
B1	Skills for writing, signing and developing projects in the field of industrial engineering, whose purpose is, specializing in Mechanics, construction, alteration, repair, maintenance, demolition, manufacturing, installation, assembly or operation of: structures, mechanical equipments, energy facilities, electrical systems and electronic installations and industrial plants, and manufacturing processes and automation.
B2	Ability to manage the activities object of the engineering projects described in B1.
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of Industrial Engineering in Mechanical specialty.
B10	Ability to work in a multidisciplinary and multilingual environment.
B12	Original exercise to realise individually and present and defend in front of a university committee, consistent in a project in the field of the specific technologies of the Industrial Engineering in the Mechanical speciality of professional nature in which the skills and competences acquired in the educations are summarised and integrated.
D4	Oral and written proficiency in a foreign language.
D12	Research skills.

Expected results from this subject		
Expected results from this subject	Training and Learning Results	
Research and structuring of information on any subject	B1 B2 B3 B4 B10 B12	D12

Preparation of a project reportwhich collects : introdcution, problematic or state of the art, aims, phases of the project, development of the project, conclusions and future lines.	B1 B2 B3 B4 B10 B12	D4 D12
Design of equipments, prototypes, programs of simulation, etc, according to specifications.	B1 B2 B3 B4 B10 B12	D12
ENAEE LEARNING OUTCOME. KNOWLEDGE AND UNDERSTANDING LO1.3.- awareness of the wider multidisciplinary context of engineering (level of development of this learning outcome - Intermediate (2)).	B10 B12	
ENAEE LEARNING OUTCOME. ENGINEERING ANALYSIS LO2.1.- The capacity to analyse products, processes and complex systems in his field of study; choose and apply of pertinent form analytical methods, of calculation and experimental already established and interpret properly resulted of said analysis (Intermediate (2))	B1 B2 B4	
ENAEE LEARNING OUTCOME. ENGINEERING ANALYSIS LO2.2.- ability to identify, formulate and solve engineering problems in their field of study; to select and apply relevant methods from established analytical, computational and experimental methods; to recognise the importance of non-technical societal, health and safety, environmental, economic and industrial constraints (Intermediate (2))	B4	
ENAEE LEARNING OUTCOME. ENGINEERING DESIGN LO3.1.- ability to develop and design complex products (devices, artefacts, etc.), processes and systems in their field of study to meet established requirements, that can include an awareness of non-technical societal, health and safety, environmental, economic and industrial considerations; to select and apply relevant design methodologies (Intermediate (2))	B4 B12	
ENAEE LEARNING OUTCOME. ENGINEERING DESIGN LO3.2.- ability to design using some awareness of the forefront of their engineering specialisation (Intermediate (2))	B1 B4 B12	
ENAEE LEARNING OUTCOME. INVESTIGATIONS LO4.1.- ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, to carry out simulation and analysis in order to pursue detailed investigations and research of technical issues in their field of study (Intermediate (2))		D12
ENAEE LEARNING OUTCOME. INVESTIGATIONS LO4.3.- laboratory/workshop skills and ability to design and conduct experimental investigations, interpret data and draw conclusions in their field of study (Intermediate (2))	B12	D12
ENAEE LEARNING OUTCOME. ENGINEERING PRACTICE LO5.2.- practical skills for solving complex problems, realising complex engineering designs and conducting investigations in their field of study (Intermediate (2))	B4	D12
ENAEE LEARNING OUTCOME. MAKING JUDGEMENTS LO6.2.- ability to manage complex technical or professional activities or projects in their field of study, taking responsibility for decision making (Advanced (3))	B1 B2	
ENAEE LEARNING OUTCOME. COMMUNICATION AND TEAM WORKING LO7.1.- ability to communicate effectively information, ideas, problems and solutions with engineering community and society at large (Advanced (3))	B1 B4 B12	D4
ENAEE LEARNING OUTCOME. COMMUNICATION AND TEAM WORKING LO7.2.- ability to function effectively in a national and international context, as an individual and as a member of a team and to cooperate effectively with engineers and non-engineers (Intermediate (2))	B1	D4

Contents

Topic	
Final Year Project	It tries to tackle the resolution of an original and individual exercise in which the student confronts to a real problem of the field of the engineering, uses the methodology acquired during his/her training and proposes a technically valid and viable solution. The contents of each TFG will be defined in the individual proposals offered by the lecturers and approved in the Centre Board, according to the regulations for the realisation of the Final Year Project. Each TFG will have a different content.

Planning

	Class hours	Hours outside the classroom	Total hours
Mentored work	20	0	20

Seminars	10	40	50
Autonomous problem solving	0	210	210
Presentation	5	15	20

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

Methodologies

	Description
Mentored work	The student, in an individual way, guided and supervised by his/her advisor, elaborates, as a result of the developed work, a project according to the indications of the Regulations for the realisation of the Final Year Project of the CUD-ENM. In said memory, the student presents the results of his/her work in which he/she has had to project, design or develop products, processes or systems of the field, as well as propose solutions to the problem posed in the field of the engineering, taking into account in the measure of the possible social factors, of health and security, environmental, economic and industrial.
Seminars	The students that fails the Final Year Project will have to improve, in an individual way, guided and supervised by his/her advisor, the project according to the indications of committee.
Autonomous problem solving	Studies/previous activities Before carrying out the work (also during the same), the student will have to make bibliographic researches and consult specific databases, what will allow him/her a better processing and preparation so much of documentation, as of proposals of resolution to the problem proposed in the TFG. These activities will be carried out in the classroom and/or laboratory, independently by the students. Personalised and individualized attention by the advisor The advisor will supervise the progress of the TFG through periodic meetings where he/she will provide feedback to the student. Integrated methodologies The student presents the result obtained in the preparation of a document on the thematic of the matter. It will be carried out individually, both in writing (memory) and orally (presentation). Presentation and public defense The students must prepare and defend the work done in front of a committee. The defense will be carried out in a face-to-face, broadcast and recorded through the conference platform.

Personalized assistance

Methodologies	Description
Mentored work	The advisor will supervise the progress of the TFG through periodic meetings where he/she will provide feedback to the student. The advisor will take time to help personally to each of the TFG students, to guide their work and guide their learning process, as well as to review and correct the report.
Seminars	The advisor will supervise the improvement of the TFG through periodic meetings where he/she will provide feedback to the student. The advisor will take time to help personally to the TFG students, to guide their work and guide their learning process, as well as to review and correct the report.
Tests	**Description**
Presentation	The students must prepare and defend the work done in front of a committee. It will carried out in a face-to-face, broadcast and recorded through the conference platform.

Assessment

	Description	Qualification	Training and Learning Results	
Mentored work	Report of the TFG advisor	25	B1 B2 B4 B12	D12
Presentation	Report of the committee of the TFG Evaluation of the presentation and defense	75	B1 B2 B3 B4 B10 B12	D4 D12

Other comments on the Evaluation

At least one committee will be appointed,consisting of three lecturers for each of the following areas: MAT (Mathematics), MEC (Mechanics), ELE (Electricity, Electrotechnics and Automatic), QUI (Chemical and Environmental Technology), TEL

(Telecommunications), OI (Industrial Organization).

The evaluation will be carried out according to the regulations for the completion of the Final Year Project as well as the evaluation rubric, both approved by the Center Board, whose updated contents are shown on the CUD-ENM website, in the section dedicated to theTFG (Studies Section -> Mechanical Engineering Degree ->Student -> Final Year Project).

ACADEMIC INTEGRITY: Students are expected to show adequate ethical behaviour, committing to act honestly. Based on article 42.1 of the *Regulation on the evaluation, qualification and quality of teaching and the student learning process of the University of Vigo*, as well as point 6 of the fifth rule of *Order DEF/711/2022, of July 18th, which establishes the requirements for evaluation, progress, and ongoing enrolment in military educational training centres for incorporation into the ranks of the Armed Forces*, **any violation of academic integrity in the assessment process, as well as the cooperation in it will result in the assignment of a failing grade to the student (zero) for the entire course in the corresponding assessment opportunity**, regardless of the percentage of importance that the test in question had in the overall continuous assessment and independently of other disciplinary actions that maybe applied.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

Important information: In the moment of the defense of the TFG, the student must have all the remaining subjects of the degree passed, as established in the article 7.7 of the Regulation for the realisation of the Final Year Project of the University of Vigo.