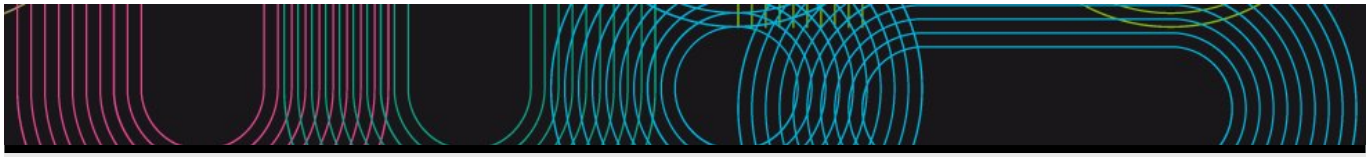

IDENTIFYING DATA				
Theory of the ship and shipbuilding				
Subject	Theory of the ship and shipbuilding			
Code	P52G381V01504			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	5th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Carrasco Pena, Pedro Jesús			
Lecturers	Carrasco Pena, Pedro Jesús González-Cela Echevarría, Gerardo			
E-mail	pedrocarrasco@cud.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This subject is framed among the specific ones of the intensification in naval technology (General Corps). Its objective is to provide specific skills or abilities to carry out the position of Damage Control Officer (S.I.). The S.I. is the set of processes, standards, techniques and material and human means used to prevent, reduce, and correct the effects that, on a ship or its crew, derive from accidents or enemy actions. The first objective of the course is to ensure that students know and understand everything related to ship stability (hydrostatic and intact and damage stability). As well as the basic concepts related to naval hydrodynamics and seakeeping due to the interaction with external factors such as waves, wind, or currents. Secondly, the course will enable students to acquire sufficient knowledge of shipbuilding. Thus, they will know the structural elements of the ship, its purpose, behavior, forms of failure and their implications when they occur. This knowledge will enable future officers to take on roles related to the survivability of surface ships and submarines. In this way, graduates will be able to have naval units ready for combat, to sustain them in combat and to carry out the temporary post-combat repairs necessary to maintain the ship at the highest operational level.			

Skills	
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.

Learning outcomes	
Expected results from this subject	Training and Learning Results

Students will be able to:
1. Identify the basic concepts of statistical analysis: unit, observation, case, variable, value, category, data, population and sample.
2. Describe the structure, organization, operation and relation with the citizenship of the public statistical systems at regional, national and European levels.
3. Find and analyze public statistics from regional, national and European administration databases.
4. Recognize and describe the relationship between variables.
5. Illustrate the behaviour of variables through suitable charts.
6. Calculate and interpret the most relevant position, dispersion and form measures.
7. Classify the variables according to the type of values and operations that can do with them.
8. Classify, organize and summarize data using computing tools.
9. Support their arguments using tables, charts and measures of position, dispersion, form and relation.
10. Judge, question and value others in a constructive manner and work with other people.

Know the ship building technology and operation and the basics of buoyancy and stability	B3 B6	C38	
Know ship buoyancy and stabiliby calculations	B4	C39	D2 D8 D9 D16
Know the basics of damage control on board	B3 B6	C40	
ENAEE LEARNING OUTCOME: KNOWLEDGE AND UNDERSTANDING: LO1.3.- Awareness of the wider multidisciplinary context of engineering (Level of achievement: Intermediate (2)).		C38 C39	
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)).	B4	C39	D2 D8 D9 D16
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)).	B6		
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)).		C38 C39 C40	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)).	B6	C40	D9

Contents

Topic	
1. General considerations on ship theory:	1.1. Buoyancy. 1.2. Stability.
2. Geometry of the hull:	2.1. Lines plan 2.2. Offset tables. 2.3. Main coefficients. 2.4. Hydrostatic curves.
3. Transverse Stabiliy:	3.1. Initial stability 3.2. Stability experiment. 3.3. Grounding.
4. Longitudinal stability:	4.1. Effect of grounding. 4.2. Docking. 4.3. Launching.
5. Damage stability:	5.1. Floodings. 5.2. Effects.
6. Watertight subdivision:	6.1. Compartmentalization. 6.2. Tightness control.
7. Regulations:	7.1. Classification. 7.2. IMO rules. 7.3. Freeboard. 7.4 GT rules.
8. CAD apps:	8.1. Naval Design. 8.2. Shipbuilding.
9. Shipbuilding:	9.1. Definition. 9.2. The ship and its types. 9.3. Shipbuilding materials.

10. General description of the hull:	10.1. Structural topology. 10.2. Hull elements. 10.3. Joint processes.
11. Structural Stresses:	11.1. Calm Waters.
12.Structural Stresses:	12.1. Rough seas.
13. Basics of naval structures calculations.	13.1. Flowchart for calculations.
14. Warship□s structure particulars.	14.1. Special loads.
Practices:	P1: Buoyancy. P2: Transversal Stability. P3: Longitudinal Stability. P4: Damage conditions. P5: Transversal Stability Spredsheet. P6: Longitudinal Stability Spredsheet P7: Technical Documentation use.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	42	70
Laboratory practical	14	28	42
Seminars	14	17	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	The basic theoretical contents of the program will be explained in detail in these lectures. Explanatory examples will be presented for deeper understanding of the subject. Slide presentations and blackboard will be used in combination. As far as possible, presentations will be provided to the students prior to the sessions. In any case, the hardcopy reproductions of the slide presentations should never be considered as substitutes of texts or notes. Thus, this material must be considered a complementary material.
Laboratory practical	Practical Tips in Master Classes. Sometimes, it will be necessary to explain certain practical concepts by providing useful tips for making the best use of the practical classes. Problem Solving. Activity in which problems and / or exercises related to the subject are formulated by the lecturers. The student must develop the appropriate or correct solutions through the repetition of routines, the application of formulas or of procedures. It is usually used as a complement to evaluate the students. Laboratory Practical. Activities for applying the knowledge to situations and for the acquisition of basic and procedural skills related to the subject. They are developed in dedicated rooms like laboratories, computer rooms, etc.
Seminars	The tutorial action is faced as a group support of the student's learning process. Tutorials are preferably done in small group seminars. In the seminars, the student's attitude towards the lecturer and the rest of their classmates is evaluated through annotations made by the lecturer.
Problem solving	Activity in which problems and / or exercises related to the subject are formulated by lecturers. The student must develop the appropriate or correct solutions through the repetition of routines, the application of formulas or of procedures. It is usually used as a complement to the lecture sessions.

Personalized assistance

Methodologies	Description
Problem solving	The teaching action will distinguish academic tutoring actions and personalized tutoring actions. For academic tutoring, students will have scheduled hours of tutoring. In these hours of tutoring, students will be able to consult any questions related to the contents, organization of the subject, development of the project, etc. For these tutorials, group tutorials will be encouraged to solve problems related to group activities, or simply to inform the lecturer about the evolution of group work. In the personalized tutorials, each student, individually, will be able to comment with the lecturer about any problem that prevents him from adequately monitoring the subject or any of its parts. these tutorials seek to find a solution to these problems between student and lecturer. It seeks, combining the two types of tutoring, it is intended to compensate the different learning rhythms through attention to diversity. The lecturers of the subject will answer the questions and queries of the students in person, following the schedule that will be published on the Centre□s website. They will also answer these questions through telematic means (email, videoconference, Moovi forums, etc.) under the modality of prior appointment.

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	The theory contents taught in the master sessions are evaluated by 2 intermediate exams along the semester. These intermediate exams are short written tests (1 hour), whose purpose is to evaluate the assimilation of the contents by the students, are to motivate the autonomous study and identify those students requiring individual tutorial attention. During the course two intermediate tests are carried out consisting of conceptual questions and short problems with a weigth of 15% each one in the final note. Regarding the final exam is a long-term test (4 hours) that aims to evaluate the learning of all the contents of the subject by means of theory questions and problems. The weigth assigned to this part is 40%.	70	B3 C38 D2 B4 C39 D8 B6 C40 D9 D16
Laboratory practical	The evaluation of the practices (NP) carries out making the average of the punctuations obtained in each one of the practices, all of them has 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

Student final mark is obtained by a weighted sum over the scores achieved in each of the above mentioned parts. A continuous evaluation mark (NEC) is defined according to:

NEC = 0,15 * PI1 + 0,15 * PI2 + 0,2 * NP + 0,4 * PF + 0,1 * CP

Passing the course by continuous evaluation requires a NEC mark equal to or greater than 5 points. However, minimum requirements will be required in some sections in order to ensure a satisfactory balance between all types of skills. These requirements are:

1. Carry out of both intermediate exams and conduct at least 6 of the 7 practical sessions.2. Obtain a grade of 4 or more points out of 10 in the Final Exam.

Students with NEC less than 5 or who do not fulfill one of the two previous requirements must attend to the regular exam in order to pass the subject. For those students who do not meet the two requirements the final mark of continuous evaluation is obtained as: NEC FINAL = min (4, NEC). In addition, the option to attend the regular exam is offered to all those students who wish to improve their continuous evaluation mark.

Both the regular and the extraordinary exam will evaluate all the subject skills. Therefore, these exams will include a question regarding the tasks performed during the practices.

ETHICAL COMMITMENT: Students are expected to have appropriate ethical behavior. If unethical behavior (cheating, plagiarism, use of unauthorized electronic devices or others) is detected, the student will be penalized with the impossibility of passing the subject by the continuous evaluation modality (in which he will obtain a grade of 0). If this type of behavior is detected in regular or extraordinary exams, a 0 mark qualification is passed to his academic record.

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

A. Biran, **Ship hydrostatics and stability**, New Riders Publishing,

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

Subjects that it is recommended to have taken before

Mathematics: Calculus II and differential equations/P52G381V01201

Fluid mechanics/P52G381V01208

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 orthografic views and cutting planes.
- Methods of approximate integration of areas and volumes, linear regressions, trapezoidal and Simpson's rules.