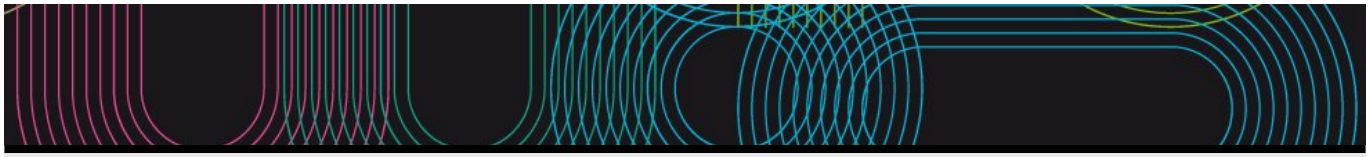

IDENTIFYING DATA				
Resistance of materials				
Subject	Resistance of materials			
Code	P52G382V01204			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Suárez García, Andrés			
Lecturers	Suárez García, Andrés Val García, Jesús del			
E-mail	asuarez@cud.uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Introduction to linear elastic materials, and analysis of internal loadings, stress and strain relationships. Study of the fundamentals of mechanics of materials and particularization for shafts and beam structures.			

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.
C14	Knowledge and use of the principles of strength of materials.
D1	Analysis and synthesis
D2	Problems resolution.
D9	Apply knowledge.
D10	Self learning and work.
D16	Critical thinking.
D17	Team working.

Expected results from this subject	Training and Learning Results		
Know the differences between rigid and elastic solids.	B3 B4	C14	D1 D2 D9 D10 D16 D17
Apply the acquired knowledge to maximum stress calculation at a point in a deformable solid.	B3 B4	C14	D1 D2 D9 D10 D16 D17
To know the basic principles governing Strength of Materials.	B3 B4	C14	D1 D2 D9 D10 D16 D17

To know the relationships between the different stresses and the stresses they cause.	B3 B4	C14	D1 D2 D9 D10 D16 D17
Apply the acquired knowledge to the determination of stresses.	B3 B4	C14	D1 D2 D9 D10 D16 D17
Apply the acquired knowledge of stresses to their estimation in bar elements.	B3 B4	C14	D1 D2 D9 D10 D16 D17
To know the fundamentals of the deformations of bar elements.	B3 B4	C14	D1 D2 D9 D10 D16 D17
Apply the knowledge acquired to the dimensioning of busbar elements.	B3 B4	C14	D1 D2 D9 D10 D16 D17
ENAEE LEARNING OUTCOME: KNOWLEDGE AND UNDERSTANDING. LO 1.2: Knowledge and understanding of the engineering disciplines specific to their speciality, at the level necessary to acquire the rest of the competences of the degree, including notions of the latest developments. Level of development: Adequate (2). NOTE: The possible values for the level of development are: Basic (1), Adequate (2) and Advanced (3).	B3	C14	
ENAEE LEARNING OUTCOME: ENGINEERING ANALYSIS. LO 2.2: The ability to identify, formulate and solve engineering problems in their speciality; to choose and apply established analytical, computational and experimental methods appropriately; to recognise the importance of social, health and safety, environmental, economic and industrial constraints. Level of development: Adequate (2).	B4		D1 D2 D9 D16
ENAEE LEARNING OUTCOME: RESEARCH AND INNOVATION. LO 4.3: Ability and skill to plan and carry out experimental research, interpret results and reach conclusions in their field of study. Level of development: Basic (1).		C14	D9

Contents	
Topic	
Topic 1. Statics	- Concept of an elastic solid - Moment of a force - Static equilibrium. Equations - Moments and products of inertia - Static equilibrium and elastic equilibrium - Stresses on a section in elastic regime
Topic 2. Basic Concepts of Strength of Materials	- Object and purpose of strength of materials - Stresses and strains - Principle of relative stiffness and superposition - Elastic equilibrium - Reactions at supports. Types of supports - Isostatic and hyperstatic systems
Topic 3. Stress State and Failure	- Stress state. Stress matrix. Mohr's circle. Principal planes - Failure criteria. Limit state. Ductile material. Brittle material - Safety factor
Topic 4. Tension-Compression	- Stress and normal stress - Deformations. Poisson's ratio. Generalized Hooke's law - Statically determinate problems - Hyperstatic problems - Uniaxial tension or compression due to thermal variations

Topic 5. Fundamentals of Buckling	- Definition - Critical load. Euler's formulation - Section modulus - Limits of application of Euler's formulation
Topic 6. Shear	- Shear stress and normal stress - Shear deformations - Shear modulus - Relationships between elastic modulus, shear modulus, and Poisson's ratio
Topic 7. Bending and Shear	- Beams. Deformation and classes. Applied forces on beams - Types of bending. Assumptions and limitations - Shear stress and bending moment. Diagrams and relationships - Normal stresses. Navier's law - Concept of section modulus. Optimal sections - Analysis of deformations: rotations and deflections. Moment-curvature relationship. Elastic curve equation. Theorems for deformation calculations - Hyperstatic vending
Laboratory 1. Tensile Test	This practical exercise aims to familiarize the student with tensile testing and the regulations that describe it.
Laboratory 2. Bending Test	This practical exercise aims to familiarize the student with bending tests and the regulations that describe them. Analyze different configurations: simply supported beam, hinged beam, and cantilever beam. Calculate the bending moment and deflection associated with each of them.
Laboratory 3. Compression Test	This practical exercise aims to familiarize the student with compression tests and the regulations that describe them. Perform tests on prototypes with different slenderness ratios and calculate the critical force. The gripping method should be the same for all specimens, resulting in a sudden change in cross-section. The normal stress diagram will also be calculated.
Laboratory 4. Shear Test	This practical exercise aims to familiarize the student with shear tests and the regulations that describe them.
Laboratory 5. Modulus of Elasticity and Other Elastoplastic Constants	This practical exercise focuses on the calculation of the experimental modulus of elasticity. The student will use data collected in previous laboratory sessions. The relationship between the elastic modulus and stresses in each test performed will be reviewed.
Laboratories 6 and 7. Software Practice	This practical exercise aims to familiarize the student with calculating normal stresses, tensions, and deformations in different scenarios using structural analysis software.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	28	56
Laboratory practical	14	14	28
Seminars	7	0	7
Essay questions exam	13	26	39
Laboratory practice	15	5	20

*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 lectures, the fundamentals of each topic are explained. Students will have the slides of the lectures at their dispossal
Laboratory practical	In laboratory sessions, the concepts taught in lectures will be applied. A series of practices have been designed to show the concepts explained in lectures and develop the student ability to propose technical solutions.
Seminars	In the seminars, a series of problems are analysed and proposed to be carried out. Students must solve exercises and problems under the supervision of the lecturer

Personalized assistance

Methodologies	Description

Lecturing	In the personalized assistance, a distinction is made between academic and personalised assessment. In the academic assessment, students will have at their disposal tutoring sessions in which they can consult any doubts related to the contents, organisation and planning of the subject. In the personalised assessment, each student, individually, will be able to discuss with the lecturer any problem that is preventing him/her from following the course properly, in order to find some kind of solution between them. By combining both types of assessment, the aim is to compensate for the different learning rhythms through attention to diversity. Both will be secheduled by appointment

Assessment

	Description	Qualification	Training and Learning Results		
Essay questions exam	Final Exam (FE) which represents 40% of the continuous assessment (EC). 2 Theoretical-Practical Assessment (TPA) representing: 2x15%=30% of EC.	70	B3 B4	C14	D1 D2 D9 D10 D16
Laboratory practice	Laboratory Practices (LP) which represent 20% of the EC. Quizzes and Tests (QT) representing 10% of EC.	30	B3 B4	C14	D1 D2 D9 D16 D17

Other comments on the Evaluation

ORDINARY CALL: CONTINUOUS ASSESSMENT

The method of continuous assessment (CA) will assess the results achieved by students in different activities carried out throughout the course, grouped into four parts: Final Exam (FE), Theoretical-Practical Controls (TPA), Laboratory Practices (LP), and Quizzes and Tests (QT). The weights for each part will be: FE 40%, TPA 30%, LP 20%, and QT 10%.

Two assessments of theoretical-practical knowledge (TP1 and TP2) will be conducted during the course. Each of them will account for 15% of the final continuous assessment grade. These assessments will be interspersed with theory sessions. The TPA grade will be the arithmetic mean of TP1 and TP2.

The student will be evaluated for each laboratory practice completed (LP1 to LP7). This evaluation will be done through practice reports or questionnaires related to them. It could happen that, to evaluate a single practice, both a report and a questionnaire are required simultaneously. The submission of reports and completion of questionnaires will be done electronically through the MOOVI platform. Additionally, during seminar and/or theory class hours, the student will be asked to complete different Quizzes and Tests (QT).

The final continuous assessment exam (FE) will include all the content of the subject and will carry a weight of 40% in the final continuous assessment grade.

The continuous assessment grade (CAG) will be the result of applying the weighted arithmetic mean of the grade for each part (FE, TPA, LP, and QT), as reflected in the following equation:

$CAG = 0.4 * FE + 0.3 * TPA + 0.2 * LP + 0.1 * QT$

To pass the continuous assessment, two conditions must be met: having a CAG ≥ 5 and an FE ≥ 4. If the latter condition is not met, the LP grade will be ignored, resulting in a failing grade for the continuous assessment of the subject, with a score equal to the minimum of 4.0 and the weighted average of FE and TPA.

ORDINARY CALL: ORDINARY EXAM

Those students who fail to pass the subject through continuous assessment must take the ordinary exam, which will evaluate all the competencies of the subject. The results of this exam will constitute 100% of the student's final grade, and obtaining a grade greater than or equal to 5 is a requirement to pass the subject. Finally, it is worth noting that every student has the option to improve their CAG. In other words, students who have passed the subject through continuous assessment will have the opportunity to take the ordinary exam to improve their grade.

EXTRAORDINARY CALL

Students who have not passed the subject in the ordinary call will take an extraordinary exam that will have the same format and requirements as the ordinary exam.

ACADEMIC INTREGITY

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

Hibbeler, Rusell, **Mecánina de Materiales**,

Complementary Bibliography

Ortiz Berrocal, Luis, **Resistencia de Materiales**,
Da Beer, Ferdinand et al., **Mecanica vectorial para ingenieros. Estática.**,

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/P52G382V01106

Other comments

The subject of Strength of Materials constitutes the study of the behavior of real materials in relation to their characteristics of strength, rigidity, and stability. This discipline requires the necessary conceptual foundation for its proper understanding. That is why, in order to successfully take this course, students must have:

- Knowledge of kinematics, dynamics, and statics acquired in the subject of Physics I in the first year of the Mechanical Engineering degree (review is recommended).

- Capacity for written and oral comprehension.

- Ability for abstraction, basic calculation, and synthesis of information.