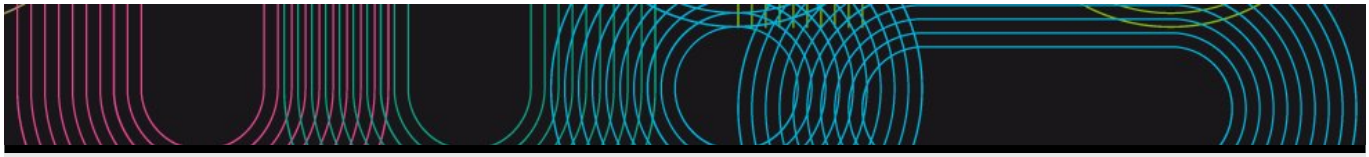

IDENTIFYING DATA				
Elasticity and additional topics in resistance of materials				
Subject	Elasticity and additional topics in resistance of materials			
Code	V12G380V01502			
Study programme	Degree in Mechanical Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Mandatory	3rd	1st
Teaching language	Spanish			
Department	Materials Engineering, Applied Mechanics and Construction			
Coordinator	Badaoui Fernández, Aida			
Lecturers	Badaoui Fernández, Aida Comesaña Piñeiro, Rafael García González, Marcos Lorenzo Mateo, Jaime Alberto Pece Montenegro, Santiago Pérez Riveiro, Adrián			
E-mail	aida@uvigo.es			
Web				
General description	This course will study the fundamentals of elasticity and deepen the study of mechanics of materials in order to be able to apply their knowledge to the actual behavior of solids (structures , machinery and resistant elements in general). This course, along with mechanics of materials course, is a holder of more specialized subjects whose object is the mechanical design.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	CG4 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.
C22	CE22 Knowledge and skills to apply the fundamentals of elasticity and strength of materials to the actual behavior of solids.
D2	CT2 Problems resolution.
D5	CT5 Information Management.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Knowledge of the foundations of elasticity theory	B3	C22	
Further deepening on mechanics of materials and stress analysis	B3 B4	C22	D2 D10
Knowledge of deformations in beams and shafts	B3 B4	C22	D2 D9
Ability to apply the knowledge of elasticity and mechanics of materials, and to analyze the mechanical performance of machines, structures, and general structural elements	B4	C22	D2 D5 D9

Ability to take decisions about suitable material, shape and dimensions for a structural element subjected to a specific load	B4	C22	D2 D5 D9 D17
Knowledge of different solving methods for structural problems and ability to choose the most suitable method for each specific problem	B4	C22	D2 D5 D9

Contents	
Topic	
Fundamentals of elasticity	Introduction to the theory of elasticity Stress analysis of elastic solids Strain Stress-strain relationships Two-dimensional elasticity
Criteria of failure based in tensions	Saint-Venant's failure criterion Tresca's failure criterion Von-Mises' failure criterion Safety coefficient
Bending	Non uniform bending: Shear stresses. Zhuravski expression Principal stresses. Stress trajectories Bending and axial load: Normal stresses. Neutral axis Eccentric axial loads Kern of the cross-section Beams of different materials
Bending. Statically indeterminate beams	General method Settlements in fixed supports Continuous beams Simplifications in symmetric and antisymmetric beams
Torsion	Definition Coulomb's fundamental theory Static torque diagrams Stress and angle of twist Statically indeterminate problems
Combined loads	Definition Bending and torsion loaded circular shafts Shear center Stress and strain calculation in plane-spatial structures
Strain energy and energy methods	Strain energy: Axial load/shearing loads/bending/torsion/general expression. Clapeyron's theorem Indirect and direct work Maxwell-Betti Reciprocal Theorem Applications Castigliano's theorem. Mohr's integral. Applications
Buckling	Introduction Buckling and stability Euler's buckling. Critical load Buckling effective length Application limits of Euler's formula. Real buckling Eccentric compression of slim columns Shearing force and critical load

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Previous studies	0	6	6
Lecturing	20	40	60
Problem solving	30	41	71
Laboratory practices	24	6	30
Autonomous problem solving	0	20	20
Problem solving	2	23	25
Self-assessment	0	8	8
Laboratory practice	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
Introductory activities	Introduction to the subject: Course aims, expected learning outcomes, course syllabus, teaching methods, assessments and grading policy.
Previous studies	Student previous activities to lectures (compulsory submission): The students will receive detailed instructions to complete and send certain exercises before lectures/laboratory sessions. The purpose of this assessment is to optimize the session outcome. The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide.
Lecturing	The contents of the subject will be presented in a organized way. Special emphasis will be put on the fundamentals of the subject and on the most troublesome points. To improve the comprehension, the contents of the next lectures will be announced on Tema platform on a weekly basis.
Problem solving	Each week will devote a time to the resolution by part of the student of exercises or problems proposed, related with the content that was seeing in the moment.
Laboratory practices	Application of theory concepts to laboratory collaborative works.
Autonomous problem solving	The students will be supplied with exercises and problems to solve, the solutions will be provided for level self-evaluation.

Personalized attention	
Methodologies	**Description**
Autonomous problem solving	

Assessment					
	Description	Qualification	Training and Learning Results		
Previous studies	The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide. It shall be deemed completed when a previous activity fully answer all questions.	0			D5 D9 D10 D17
Laboratory practices	Attendance and active participation in the complete laboratory lessons and practice reports will be assessed. They will be graded from 0 to 10, provided that the student gets a minimum mark in the written examination (minimum mark: 4.5/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	5	B4	C22	D2 D5 D9 D10 D17
Problem solving	Exam for the assessment of the module learning outcomes. The exam comprises of brief problems and/or theoretical questions. The duration and precise grading will be communicated at the beginning of the exam.	80	B3 B4	C22	D2 D9
Laboratory practice	Short exercises and conceptual tests will be taken during the course (within lecture or laboratory hours; grading from 0 to 10). The mark will be added to the exam mark, provided that the student gets a minimum mark in the written examination (minimum mark: 4.0/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide	15	B3		D9

Other comments on the Evaluation

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

The written examination of students not able to attend laboratory sessions will be graded 100% of the module mark, provided the student resigns from continuous assessment (and gets the required school approval) within the period

established for that purpose. This examination will assess the subject overall competencies.

The qualification obtained in the laboratory practices in the course 2016/2017 and 2017/2018 (5% of the qualification) will be preserved in 2018/2019, provided the student requests that within an established period in the beginning of the course.

The qualification obtained in the conceptual tests in the course 2016/2017 and 2017/2018 (15% of the qualification) will be preserved in 2018/2019, provided the student requests that within an established period in the beginning of the course.The rating obtained only remain within the language chosen at the time in which he studied the subject.

Comments about continuous assessment:

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

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

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

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

Additional comments:
The absence from a laboratory session, even justified, does not lead to the repetition of the session.
The absence from a test, even justified, does not lead to the repetition of the test.
The date and place of of examinations of all calls shall be determined by the center before the start of course and will make them public .

Ethical commitment: it is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).
The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Group responsible lecturer: Groups with teaching in Spanish: Aida Badaoui Fernández (aida@uvigo.es) , Pérez Riveiro, Adrián (adperez@uvigo.es).
Group with teaching in English: Rafael Comesaña Piñeiro (racomesana@uvigo.es), Borja Conde Carnero (bconde@uvigo.es)

Reading list for the group in English:
Recommended:
- Hibbeler R.C., Mechanics of Materials, SI Edition, Prentice Hall. 9th. edition
- José Antonio González Taboada , Tensiones y deformaciones en materiales elásticos, 2a Edición, Tórculo.
- José Antonio González Taboada , Fundamentos y problemas de tensiones y deformaciones en materiales elásticos, 1ª Edición, Tórculo.
Complementary:
- Timoshenko, Goodier, Theory of elasticity, 3rd ed., (International student ed.), McGraw-Hill
- Manuel Vázquez , Resistencia de Materiales.

Sources of information

Basic Bibliography

José Antonio González Taboada, **Tensiones y deformaciones en materiales elásticos**, 2a Edición,

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

Complementary Bibliography

Manuel Vázquez, **Resistencia de Materiales**,
Luis Ortiz-Berrocal, **Elasticidad**, 3a Edición,
Recommended: Hibbeler R.C., **Mechanics of Materials, SI Edition**, 9th Edition in SI units,
Complementary: Timoshenko, Goodier., **Theory of elasticity**, 3rd ed., International student ed.,

Recommendations

Subjects that continue the syllabus

Machine design I/V12G380V01304
Theory of structures and industrial constructions/V12G380V01603

Subjects that it is recommended to have taken before

Physics: Physics I/V12G380V01102
Physics: Physics II/V12G380V01202
Resistance of materials/V12G380V01402

Other comments

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

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