

Academic Year: (2022 / 2023)

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Department assigned to the subject: Continuum Mechanics and Structural Analysis Department

Coordinating teacher: BARBERO POZUELO, ENRIQUE

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

We strongly advise you not to take this course if you have not passed

- Mecánica de Estructuras
- Cálculo I y II
- Álgebra

DESCRIPTION OF CONTENTS: PROGRAMME**CHAPTER 1. INTRODUCTION TO SOLID MECHANICS****Subject 1: Kinematic of deformable bodies**

- Motion: Basic concepts
- Strain Tensor
- Infinitesimal strain
- Geometrical meaning of the components of infinitesimal strain tensor
- Principal Strains
- Equations of compatibility

Subject 2: Equilibrium in deformable bodies

- Body and surface forces
- Concept of stress
- Stress tensor
- Stress equations of equilibrium
- Stationary stresses

Subject 3: Constitutive equations

- Behaviour laws
- Hyperelastic behaviour
- Linear elastic behaviour
- Material symmetries
- Physical meaning of the constants

CHAPTER 2. INTRODUCTION TO ELASTICITY**Subject 4: Formulation of Elasticity equations**

- Elasticity equations
- Boundary and contact conditions
- Displacement and Stress formulations
- Theorems and general principles.

Subject 5: Two dimensional theory of Elasticity

- Plain Stress and Plain Strain
- Plane Elasticity in term of displacement
- Plane Elasticity in terms of stresses
- Methods of solutions
- Mohr's circle in 2D
- Elasticity in polar coordinates
- Plane Elasticity in term of displacement

- Plane Elasticity in terms of stresses

Subject 6: Failure criteria

- Failure by yielding
- Plasticity criteria
- Equivalent stress and safety factor

CHAPTER 4. INTRODUCTION TO STRENGTH OF MATERIALS

Subject 7: Bending in beams

- Fundamentals concepts
- External and internal forces
- Equilibrium equations
- Kinematic hypotheses
- Normal stresses in beams
- Neutral axis
- Shear stresses
- Sections with symmetries

Subject 8: Torsion

- Kinematic hypotheses
- Displacement formulation
- Stress formulation
- Circular cross sections
- Thin-walled cross-sections

Subject 9: Deflections of beams

- Equilibrium equations of beams
- Internal forces and moments equations
- Deflections by integration of the internal forces- and moment-equations (Navier-Bresse equations)
- Moment-area method(Mohr's theorems)

Subject 10: Analysis of hyperstatic beams

- Differential equation of the deflection curve (Euler and Timoshenko beams)
- Kinematic definitions
- Static definitions
- Introduction to the displacement (or stiffness) method

LEARNING ACTIVITIES AND METHODOLOGY

In each week one lecture session (master class) and one practical session (in reduced groups) will be taught. The first is geared to the acquisition of theoretical knowledge, and the second to the acquisition of practical skills related to theoretical concepts. In addition to this sessions four laboratory practical sessions in reduced groups (maximum 20 students) will be impart.

Students will have the possibility of individual tutorials.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	60
% of continuous assessment (assignments, laboratory, practicals...):	40

Final exam (obligatory): 60%

Continuum evaluation: 40%

If the mark obtained in the final exam is lower than 4.5, the final mark of the student will be computed only with the final exam

To pass the subject, attendance and completion of the laboratory sessions are mandatory. The weighting of the mark of the laboratory sessions in the continuous evaluation corresponds to what is established in the subject, in accordance with the university regulations. The weighting of laboratory sessions takes the value of 37.5% of the continuous assessment mark.

BASIC BIBLIOGRAPHY

- Barber, J.R. Elasticity, Kluwer Academic Publishers, 1992

- F.P. Beer, E.R. Johnston, J.T. DeWolf, D.F. Mazurek. Mechanics of Materials, McGraw-Hill., 2013

- J.M. Gere, S. Timoshenko. Mechanics of Materials, Cengage Learning, 2009

ADDITIONAL BIBLIOGRAPHY

- Benham, P.P. y Crawford, R.J. Mechanics of engineering materials, Longman Scientific & Technical, 1987

- Chung T.J. Applied continuum mechanics, Cambridge University Press, 1996

- Shames, I.H. y Cozzarelli, F.A. Elastic and inelastic stress analysis, CRC Press, 1997

- Wunderlich, W. y Pilkey, W.D. Mechanics of structures: Variational and Computational Methods, CRC Press. , 1992