

Academic Year: (2022 / 2023)

Review date: 20-06-2022

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

Coordinating teacher: BARBERO POZUELO, ENRIQUE

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

DESCRIPTION OF CONTENTS: PROGRAMME

Subject 1: Equilibrium in deformable bodies

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

Subject 2: 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 3: Constitutive equations

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

Subject 4: Differential formulation

- Elasticity equations
- Boundary and contact conditions
- Displacement (Navier) formulation
- Stress (Michell-Beltrami) formulation

Subject 5: Integral formulation and principles (I)

- Theorem of Virtual Works
- Clapeyron theorem
- Theorem of Minimum Potential Energy

Subject 6: Integral formulation and principles (II)

- Reciprocity Theorems
- General Principles

Subject 7: Failure criteria

- Failure by yielding
- Haig-Westergaard representation
- Von Mises-Hencky-Nadai yield criterion
- Tresca-Guest yield criterion
- Alternate yield criteria
- Equivalent stress and safety factor

Subject 8: Two dimensional theory of Elasticity (I)

- 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

Subject 9: Two dimensional theory of Elasticity (II)

- Elasticity in polar coordinates
- Plane Elasticity in term of displacement
- Plane Elasticity in terms of stresses

Subject 10: Bending in beams

- Kinematic hypotheses
- Normal stresses in beams
- Neutral axis

Subject 11: Torsion

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

CHAPTER 5. DEFLECTIONS OF BEAMS (N^oof sessions: 3)

Subject 12: Deflections of beams (I)

- Equilibrium equations of beams
- Internal forces and moments equations
- Deflections by integration of the internal forces- and moment-equations (Navier-Bresse equations)

Subject 13: Deflections of beams (II)

- Moment-area method(Mohr's theorems)
- 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

AF1. THEORETICAL-PRACTICAL CLASSES. Knowledge and concepts students must acquire. Receive course notes and will have basic reference texts. Students partake in exercises to resolve practical problems

AF2. TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher. Subjects with 6 credits have 4 hours of tutoring/ 100% on-site attendance.

AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK. Subjects with 6 credits have 98 hours/0% on-site.

AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.

AF9. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. It entails 4 hours/100% on-site

AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 3 credits have 4 hours with 100% on-site instruction. Subjects with 6 credits have 8 hours/100% on-site instruction.

MD1. THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject's main concepts are developed, while providing material and bibliography to complement student learning

MD2. PRACTICAL CLASS. Resolution of practical cases and problem, posed by the teacher, and carried out individually or in a group

MD3. TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with teacher as tutor. Subjects with 6 credits have 4 hours of tutoring/100% on-site.

MD6. LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

ASSESSMENT SYSTEM

SE1. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. The percentage of the evaluation varies for each subject between 60% and 0%.

SE2. CONTINUOUS EVALUATION. Assesses papers, projects, class presentations, debates, exercises, internships and workshops throughout the course. The percentage of the evaluation varies for each subject between 40% and 100% of the final grade.

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