EN 399 MECHANICS OF MATERIALS

IES Abroad Madrid

DESCRIPTION:

1. Introduction-Concept of Stress
2. Stress and Strain-Axial Loading
3. Torsion
4. Pure Bending
5. Analysis and Design of Beams for Bending
6. Shearing Stresses in Beams and Thin-Walled Members
7. Transformations of Stress and Strain
8. Principal Stresses Under a Given Loading
9. Deflection of Beams
10. Columns
11. Energy Methods

CREDITS: 4 credits

CONTACT HOURS: 60

LANGUAGE OF INSTRUCTION: English

PREREQUISITES: Physics, Calculus, Algebra

METHOD OF PRESENTATION:
4 hours of lecture per week (the instructor will present the theory and cover examples) and one hour of recitation per week to do exercises, examples and prepare homework. There will be two class visits related to the course.

REQUIRED WORK AND FORM OF ASSESSMENT:

- **First Midterm Exam (25%):**
  Including 50% of the chapters (1 to 6). Practical Exercises (70%). 20 questions test (30%).
- **Final Exam (35%):**
  Including 100% of the contents.
  Practical Exercises (70%). 20 questions test (30%).
- **Written Assignments (30%):**
  There will be 3 workshops sessions with computer SW. A written assignment must include results and conclusions. These deliveries are mandatory, and marks must be over 50% to pass the subject.
- **Participation (10%):**
  Additional written exercises will be accepted to cover up to 10% of the global mark.

LEARNING OUTCOMES:
By the end of this content area, students will be able to have:

- Knowledge and understanding of mechanical of materials and structural calculus.
- Awareness of the wider multidisciplinary context of engineering.
- The ability to apply their knowledge and understanding to identify, formulate and solve problems of mechanics of materials and structural calculus using established methods.
- The ability to design and conduct appropriate experiments, interpret data and draw conclusions.
- Workshops and lab skills with calculus sw.
- The ability to select and use appropriate equipment, tools and methods.
- The ability to combine theory and practice to solve problems of mechanics of materials and structural calculus
- Understanding of applicable techniques and methods in mechanics of materials, and their limitations

ATTENDANCE POLICY:
Please consult in Moodle and in the orientation booklet IES Abroad Madrid Attendance Policy.

CONTENT:

Session	Content	Required reading:
Session 1	Introduction-Concept of Stress 1/1	Mechanics of Materials 8th Edition Chapter 1. Introduction – Concept of Stress to 1.3 Stress on an oblique Plane under axal loading
Session 2	Introduction-Concept of Stress 1/2	Chapter 1.4 Stress Under General Loading conditions; components of stress to 1.5 Design consideration problems.
Session 3	Stress and Strain-Axial Loading 1/2	Chapter 2: Stress and strain-axial loading to 2.7 Shearing strain.
Session 4	Stress and Strain-Axial Loading 2/2	Chapter 2.8 Deformations under Axial Loading To Chapter 2.13 Residual stresses.
Session 5	Torsion 1/2	Chapter 3: Torsion To 3.5 Stress concentrations in circular shafts problems
Session 6	Torsion 1/2	Chapter 3.6 Plastic deformations in circular shafts to Chapter3.10 Thin-walled hollow shafts problems
Session 7	Pure Bending 1/2	Chapter 4: Pure bending to Chapter 4.5 Stress concentrations problems
Session 8	Pure Bending 2/2	Chapter 4.6 Plastic deformations to Chapter 4.10 Curved members problems.

Session 9	Analysis and Design of Beams for Bending 1/2	Chapter 5: Analysis and design of beams for bending to Chapter 5.3 Design of prismatic beams for bending.
Session 10	Analysis and Design of Beams for Bending 2/2	Chapter 5.4 Singularity Functions used to determine shear and bending moment problems Chapter 5.5 non prismatic Beams.
Session 11	Shearing Stresses in Beams and Thin-Walled Members 1/1	Chapter 6: shearing stresses in beams and thin-walled members to Chapter6.3 Longitudinal shear on a beam element of arbitrary shape.
Session 12	Shearing Stresses in Beams and Thin-Walled Members 1/2	Chapter 6.4 Shearing Stresses in Thin-Walled Memebers to Chapter 6.6 unsymmetric loading of thin-walled members and shear center
Session 13	Transformations of Stress and Strain 1/2	Chapter 7: Transformations of Stress and strain to Chapter 7.5 Theories of failure Problems
Session 14	Workshop lab Session 1	Not required. .
Session 15	First Midterm Exam (25%)	Not required.
Session 16	Transformations of Stress and Strain 2/2	Chapter 7.6 Stresses in thin-walled pressure vessels to Chapter 7.9 Measurement of Strain: strain rosette
Session 17	Principal Stresses Under a Given Loading 1/2	Chapter 8: principal stresses under a given loading to Chapter 8.2 Design of transmission shafts.
Session 18	Principal Stresses Under a Given Loading 2/2	Chapter 8-3 Stresses under combined loads
Session 19	Workshop lab Session 2	Not required.
Session 20	Deflection of Beams 1/2	Chapter 9. Deflection of beams to Chapter 9.3 singularity functions to determine slope and deflection.
Session 21	Deflection of Beams 2/2	Chapter 9.4 Method of superposition to Chapter 9.6 Moment-Area Theorems applied to beams with asymmetric loading.
Session 22	Columns 1/2	Chapter 10: Columns to Chapter 10.2 Eccentric loading and the secant formula
Session 23	Columns 2/2	Chapter 10.3 Centric load design to Chapter 10.4 Eccentric Load design.

Session 24	Energy Methods 1/2	Chapter 11: Energy methods to Chapter 11.5 Single Loads.
Session 25	Energy Methods 2/2	Chapter 11.6 Work and energy under multiple loads to Chapter 11.9 Statically indeterminate structures.
Session 26	Exam readiness 1/2	Not required.
Session 27	Exam readiness 2/2	Not required.
Session 28	Final EXAM	Not required.

REQUIRED READING:

- Mechanics of Materials 8th Edition
  By Ferdinand Beer and E. Johnston and John DeWolf and David Mazurek
  SBN10: 1260113272 ISBN13: 9781260113273

RECOMMENDED READING:

- J. Case Strength of material and structures, Ed. Arnold, 1999
- W.M.C. McKenzie Examples in structural analysis, Taylor & Francis, 2006