



BARC-EM 399 MECHANICS OF
MATERIALS
IES Abroad Barcelona

DESCRIPTION:

Mechanics of Materials, also known as Strength of Materials, is a fundamental engineering course that focuses on the behavior of solid objects subjected to stresses and strains. This course covers the essential principles and methodologies used to analyze and design structures and mechanical components to ensure they can withstand the forces and loads encountered during service.

CREDITS: 3credits

CONTACT HOURS: 45 hours.

LANGUAGE OF INSTRUCTION: English

PREREQUISITES: Physics (Mechanics). Mathematics (Basic Calculus).

ADDITIONAL COST: None

METHOD OF PRESENTATION:

The different lessons will consist of explanations of the theoretical concepts needed to understand each module of the course, combined with demonstrations supported by engineering software. After each module is completed, several problems will be solved by the students with the instructor's support. Homework assignments will also be given to practice everything learned in the course.

REQUIRED WORK AND FORM OF ASSESSMENT:

- Midterm Exam - 25%
- Final exam - 35%
- Homework/Written Assignments - 30%
- Participation - 10%

Course Components

Lectures: The instructor will present the theory and cover examples.

- **Midterm Exam.** The Midterm exam will be comprehensive. It consists of exercises and multiple-choice questions
- **Final exam:** The Final Exam will be comprehensive. It consists of exercises and multiple-choice questions.
- **Homework/Written Assignments:** Referred to as problems in the syllabus. Problem solving and case projects that will be proposed in the different sessions that will be assigned weekly. The completion of the assignment (reading and writing) should take 3-4 hours. No late homework will be accepted. Each written project must include results and conclusions. Students are invited to work together on the assignments, but each student must complete and hand-on his/her own assignment.

- **Participation:** This includes the student's interaction in the classroom, the ability to answer questions posed by the instructor, and the general interest shown in the course.

LEARNING OUTCOMES:

By the end of the course, students will have

- The knowledge and understanding of mechanical of materials and structural calculus.
- The knowledge 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.
- 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.
- The understanding of applicable techniques and methods in mechanics of materials, and their limitations.

ATTENDANCE POLICY:

As a member of our class community, you are expected to be present and on time every day. Attending class has an impact on your learning and academic success. For this reason, attendance is required for all IES Barcelona classes, including course-related excursions. If a student misses more than three classes in any course without justification, 3 percentage points will be deducted from the final grade for every additional absence. Seven unjustified absences in any course will result in a failing grade. Absences will only be justified, and assessed work, including exams, tests and presentations rescheduled, in cases of documented medical or family emergencies.

CONTENT:

Week	Content	Assignments
Week 1	Introduction to Strength of Materials. Session 1: General Stress and Strain Session 2: Mechanical properties of Materials	
Week 2	Axial stress and strain Session 3: Axial Loads and stresses Session 4: Axial Strain and deformations	
Week 3	Torsion and Shear Session 5: Pure Shear forces and Stress Session 6: Torsional loads a deformation	

Week	Content	Assignments
Week 4	Thermal & Statically Indeterminate Stress Session 7: Thermal expansion and related stress Session 8: Statically indeterminate stress	
Week 5	Beams I Session 9: Bending loads. Shear forces and bending moment diagrams I Session 10: Bending loads. Shear forces and bending moment diagrams II	
Week 6	Geometrical properties of Sections and Mohr's Circle Session 11: Axes of symmetry Centre of gravity Moment of inertia Radius of gyration Product of inertia Principal moment and principal axes of inertia Mohr's circle for moment of inertia Session 12: Problems solving	
Week 7	Beams II Session 13: Beam Deflection Session 14: Mid-Term Exam	
Week 8	Beams III Session 15: Pure bending and Bending Stress Session 16: Transverse Shear Stress	
Week 9	Beams IV Session 17: Combined Loading Session 18: Problems solving.	

Week	Content	Assignments
Week 10	Stress transformations Session 19: Plane stress Session 20: Stress transformation and Mohr's circle for plane stress	
Week 11	Unsymmetrical geometries and Buckling Session 21: Pure and complex bending on unsymmetrical geometries Session 22: Column buckling	
Week 12	Final review and Exam Session 23: Review of theory and exercises Session 24: Final Exam	

REQUIRED READINGS:

- Mechanics of Materials, 10 th ed. 2015 – R.C Hibbeler. Prentice Hall.

RECOMMENDED READINGS:

- Strength of Materials (Mechanics of solids) – R.S Khurmi, 2019 – S. Chand Publishing
- Strength of Materials 1. Elementary Theory and problems – Stephen Timoshenko – Third Edition – CBS Publishers
- Vector Mechanics for Engineers: Statics and Dynamics- P. Beer and R. Johnston- 12th ed. Mc Graw Hill