



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE2M2. Mechanics of Materials II (Elective)

2. GENERAL INFORMATION

2.1 Course	: CE2M2. Mechanics of Materials II
2.2 Semester	: 5 th Semester.
2.3 Credits	: 4
2.4 Hours	: 4 HT; 4 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Elective
2.7 Learning modality	: Face to face
2.8 Prerequisites	: CE2M1. Mechanics of Materials I. (4 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Mechanics of Materials II is the advanced continuation of the study of deformable solids. This course addresses problems of greater technical complexity, such as beam deflection using various methods, the elastic stability of columns, and combined-stress failure analysis. These concepts enable students to carry out more refined structural designs and understand the limits of failure by instability, ensuring the integrity of buildings and civil engineering structures.

5. GOALS

- Determine deflections and slopes in beams using integration, area-moment, and energy methods.
- Analyze and design columns subjected to axial load considering elastic and inelastic buckling.
- Apply failure theories for ductile and brittle materials in the design of elements under complex stress states.

6. COMPETENCES

ABET-1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Usage)

ABET-6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (Usage)

7. TOPICS

Unit 1: Beam Deflections (24 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• The equation of the elastic curve. • Double integration method and discontinuity functions. • Moment-area method and the conjugate-beam method. • Analysis of statically indeterminate beams by superposition.	• Calculate displacements and rotations in beams under various loading and support conditions [Evaluar]. • Solve statically indeterminate structures through compatibility-of-deformation analysis [Usar].
Readings : [Hib17], [GG17]	

Unit 2: Column Stability (16 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Concept of stability and Euler's critical load. • Columns with different support conditions: effective length. • Inelastic buckling and the secant formula. • Design of columns under concentric and eccentric loading.	• Determine the maximum load a slender column can support before failing by instability [Evaluar]. • Design column cross-sections that comply with structural safety codes [Usar].
Readings : [Hib17]	

Unit 3: Energy Methods and Failure Theories (24 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Strain energy due to axial load, bending, and torsion. • Castigliano's theorem and its application to deflections. • Failure theories for ductile materials: Tresca and von Mises. • Failure theories for brittle materials: Mohr-Coulomb.	• Apply energy principles to solve displacement problems in structures of complex geometry [Usar]. • Predict the onset of yielding or fracture of a material under combined stress states [Evaluar].
Readings : [GG17]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY

- [GG17] James Gere and Barry Goodno. *Mechanics of Materials*. 9th. Cengage Learning, 2017.
- [Hib17] Russell Hibbeler. *Mechanics of Materials*. 10th. Pearson, 2017.