



National University of Engineering (UNI)
School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE1M2. Dynamics (Elective)

2. GENERAL INFORMATION

2.1 Course	: CE1M2. Dynamics
2.2 Semester	: 4 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	: • CE1M1. Statics. (3rd Sem) • BFI102. Physics II. (3rd Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Dynamics studies the accelerated motion of particles and rigid bodies under the action of forces. In Civil Engineering, this knowledge is essential for the analysis of structures subjected to time-varying loads, such as earthquakes, wind, vehicular traffic, and heavy machinery. It provides the foundation for advanced courses such as Earthquake Engineering and Structural Dynamic Analysis.

5. GOALS

- Analyze the kinematics of particles and rigid bodies in various coordinate systems.
- Apply Newton's laws, the principles of work and energy, and impulse and momentum to solve kinetics problems.
- Model and solve single-degree-of-freedom mechanical vibration problems to evaluate structural response.

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: Kinematics of Rigid Bodies in Plane Motion (10 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Translation and rotation about a fixed axis • General plane motion: relative velocity and acceleration, and the instantaneous center of rotation	• Determine the velocity and acceleration of any point in a planar mechanism using the instantaneous center of rotation [Usage] • Explain the distinction between translation, fixed-axis rotation, and general plane motion [Familiarity]
Readings : [Hib16]	

Unit 2: Kinetics of Rigid Bodies in Plane Motion (10 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Equations of motion for a rigid body in plane motion • Kinetic energy of a rigid body and the principle of work and energy	• Apply the equations of motion to relate external forces to the angular acceleration of rigid bodies [Assessment] • Analyze rigid-body motion problems using the principle of work and energy [Usage]
Readings : [Hib16]	

Unit 3: Introduction to Structural Vibrations (12 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Undamped free vibration of a single-degree-of-freedom system • Simple pendulum and mass-spring models • Natural frequency, period, and amplitude concepts • Introduction to damped free vibration	• Model simple structural systems as single-degree-of-freedom systems [Usage] • Calculate the natural frequency of a structure to avoid basic resonance phenomena [Assessment] • Describe the effect of damping on the free-vibration response of a structural system [Familiarity] • Interpret period and amplitude parameters from a structure's free-vibration response [Usage]
Readings : [BF08]	

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

[BF08] Anthony Bedford and Wallace Fowler. *Engineering Mechanics: Dynamics*. 5th. Prentice Hall, 2008.

[Hib16] Russell Hibbeler. *Engineering Mechanics: Dynamics*. 14th. Pearson, 2016.