



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE3G4. Soil Mechanics Applied to Transportation Roads (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE3G4. Soil Mechanics Applied to Transportation Roads
2.2 Semester	: 9 th Semester.
2.3 Credits	: 3
2.4 Hours	:
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: CE2G2. Soil Mechanics II. (8 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Soil Mechanics Applied to Transportation Roads is the pavement-engineering course of the Geotechnical Engineering track, building on the subgrade behavior established in Soil Mechanics II to address the design, evaluation, and management of the pavement structure itself. The course first develops the design philosophy of pavements and the mechanisms by which flexible and rigid pavements fail, then covers the traffic, subgrade, and material parameters that govern pavement design, the structural design of flexible and rigid pavements using empirical and mechanistic-empirical methods, and the criteria used to decide when and how to rehabilitate an existing pavement. The course closes with the surface and structural evaluation techniques (distress surveys, roughness, and deflection testing) used to diagnose the condition of an in-service pavement, and the maintenance and rehabilitation planning that follows from that diagnosis.

5. GOALS

- Characterize subgrade, aggregate, and asphalt materials, and recognize pavement types and failure mechanisms relevant to pavement design.
- Determine the traffic, reliability, serviceability, and environmental parameters required as inputs for pavement structural design.
- Design flexible and rigid pavement structures using empirical and mechanistic-empirical methods, and select rehabilitation strategies based on established criteria.
- Conduct surface distress and roughness evaluations of in-service pavements, including pavement condition index (PCI) computation.
- Perform structural evaluation of pavements using deflection testing, and backcalculate layer moduli to assess structural capacity.
- Estimate the remaining service life of a pavement and develop maintenance and rehabilitation program plans.

6. COMPETENCES

- ABET-1)** An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Usage)
- ABET-2)** An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (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: Pavement Materials and Characterization (6 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Pavement types and structural components • Asphalt binder and mixture properties • Aggregate properties and gradation requirements • Subgrade characterization and stabilization • Sustainable pavement technologies and recycling	• Identify pavement types and describe their structural functions [Familiarity] • Characterize asphalt binders and design asphalt mixtures [Assessment] • Evaluate aggregate quality for pavement applications [Usage] • Assess subgrade strength and specify stabilization treatments [Assessment] • Incorporate sustainable practices and recycled materials in pavement design [Familiarity]
Readings : [Hua04]	

Unit 2: Pavement Design and Management (14 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Traffic load characterization and equivalent single axle load (ESAL) computation • Design reliability, serviceability, and drainage/environmental factors in pavement design • Flexible pavement design using empirical methods • Rigid pavement design and joint systems • Mechanistic-empirical pavement design methods • Pavement performance prediction and distress mechanisms • Rehabilitation strategies and overlay design • Pavement management systems and life-cycle cost analysis	• Compute the design equivalent single axle load (ESAL) from traffic composition and growth projections [Usage] • Determine design reliability, serviceability, and drainage/environmental parameters for flexible and rigid pavement design [Assessment] • Design flexible pavements using AASHTO or equivalent methods [Assessment] • Proportion rigid pavement thickness and design joint spacing [Usage] • Apply mechanistic-empirical methods for pavement design [Usage] • Predict pavement performance and identify distress mechanisms [Assessment] • Select appropriate rehabilitation strategies and design overlays [Usage] • Implement pavement management systems and perform life-cycle analysis [Assessment]
Readings : [Hua04], [AAS93]	

Unit 3: Pavement Condition Evaluation and Maintenance Planning (10 hours)	
Competences Expected: ABET-6	
Topics	Learning Outcomes
• Visual distress surveys and pavement condition index (PCI) computation • Pavement roughness measurement and the international roughness index (IRI) • Structural evaluation using deflection testing (falling weight deflectometer, Benkelman beam) • Backcalculation of pavement layer moduli and structural capacity assessment • Remaining service life estimation and rehabilitation treatment selection • Maintenance and rehabilitation program planning and scheduling	• Conduct visual distress surveys and compute the pavement condition index (PCI) [Usage] • Explain pavement roughness measurement methods and interpret the international roughness index [Familiarity] • Perform structural evaluation of in-service pavements using deflection testing methods [Usage] • Backcalculate pavement layer moduli from deflection basin data [Assessment] • Estimate the remaining service life of a pavement and select an appropriate treatment [Assessment] • Develop maintenance and rehabilitation program plans and schedules [Usage]
Readings : [Hua04], [HHU97]	

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

- [AAS93] AASHTO. *AASHTO Guide for Design of Pavement Structures*. Tech. rep. American Association of State Highway and Transportation Officials, 1993.
- [HHU97] W. Ronald Hudson, Ralph Haas, and Waheed Uddin. *Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation*. McGraw-Hill, 1997.
- [Hua04] Yang H. Huang. *Pavement Analysis and Design*. 2nd. Pearson Prentice Hall, 2004.