



National University of Engineering (UNI)

School of Civil Engineering

Syllabus 2027-I

1. COURSE

CE3T6. Pavement Engineering (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE3T6. Pavement Engineering
2.2 Semester	: 10 th Semester.
2.3 Credits	: 4
2.4 Hours	: 3 HT; 2 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: CE2T5. Highway Geometric Design. (9 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Pavement Engineering is the pavement design and management course of the Vialidad, Geomática y Transporte (DAVG) track, building on the cross-section, subgrade, and earthwork concepts introduced in Highway Geometric Design (CE2T5) to address how flexible and rigid pavement structures are characterized, designed, evaluated, and managed throughout their service life. The course opens with pavement materials and characterization, covering pavement types and structural components, asphalt binder and mixture properties, aggregate properties and gradation requirements, and sustainable pavement technologies and recycling. It then develops pavement design and management, covering traffic load characterization and the design equivalent single axle load (ESAL), flexible pavement design using empirical methods, rigid pavement design and joint systems, and mechanistic-empirical design methods. Building on this design foundation, the course covers pavement condition evaluation and maintenance planning, including performance prediction and deterioration mechanisms, visual distress surveys and the pavement condition index (PCI), roughness measurement, structural evaluation using deflection testing, and maintenance and rehabilitation program planning. The course closes with road and bridge asset management, covering inventory and condition assessment, deterioration models and prioritization criteria, and life-cycle cost analysis for network-level preservation – providing the materials, design, evaluation, and asset-management foundation required for professional practice in pavement engineering.

5. GOALS

- Characterize asphalt binders and mixtures, evaluate aggregate quality, and apply sustainable pavement technologies and recycling.
- Compute the design equivalent single axle load (ESAL) from traffic composition and growth projections.
- Design flexible pavements using empirical methods and rigid pavements with appropriate joint systems.
- Apply mechanistic-empirical methods for pavement design and predict pavement performance and distress mechanisms.
- Conduct visual distress surveys, compute the pavement condition index (PCI), and perform structural evaluation using deflection testing.
- Develop maintenance and rehabilitation program plans based on remaining service life estimation.
- Apply condition indices, deterioration models, and life-cycle cost analysis to plan and budget road and bridge asset management programs.

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 (10 hours)	
Competences Expected: ABET-6	
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 : [Roberts1996AsphaltMixtures], [MTC Suelos Pavimentos 2014]	

Unit 2: Pavement Design and Management (44 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 : [Huang 2004], [AASHTO 1993 Pavement Guide]	

Unit 3: Pavement Condition Evaluation and Maintenance Planning (15 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 : [Shahin2005PavementManagement], [ASTMD6433]	

Unit 4: Road and Bridge Asset Management (5 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• Inventory, inspection, and condition assessment of roads and bridges • Condition indices, deterioration models, and prioritization criteria for maintenance and rehabilitation programs • Life-cycle cost analysis and budgeting for road and bridge network preservation	• Describe the fundamentals of an infrastructure asset management system for roads and bridges [Familiarity] • Apply condition indices and prioritization criteria to plan maintenance and rehabilitation actions for a road or bridge network [Usage] • Analyze life-cycle cost to budget preservation programs for road and bridge infrastructure [Assessment]
Readings : [Shahin2005PavementManagement], [Huang2004]	

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