



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE3S5. Bridges and Structures (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE3S5. Bridges and Structures
2.2 Semester	: 8 th Semester.
2.3 Credits	: 3
2.4 Hours	: 2 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	: • CE2S1. Structural Analysis I. (7th Sem) • CE2S2. Reinforced Concrete Design I. (7th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Bridges and Structures introduces the fundamentals of bridge engineering, from conceptual planning and typology selection to the structural analysis and design of highway bridge superstructures and substructures according to the AASHTO LRFD Bridge Design Specifications. Building on structural analysis and reinforced concrete design, students learn the basic site and design studies required for a bridge project, the loads and load combinations that govern bridge design, approximate and refined methods for analyzing slab-and-girder superstructures, and the flexural and shear design of reinforced concrete, prestressed concrete, steel composite, and truss superstructure members. The course also covers the design of bridge bearings, abutments, and foundations, and closes with an introduction to road and bridge asset management, providing the design foundation required for professional practice in bridge engineering.

5. GOALS

- Identify the basic studies, design specifications, aesthetic considerations, and typology-selection factors involved in a bridge project.
- Determine the loads, load models, and load combinations that govern the design of highway bridges according to AASHTO LRFD.
- Model and analyze bridge superstructures using refined and approximate methods for slab-and-girder systems.
- Design reinforced concrete, prestressed concrete, and steel composite bridge superstructure members for flexure and shear according to AASHTO LRFD.
- Design truss bridge members subject to combined flexure and axial force, and design bridge bearings, abutments, and foundations.
- Recognize the fundamentals of road and bridge asset management for the operation and preservation of highway infrastructure.

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)

7. TOPICS

Unit 1: Bridge Superstructure Design (36 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Bridge types, components, and structural systems • Load models and load combinations for bridge design • Concrete slab bridges and T-beam bridge design • Steel girder bridges and composite bridge deck design • Prestressed concrete girder bridges • Box girder and curved bridge analysis • Truss bridge design considerations for members under combined flexure and axial force	• Classify bridge types and select appropriate systems for given site conditions [Familiarity] • Apply AASHTO load models and determine critical load combinations [Usage] • Design reinforced concrete slab bridges and T-beam superstructures [Assessment] • Proportion steel girders and design composite deck systems [Assessment] • Analyze and design prestressed concrete girder bridges [Assessment] • Model box girder bridges and analyze curved alignment effects [Usage] • Design truss bridge members subject to combined flexo-tension and flexo-compression [Usage]
Readings : [BP13], [AAS20], [CD14]	

Unit 2: Bridge Substructure, Evaluation, and Special Systems (4 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• Substructure design including abutments and piers • Cable-stayed and suspension bridge concepts • Bearings, expansion joints, and bridge deck details • Bridge load rating and evaluation procedures • Seismic design of bridges and isolation systems	• Design bridge abutments and piers for vertical and lateral loads [Usage] • Explain the structural behavior of cable-supported bridge systems [Familiarity] • Select and design bridge bearings and expansion joint systems [Assessment] • Perform load rating analysis for existing bridges [Usage] • Implement seismic design criteria for bridge structures [Assessment]
Readings : [BP13], [AAS20]	

Unit 3: Road and Bridge Asset Management (2 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 : [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

- [HHU97] W. Ronald Hudson, Ralph Haas, and Waheed Uddin. *Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation*. McGraw-Hill, 1997.
- [BP13] Richard M. Barker and Jay A. Puckett. *Design of Highway Bridges: An LRFD Approach*. 3rd. Wiley, 2013.
- [CD14] Wai-Fah Chen and Lian Duan, eds. *Bridge Engineering Handbook*. 2nd. CRC Press, 2014.
- [AAS20] AASHTO. *AASHTO LRFD Bridge Design Specifications*. Tech. rep. American Association of State Highway and Transportation Officials, 2020.