



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE2S2. Reinforced Concrete Design I (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE2S2. Reinforced Concrete Design I
2.2 Semester	: 7 th Semester.
2.3 Credits	: 5
2.4 Hours	: 4 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	: CE2M2. Mechanics of Materials II. (5 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Reinforced Concrete Design I introduces the principles and methodology for the design of reinforced concrete members following limit state design philosophy and the ACI 318 building code. Building on the mechanics of materials, students learn to design beams for flexure and shear, columns for combined axial load and biaxial bending, one-way slabs, and to verify deflection and serviceability requirements. The course also covers the design of supported and cantilevered concrete staircases and an introduction to shallow foundation design, providing the structural design foundation required for subsequent reinforced concrete and earthquake-resistant design courses.

5. GOALS

- Apply limit state design philosophy and load factor combinations to reinforced concrete design.
- Design reinforced concrete beams for flexure and shear.
- Design reinforced concrete columns for axial load and biaxial bending.
- Design one-way reinforced concrete slabs and verify deflection and serviceability requirements.
- Design supported and cantilevered concrete staircases.
- Design isolated spread footings for shallow foundations.

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: Reinforced Concrete Design (68 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Design philosophy and limit state methodology for concrete structures • Flexural design of rectangular and T-beams • Shear and torsion design of concrete members • Compression members and column design • Slab design including one-way and two-way systems • Development length and splicing of reinforcement • Deflection control and serviceability requirements for concrete beams and slabs	• Explain limit state design philosophy and load factor combinations [Familiarity] • Design reinforced concrete beams for flexure and check serviceability [Assessment] • Calculate shear and torsional reinforcement requirements [Usage] • Proportion columns for axial load and biaxial bending [Assessment] • Design one-way and two-way slab systems with appropriate reinforcement [Usage] • Determine development lengths and design lap splices for reinforcing bars [Assessment] • Control deflections and verify serviceability requirements through adequate member sizing and reinforcement [Usage]
Readings : [WM16], [ACI19], [MB21]	

Unit 2: Design of Reinforced Concrete Stairs (6 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• Geometry of stair flights, landings, and waist slabs • Load distribution and effective span for simply supported staircases • Load distribution and effective span for cantilevered staircases • Reinforcement detailing for stair flights, landings, and supports	• Design a supported reinforced concrete staircase for gravity loads [Assessment] • Design a cantilevered reinforced concrete staircase for gravity loads [Assessment] • Detail reinforcement for stair flights, landings, and supports [Usage]
Readings : [MB21]	

Unit 3: Bearing Capacity and Design (10 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• Bearing capacity theory and failure mechanisms • Ultimate bearing capacity equations for various conditions • Settlement analysis using elastic and consolidation methods • Isolated spread footing design • Combined footings and strap footings • Allowable bearing pressure and factor of safety selection • Mat foundation analysis and design • Eccentric and inclined loading effects • Soil-structure interaction effects • Differential settlement and tolerable limits • Continuous (strip) footing design for basement and foundation walls	• Explain bearing capacity failure mechanisms in shallow foundations [Familiarity] • Calculate ultimate bearing capacity using Terzaghi and Meyerhof equations [Assessment] • Predict total and differential settlements for shallow foundations [Usage] • Design isolated spread footings for gravity loads [Assessment] • Proportion combined and strap footings for column arrangements [Usage] • Determine allowable bearing pressures based on strength and settlement criteria [Assessment] • Analyze mat foundations using conventional and finite element methods [Assessment] • Evaluate bearing capacity under eccentric and inclined loading [Usage] • Consider soil-structure interaction in foundation design [Familiarity] • Assess differential settlement and apply tolerable settlement criteria [Assessment] • Design continuous strip footings for basement and foundation walls [Usage]
Readings : [Cod01]	

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

- [Cod01] Donald P. Coduto. *Foundation Design: Principles and Practices*. 2nd. Prentice Hall, 2001.
- [WM16] James K. Wight and James G. MacGregor. *Reinforced Concrete: Mechanics and Design*. 7th. Pearson, 2016.
- [ACI19] ACI Committee 318. *Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary*. Tech. rep. American Concrete Institute, 2019.
- [MB21] Jack C. McCormac and Russell H. Brown. *Design of Reinforced Concrete*. 10th. Wiley, 2021.