



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE3S9. Prestressed Concrete (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE3S9. Prestressed Concrete
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	: CE2S2. Reinforced Concrete Design I. (7 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Prestressed Concrete introduces the fundamental principles, elastic analysis, and design methodology for prestressed and post-tensioned concrete members following the ACI 318 building code, building directly on the limit state design foundation established in Reinforced Concrete Design I. Students learn to analyze elastic stresses in prestressed concrete sections under service loads, evaluate composite construction combining precast members and cast-in-place concrete, and calculate immediate and time-dependent losses of prestress. The course develops the design of pretensioned and post-tensioned members for flexural, shear, and torsional strength at the ultimate limit state, the design of post-tensioned slabs including tendon layout, the analysis of statically indeterminate prestressed concrete structures, and the verification of deflection and serviceability requirements, preparing students for advanced structural design practice involving prestressed concrete elements.

5. GOALS

- Apply elastic theory to analyze stresses in prestressed concrete sections under service loads.
- Design composite prestressed concrete sections combining precast members and cast-in-place concrete.
- Calculate immediate and time-dependent losses of prestress.
- Design prestressed concrete members for flexural strength at the ultimate limit state.
- Design prestressed concrete members for shear and torsion strength.
- Design post-tensioned slabs and beams, including tendon layout.
- Analyze statically indeterminate prestressed concrete structures, including secondary moments, and control deflections.

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: Seismic Detailing of Reinforced Concrete (16 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Beam-column joints and moment-resisting frame connections • Seismic detailing and ductile design of concrete structures • Design of special reinforced concrete structural walls (shear walls) for seismic lateral force resistance • Special seismic detailing provisions for reinforced concrete moment-resisting frames	• Detail beam-column joints for moment transfer and shear resistance [Assessment] • Implement seismic detailing requirements for ductile concrete frames [Assessment] • Design special reinforced concrete structural walls for combined axial, flexural, and shear demands under seismic loading [Assessment] • Apply special seismic detailing provisions to reinforced concrete moment frame members and beam-column joints [Usage]
Readings : [Naw10], [Nil87], [ACI19], [LB81]	

Unit 2: Prestressed Concrete Analysis (16 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Prestressed concrete principles and pre-tensioning methods • Elastic analysis of stresses in prestressed concrete sections under service loads • Composite prestressed concrete sections: precast members with cast-in-place topping • Immediate and time-dependent losses of prestress	• Apply prestressing principles to design pre-tensioned members [Usage] • Analyze stresses in prestressed concrete sections under service loads using elastic theory [Usage] • Design composite prestressed concrete sections combining precast members and cast-in-place concrete [Assessment] • Calculate immediate and time-dependent losses of prestress [Usage]
Readings : [Naw10], [Nil87], [ACI19], [LB81]	

Unit 3: Prestressed Concrete Design (20 hours)	
Competences Expected: ABET-1,ABET-2	
Topics	Learning Outcomes
• Post-tensioned concrete systems and tendon design • Deflection control and serviceability requirements • Flexural strength of prestressed concrete members at ultimate limit state • Shear and torsion design of prestressed concrete members • Statically indeterminate prestressed concrete structures, including secondary moments	• Design post-tensioned slabs and beams including tendon layout [Assessment] • Control deflections through appropriate member sizing and reinforcement [Usage] • Design prestressed concrete members for flexural strength at the ultimate limit state [Assessment] • Design prestressed concrete members for shear and torsion strength [Assessment] • Analyze statically indeterminate prestressed concrete structures, including secondary moments [Assessment]
Readings : [Naw10], [Nil87], [ACI19], [LB81]	

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

- [LB81] T. Y. Lin and Ned H. Burns. *Design of Prestressed Concrete Structures*. 3rd. John Wiley & Sons, 1981.
- [Nil87] Arthur H. Nilson. *Design of Prestressed Concrete*. 2nd. John Wiley & Sons, 1987.
- [Naw10] Edward G. Nawy. *Prestressed Concrete: A Fundamental Approach*. 5th. Pearson, 2010.
- [ACI19] ACI Committee 318. *Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary*. Tech. rep. American Concrete Institute, 2019.