College: Engineering Department: Civil Engineering

Course Title: Prestressed Concrete

Course No: 0901511

Credit Hours: 3 C.H.

Semester: 2020/2021

About The Course

Course Title: Prestressed Concrete Class:1

Course No: 0901511

Credit Hours: 3 C.H.

Lecture Room:502

Obligatory/ Optional: Obligatory

1. Text Book: Nilson, Arthur, H., Design of Prestressed Concrete, John Wiley and Sons.
2. Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary, ACI Committee (318-14)

The Instructor

Name: Dr. Manal Osman Suliman Title: Assistant Professor

Office Tel: 330

Office No: 206 Office Hours012:30-03:00 SUN &TUE , 9:30-12:30 MON&WED

E-male: Manal2015sd@gmail.com

Course Description

This course will cover the basic prestressed concrete design. Principles of prestressing, constituent material, loading and allowable stresses, working and ultimate stress analysis and design, shear and torsion, deflections, prestress losses, continuous beams, and composite beams .

Course Objectives

To provide an understanding of the behavior of prestressed concrete composite material, members and structures. Study the basic principles and design applications for prestressed concrete. The basic concepts to be covered include stress analysis, flexural and shear analysis/design, prestress losses, deflections. An introduction precast structural concrete systems will also be covered.

Learning Outcome

After successfully completing this course, the students should be able to:

1- To develop firm basic understanding of the fundamental principles of prestressed concrete behavior, and prestressing capabilities.

2-To be fully aware of the differences in the material properties and structural behavior of prestressed verses reinforced concrete element.

3-To be able to handle with confidence complete design of prestressed concrete elements using various approaches.

4- To apply fundamental concepts of analysis and design of prestressed concrete structures.

Course Outline and Time schedule

Week	Course Outline
First week	Introduction: Text Book, References, and Outlines
	Introduction, Basic concepts, definitions, equivalent loads classification and types of prestressed concrete structures, Reinforced vs. Prestressed Concrete
2nd week	Stressing Methods , Facilities, equipment , Materials; types, reinforcing steel , prestressing steel, importance of using high strength steel concrete
	Elastic analysis of sections for flexure, Loading Stages, critical loadings ,Useful Section Properties and Notations , sign convention.
3rd week	Loads and loading stages, critical loadings, stresses at critical loadings, Stresses in concrete due to prestress and external load.

	Stresses at critical loadings, calculation of stresses at transfer , calculating of stresses at full service loads, Examples(Concentric straight tendon)
4th week	Stresses at critical loadings, load balancing concept ,Examples(Eccentric straight tendon
	Stresses at critical loadings, calculation of stresses at transfer , calculating of stresses at full service loads, Examples(Eccentric curved and bend tendons)
5th week	Permissible stresses for flexure member
	Calculation of prestressing steel stress
6th week	Flexural strength of prestress beam , calculation of the ultimate moment capacity
	Midterm Exam I
7th week	Design of PSC Members
	Minimum Section Modulus, Shape Selection
8th week	Prestressing Force & Eccentricity
	Eccentricity Limits and Tendon Profile
9th week	Limit State Design. Rectangular Stress Block. Ultimate Moment Capacity
	Detailed Estimation of Ultimate Moment Capacity
10th week	**Midterm Exam II**

11th week	Losses of Prestress Force, Lump Sum Estimate
	Detailed Estimation of Losses, Short-Term and Long-Term Losses
12th week	Deflection of Prestressed Concrete Beams
	Detailed Estimation of Deflection, Short-Term and Long-Term Deflection
13th week	Shear in prestress beam, effect of prestress
	shear reinforcement calculation
14th week	Prstressed Slabs
	Statically Indeterminate Beams, Introduction to Continuous Prestressed Concrete Beams
	Practical Tendon Profiles; Moment Redistribution; Secondary Effects at Ultimate
15thweek	Final Exam

Presentation methods and techniques

Methods of teaching varied according to the type of text, student and situation. The following techniques are usually used:

1- Lecturing with active participations.

Involve the civil engineering students in asking some questions related to the target topic of the course.

2- Problem solving.

Encourage the students to solve the given assignments and submit them at the definite time,

3- Cooperative learning.

By enhancing the students studying in groups .

4- Discussion.

To discuss the results and the answers of the target problems.

5- Learning by activities.

To encourage the students to some group activity.

6- Connecting students with different sources of information.

Sources of information and Instructional Aids

- Computer software … power point
- Using weight board.
- Library sources

Assessment Strategy and its tools

The assigned syllabus is assessed and evaluated
Through: feedback and the skills that are acquired by the students
The tools:

1- Formal (stage) evaluation
   a) Class Participation 10%
   b) Ist Exam 20%
   c) 2nd Exam 20%
   d) Group activity and Quizzes 10%

Tool & Evaluation

Tests and quizzes are permanent tools & assessment, in addition to the activity file which contains curricular and the co-curricular activities, research, report papers and the active participation of the student in the lecture.

The following table clarifies the organization of the assessment schedule:

Test	Date	Grade
First Exam		20
2nd Exam		20
Activities & Participation And Quizzes	Students should be notified about their marks	20
Final Exam		40

Activities and Instructional Assignment

1- Practical assignments to achieve the syllabus objectives.

2- Group Activity.

Regulations to maintain the teaching-Learning Process in the Lecture:

1- Regular attendance.

2- Respect of commencement and ending of the lecture time.

3- Positive relationship between student and teacher.

4- Commitment to present assignments on time.

5- High commitment during the lecture to avoid any kind of disturbance and distortion.

6- High seuse of trust and sincerity when referring to any piece of information and to mention the source.

7- The student who absents himself should submit an accepted excuse.

8- University relevant regulations should be applied in case the student's behavior is not accepted.

9- Allowed Absence percentages is (20%).

References :

1. Nawy, E. G., Prestressed Concrete A Fundamental Approach, Prentice Hall.
2. PCI Design Handbook, Prestressed/Precast Concrete Institute.
3. Lin, T. Y., Design of Prestressed Concrete Structures, John Wiley and Sons.
4. Naaman, A. E., Prestressed Concrete Analysis and Design – Fundamentals, McGraw Hill Book Company
5. Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary, ACI Committee (318-14), Farmington Hills, MI, 2014, 530 pp.
6. Teaching notes

Syllabus Classification

Objectives	***Learning outcome***	***Assessment tools***
Be able to perform analysis and design of pre-stress concrete members	1)Understand the advantages of prestressed concrete by reducing tensile stresses in concrete structures. 2) Understand and calculate the various effects that contribute to the partial loss of prestress in the elements. 3) Develop the ability to check stresses in elements at service and transfer, and design for flexure and shear at the ultimate limit state. 4) Understand how to perform detailed design of simply supported prestressed elements of various forms including rectangular, T-beam, and I-beams 5) Understand how to calculate camber and deflection in prestressed concrete beams.	1--Correct answers to 1 or 2of design problems corresponding to each outcome. 2- Correct answers to midterm and final examinations
Be able to identify and interpret the appropriate relevant industry design codes	1. Students will be able to identify and apply the applicable industry design codes relevant to the design of prestressed concrete members. 2. Student will be familiar with professional and ethical issues and the importance of lifelong learning in structural engineering.	1-Correct answers to 1or 2 design of problems corresponding to each outcome with emphasis placed on identification of applicable industry design code. 2- Correct answers to midterm and final examinations. Questions include design/analysis problems that require the selection of the appropriate industry design code.
To become familiar with professional and contemporary issues in the design and fabrication of pre-stressed concrete members	1. Students will become familiar with the prestress concrete fabrication and construction process. 2. Students will be able to perform an industry relevant design project in a team setting	Students will be required to perform as a group, each with individual assignments, on an industry relevant design project
