4- of Prestressed and Precast Concrete (CE 587)

I. Course Identification and General Information:

1.	**Course Title:**	*Prestressed and Precast Concrete*				
2.	**Course Code & Number:**	CE 587				
3.	**Credit hours:**	C.H				**Credit Hours**
		Lecture.	**Laboratory**	**Seminars.**		
		3	-	-		3
4.	**Study semester at which this course is offered:**	1st semester				
5.	**Pre –requisite (if any):**	Reinforced Concrete, Strength of Materials, Structural Analysis				
6.	**Co –requisite (if any):**	Non				
7.	**Program (s) in which the course is offered:**	Master of Science in structural engineering program				
8.	**Language of teaching the course:**	English+ Arabic				
9.	**Course type**	Required				
10.	**Location of teaching the course:**	Class room				
11.	**Prepared By:**	Dr. Mohammad Abdulla Algorafi				
12.	**Date of Approval**					

II. Course Description:

Prestressed concrete is used extensively in multistory buildings and many other important parts of today's modern infrastructure. This course deal with Behavior and design of Precast and Prestressed Concrete. It will cover the 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, composite beams, and compression members, also it cover Precast Concepts, History and Design Philosophy, Design of Skeletal Structures, Design of Precast Floors Used in Precast Frames, and Design of Connections and Joints.

III. Course Intended learning outcomes (CILOs) of the course		**Reference PILOs**
a.1	Describe the properties of prestressed and precast concrete constituents.	A2,A3
a.2	Discuss and appraise the recent advances in the concrete prestressed and precast concrete technology including the use of advanced materials and application of new technologies.	A2,A3
b.1	Evaluate the behavior of prestressed concrete beams under strength and serviceability limit states.	B3
b.2	Analyze the stresses along the beam and anchorage zones considering	B1, B2

	losses for prestressed concrete beams under strength and serviceability limit states.	
c.1	Design of prestressed and precast concrete beams and end anchorages under strength and serviceability limit states considering the losses against flexural, shear, and deflection using ACI/AASHTO codes.	C3
c.2	Calculate prestress losses for simple prestressed concrete girders.	C2
d.1	Conduct independently research related to prestressed and precast concrete.	D3
d.2	Present the ideas Cleary using oral and writing.	D3

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Describe the properties of prestressed and precast concrete constituents.	Lecture self-study presentation	Written exam Assignment Student presentation
a2. Discuss and appraise the recent advances in the concrete prestressed and precast concrete technology including the use of advanced materials and application of new technologies.		

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Evaluate the behavior of prestressed concrete beams under strength and serviceability limit states.	Lecture self-study presentation Analysis and Problem Solving.	Written exam Written assignment Presentations/ Presenting researches
b2. Analyze the stresses along the beam and anchorage zones considering losses for prestressed concrete beams under strength and serviceability limit states.		

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1. Design of prestressed and precast concrete beams and end anchorages under strength and serviceability limit states considering the losses against flexural, shear, and deflection using ACI/AASHTO codes.	Lecture self-study presentation Analysis and Problem Solving.	Written exam Written assignment Presentations/ Presenting researches
c2. Calculate prestress losses for simple prestressed concrete girders.		

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies

d1.Conduct independently research related to prestressed and precast concrete.	presentation, independent study, Presenting reports, ، Presenting researches	survey, presentation, written report.
d2. Present the ideas Cleary using oral and writing.		

IV. Course Content:

A – Lecture Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Material & System for Prestressing	a1,a2,d1	Concrete, Nonprecessing Reinforcement, Prestressing Reinforcement ACI Max Permissible Stresses	1	3
2	Basic Concept	a1,b1,b2,c1	Basic Concept Method C-Line Method Load Balance Method	1	3
3	Partial Loss of Prestress	a2,b1,b2,c1,c2,d1,d2	Elastic strain Steel Relaxation Creep loss Shrinkage Loss Friction Loss Anchorage-Seating Losses	3	9
4	Flexural Working Stress Analysis and Design	a2,b1,b2, c1,c2,d2	Loading Stages Useful Section Properties and Notations Sign Conventions Flexural Analysis - Mathematical Basis Use of Stress-Inequality Conditions for the Design of Section Properties Limiting the Eccentricity along the Span Some Preliminary Design Hints Cracking Moment	3	9
5	Flexural Ultimate Strength Analysis and Design	a2,b1,b2, c1,c2,d2	Load-Deflection Response Flexural Types of Failure Analysis of the Section at Ultimate Concept of Reinforcement Index Limiting Values of the Reinforcement Index Satisfying Ultimate Strength Requirements Design for Ultimate Strength	1	3
6	Design for Shear	a1, ,b1,b2,c1,d2	Reinforced Versus Prestressed Concrete - Shear Diagonal Tension in Uncracked Sections Shear Stresses in Uncracked Sections Shear Cracking Behavior Shear Reinforcement after Cracking	1	3

			Design for Shear		
7	Camber, Deflection and Crack	a2, ,b1,b2,c1,d2	Short-Term Deflections Long-Term Deflections (Simplified Method) Long-Term Deflections (Incremental Time-Step Method) Deflection Limitations Deflection Control	1	3
8	Prestressed slab	a2,b1,b2, c1,c2,d2	a. Review method of analysis b. Flexural strength of two-way slab c. Two- Directional load balancing	1	3
9	Precast Concrete	a1,a2,c1,d1,d2	Precast Concepts, History and Design Philosophy Architectural and Framing Considerations Design of Skeletal Structures Design of Precast Floors Used in Precast Frames Design of Connections and Joints	2	6
Number of Weeks /and Units Per Semester				**14**	**42**

B - Laboratory Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1				
2				
3				
4				
5				
6				
7				
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	assignment	2,5, 8, 10, 11, 12, 14	15	10	a1,a2,b1,b2,c1,c2

2	Project	During class	22.5	15	b1,b2, c1,c2,d1,d2
3	Quizzes	Three times randomly	7.5	5	b1,b2,c1,c2
5	Midterm Exam	9	30	20	a1,a2,b1,b2,c1,c2
6	Final-exam	16	75	50	a1,a2,b1,b2,c1,c2
7					
Total			**150%**	**100%**	

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Basic Concept	a1,b1,b2,c1	2	2
2	Partial Loss of Prestress	a2,b1,b2,c1,c2	5	2
3	Flexural Working Stress Analysis and Design	a2,b1,b2, c1,c2	8	2
4	Flexural Ultimate Strength Analysis and Design	a2,b1,b2, c1,c2	9	2
5	Design for Shear	a1, ,b1,b2,c1	10	2
6	Camber, Deflection and Crack	a2, ,b1,b2,c1	11	2
7	Prestressed Slab	a2,b1,b2, c1,c2	12	1.5
8	Precast Concrete	a1,a2,c1,d1	14	1.5
	Number of Weeks /and Units Per Semester			

VII. Report:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1			4	1
2			6	1
3			8	1
4			10	1.5
5			11	1.5
6			14	1.5

VIII. Learning Resources and Facilities:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

3. PCI Design Handbook, Sixth Edition, 2004
4. LFRD: Load & Resistance Factor Design
5. Nawy, Edward G. "Prestressed concrete : a fundamental approach". Published Upper Saddle River: Prentice Hall, c2010. Edition 5th ed. update.

2- Essential References.

1. Gilbert, RI & Mickleborough, NC 1990, Design of Prestressed Concrete, Unwin Hynm, London.
2. Loo, Y-C & Chowdhury, SH 2013, Reinforced and prestressed concrete: analysis and design with emphasis on application of AS3600-2009, 2nd edn, Cambridge University Press, Melbourne, Vic.

3- Electronic Materials and Web Sites *etc*.

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Educational and research Facilities and Equipment Required

Technology Resources
(AV, data show, Smart Board, software, etc.)

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Other Resources
(Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)

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IX. Course Policies:	
29.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
30.	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.
31.	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
32.	**Assignments & Projects**: The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
33.	**Cheating:** If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquires.
34.	**Plagiarism:** The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
35.	**Other policies**: • All the teaching materials should be kept out the examination hall. • the mobile phone is not allowed. • There should be a respect between the student and his teacher.

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies** **Dr. Tarek A. Barakat** **Dr. Ahmed Alwathaf** **Dr. Mohammad Algorafi**
	Dr. Ahmed mujahed **Dr. Munaser Alsubri**