Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2019-2020
Course Handout Part II

Date: 15-07-2019

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CE G614
Course Title : PRESTRESSED CONCRETE STRUCTURES
Instructor-in-Charge : Bahurudeen A

Scope and objective of the Course:

This course provides the basic and enhanced overview on design of pre-stressed concrete structures. Basic concepts of prestressing, types of prestressing systems and their analysis are discussed in the course. Additionally, the course enlightens design details for flexure, shear, torsion. Relevant Indian Standard codes of practice will be given emphasis throughout lecture sessions.

Course Outcomes:

1. On the completion of the course the learner will be able to choose choices of prestressing methods, recent systems and accessories relevant to any method for a given construction project.
2. On completion of the course the learner will be able to analyze different sections used in pestressed concrete construction.
3. On completion of the course the student will be able to design and detail for flexure, shear and torsional reinforcemtent in varous section of prestressed concrete.
4. On the completion of course the student will able to assess transimission of prestressing and durability of prestressed concrete structures.

Text Book:

T1. Krishna Raju, N., Prestressed Concrete, 4th Edition, Tata McGraw-Hill Publishing Company Ltd., 2007.

Reference Books:

R1. Collins, M. P. and Mitchell, D., Prestressed Concrete Structures, Prentice-Hall, Inc., 1997
R2. Khan, S. and Williams, M., Post-tensioned Concrete Floors, ButterworthHeinemann Ltd., 1995.
R3. Lin, T. Y. and Burns, N. H., Design of Prestressed Concrete, 3rd Edition, John Wiley & Sons, 2010.
R4. Rajagopalan, N., Prestressed Concrete, Narosa Publishing House, 2010.

R5. Relavant Indian and International Standards (IS:784 – 2001; IS:1343 – 2012; IRC:18 – 2000; ACI 318M-05; BS 8110 : Part 1 : 1997)

Course Plan:

No. of Lectures	Learning Objectives	Topics to be covered	References	SLO
1-3	Describe the importance and significance of prestressing. Discuss the evolution of prestressing techniques with time.	Basic Concept; Early Attempts of Prestressing; Brief History.	1, T1	**(h),(j)**
4-6	List the various types of prestressing techniques. Recommend suitable prestressing techniques for various structural applications. Explain the limitations of prestress techniques. Describe the merits of prestressing over the conventional reinforcement design.	Effect and Source of Prestressing Types of Prestressing; Partial prestressing Limitations of Prestressing Advantages of Prestressing	1, T1	**(a)**
7-9	List different accessories used in prestressing concept	Prestressing steel and concrete for construction. Materials and accessories used in prestressed concrete construction.	2, 3 T1	**(c)**
10-15	Outline the basic assumptions used in presetressing applications. Analyse prestressed concrete members. Solve and find out the cracking moments in prestressed members under specific loadings.	Elastic flexure analysis, Basic assumptions; Analysis; Resultant stresses; stresses in tendons; Cracking Moment	4, T1	**(h), (e)**
16-20	Define the phenomenon of elastic shortening.	Losses due to prestress	5, T1	**(k),(a)**

	Describe the various prestressing losses and explain the reasons for them.	Elastic Shortening; Anchorage Slip; Creep of Concrete; Shrinkage of Concrete; Relaxation of Steel; Total Time-dependent Loss		
21-22	Carry out Flextural design based on concrete stress limits	Magnel method of flexural design	7, T1	**(c)**
23-24	Perform Flextural design based on Load balancing concept	Load balancing method	4, T1	**(c)**
25- 31	List and examine the different components of shear resistance Describe the sequential design steps for prestressing .	Shear diagonal tension and web reinforcement: Components of Shear Resistance; Design of Transverse Reinforcement; Detailing of shear Reinforcement; Design Steps	8, T1	**(e), (k)**
32-36	Examine the effects of pure torsion on a prestressed concrete member Summarize the concept of pure torsion and extend the theory to explain the failure modes Discuss in detail the limit state of collapse for torsion.	Crack Pattern Under Pure Torsion Components of Resistance for Pure Torsion; Modes of Failure; Effect of Prestressing Force Limit State of Collapse for Torsion; Design and Detailing Requirements	8, T1	**(a), (k), (e)**
37-39	Illustrate transmission of prestress in a structural concrete member Define bond stress and explain the concept of transmission length	Bond stress, transfer and development length, Anchorage Zone.	9, T1	**(a), (k)**
40-42	List the various types of deflections that occur in prestressed concrete members and explain the reasons.	Deflection due to Gravity Loads; Deflection due to Prestressing Force; Total Deflection; Limits of Deflection; Calculation of Crack Width and Limits of Crack Width	6, T1	**(e), (a)**
Total: 42				

***Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Remarks
Mid Semester Test	90 min	25	03/10/2019 11:00-12:30 pm	Closed Book
Surprise Quiz	-	10	Continuous	Open Book
Term project	-	15	Continuous	Open Book
Take Home Assignment	-	15	Continuous	Open Book
Comprehensive Exam	180 min	35	09/12/2019 FN	Closed book

Chamber Consultation Hour: Wednesday 3:00 -4:00 pm

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Notices: Notices will be displayed on the Notice Board of Civil Engineering Department and Google class room of the course.

Make-up Policy:

1. Prior permission is mandatory in genuine cases. Applications (preferably email/hardcopy) received 24 hours after (in case of medical emergencies) the test will not be entertained. Applications on informal forums will be ignored.Medical emergencies have to be supported by valid certificates

INSTRUCTOR-IN-CHARGE
CE G614