BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2021-22
COURSE HANDOUT

Date: 22.12.2021

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

Course No. : **CE F415**
Course Title : **DESIGN OF PRESTRESSED CONCRETE STRUCTURE**
Instructor In-charge : **MD RUSHDIE IBNE ISLAM**
Instructor : **NA**

1. Course Description

Introduction to basic concepts of prestressing; load balancing technique prestressing systems; analysis of prestress; losses in prestress; deflection; design of anchorage zone, design of prestressed concrete girders.

2. Scope and Objectives

The universal use of prestressed concrete as a versatile construction material is well established due to its suitability in multifarious types of structural applications. The application of prestressed concrete is increasing with the development of technology. Prestressing is the application of an initial load on a structure to enable it to counteract the stresses arising from subsequent loads during its service period. In this course, the students will be introduced to prestressed concrete and its applications.

The course would cover important topics of prestressed concrete including the design of structural elements based on limit state philosophy of design. It would partially fulfill the requirements of practicing structural design engineers.

The course integrates science and engineering principles to design prestressed concrete members and structural systems. The application of scientific and engineering knowledge would be demonstrated in solving engineering problems associated with the design of precast prestressed building members. This course would be quite helpful for the students who wants to join the structural design or construction industry. At the end of the course work students will be able to determine the behavior of prestressed concrete structures.

3. Prescribed Textbook

T1. N Krishna Raju, “Prestressed Concrete”, McGraw Hill Education (India) Pvt. Ltd., 6th Edition, 2019.

4. Reference Books

R1. N. Rajagopalan, “Prestressed Concrete”, Alpha Science International Ltd., 2nd edition, 2005.

5. Course Plan

Module Number	Lecture session	Reference	Learning Outcome

1. Introduction, Materials and Prestressing Systems	Introduction and Prestressing systems; Materials used – High Strength Concrete, High strength steel etc.; Prestressing systems – pre-tensioning systems, post tensioning systems	T1-1,2,3	Understanding the basics of prestressed concrete.
2. Analysis of Prestress and Bending Stress	Basic assumptions and analysis of prestress; Pressure line or thrust line and internal resisting couple; Concept of load balancing; Stresses in tendons; Numerical examples.	T1-4	Understanding the fundamentals of the analysis of prestress and bending stress.
3. Losses of Prestress	Nature of loses of prestress; Reasons for losses of prestress; Numerical examples.	T1-5	Understanding the reasons of prestress losses.
4. Deflection of Prestressed Concrete Members and limit state design criteria	Factors influencing deflections; Deflection of prestressed concrete members – uncracked and cracked; Numerical examples; Philosophy of limit state design; Crack widths in prestressed members	T1-6,11	Understanding the deflections of prestressed concrete members and limit state design criteria.
5. Flexural and Shear Strength	Types of failure in flexure; Methods of determining flexural strength for prestressed concrete sections; Numerical examples; Shear resistance of prestressed concrete members; Design of shear reinforcements; Numerical examples.	T1-7,8	Understanding the flexural and shear strengths of prestressed concrete structures.
6. Transfer of prestress in pretensioned members and anchorage zone stresses in post-tensioned members	Transfer of prestress in pre-tensioned members – estimation of the transfer bond stresses, estimation of transverse tensile stresses; Numerical examples; Anchorage zone stresses in post-tensioned members – investigation on anchorage zone stresses; Numerical examples.	T1-9,10	Understanding the transfer of prestress in pretensioned and post-tensioned members.

7. Design of Prestressed Concrete Sections	Design for flexure; Numerical examples; Limitations of Prestress in long span; Limiting zone for the prestressing force; Numerical examples.	T1-12	Understanding the design of prestresses concrete sections.
8. Design of Pre-tensioned and Post-tensioned Members	Review of codal provisions; Bennett;s chart; Design examples of a pre-tensioned flanged section; Design example of a post-tensioned beam; Numerical examples.	T1-13	Understanding the design of pre-tensioned and post-tensioned members.
9. Composite Construction of Prestressed & In-situ Concrete	Types of composite constructions commonly used; Propped and unpropped constructions; Differential shrinkage; Deflection of composite members; Flexural strength of composite sections; Numerical examples.	T1-14	Understanding the composite construction of prestressed & in-situ concrete
10. Statically Indeterminate Structures	Statically indeterminate (continuous) prestresses concrete structures; Secondary moments; Equivalent load method; Concordant cable profile and concordant beam; Ultimate strength behavior; Numerical examples.	T1-15	Understanding the statistically indeterminate structures.
11. Prestresses Concrete Bridges	Design of a post-tensioned prestressed concrete T beam slab bridge; Design of post-tensioned continuous two-span bridge girder.	T1-21	Understanding the prestress concrete bridges.

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	25	<TEST_1>	Close Book/ Open Book
Comprehensive Examination	2 h	35	<TEST_C>	Close Book/ Open Book
Assignments/Class Tests/ Term Paper		40	Spread over the semester	Close Book/ Open Book

7. Chamber Consultation Hour: To be announced during the lecture.

8. Notices: Notices concerning this course will be displayed on Department Notice Board.

9. Make-up Policy: If the student is unable to appear for the Regular Test/Examination due to genuine exigencies, the student must refer to the procedure for applying for Make-up Test/Examination. No make up for the assignments.

10. Note (if any):

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

(MD RUSHDIE IBNE ISLAM)
Instructor In charge
CE F415