Design of Prestressed Concrete Structure

01CI1809

Objective of the Course:

- Gain an understanding of the fundamental principles underlying prestressing structures, including concepts such as pre-tensioning and post-tensioning.
- Develop the ability to calculate different types of prestress losses, such as friction losses and elastic shortening, and determine deflections in prestressed members.
- Learn to analyze determinate and indeterminate prestressed concrete members using appropriate analytical techniques and methods.
- Master the application of Indian Standard code provisions in the design of prestressed concrete structures, ensuring compliance with relevant guidelines and regulations to achieve safe and efficient construction practices.

Credit Earned: 03

Prerequisite: Structural Analysis, Elementary Design of Structures.

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Understand the basic fundamental principles of prestressing structures.
2. Calculate the various types of prestress losses and deflections of the prestressed members.
3. Analyze the determinate & indeterminate prestressed concrete members.
4. Design prestressed concrete structures as per Indian Standard codded provisions.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	00	03	50	30	20	25	25	150

Detailed Syllabus

Sr. No	Topic name	Hours
1	**Introduction**	**08**
	1.1 Introduction, Basic Concepts, History of the development of materials and prestressing.	02
	1.2 Different methods of prestressing, Advantages, and Limitations, IS provisions related to materials properties & prestressing, Systems & Devices.	06
2	**Analysis of Prestress and Bending Stress**	**18**
	2.1 Estimation of Losses due to various effects in prestress, Short-term and long-term deflections; flexural, shear and torsional strength, and Estimation of crack width. Fatigue and impact strength, resistance to fire, and corrosion	08
	2.2 Analysis of PSC Flexural members, Basic concept, Bending Stresses at various Stages, Pressure Line, Codal Provisions, Ultimate Strength in Prestress	06
	2.3 Design for Ultimate and Serviceability Limit States for Flexure, Analysis and Design for Shear and Torsion,	04
3	**Design of Structural Elements**	**16**
	3.1 Prestress Transmission in pre-tensioned members, Anchorage zone stresses and design for post-tensioned members, Limit state design criteria	08
	3.2 Analysis and Design of Continuous Beam, Choice of Cable Profile, Creep and Shrinkage Effects. Partial prestressing - principles, Analysis and design concepts, Crack width calculations	08
		42

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	25%	30%	20%	10%

Instructional Method and Pedagogy:

1 At the start of the course, the course delivery pattern and prerequisite of the subject will be discussed.
2 Lectures will be taken in the classroom with the use of multi-media presentations, whiteboard– a mix of both.

3 Attendance is compulsory in lectures which carries a 5% component of the overall evaluation.
4 About 10 to 15% of the topics/ sub-topics, which are relatively simple, are to be given to the students for self-learning and collaborative learning methods. The assessment of Cos for the particular topics will be through classroom presentations.
5 Guide Students to undertake a micro-project/ physical model of the various elements.
6 Minimum two internal exams will be conducted an average of two will be considered as a part of continuous evaluation
7 Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular intervals. It carries a weightage of 5%.
8 Surprise tests/Quizzes will be conducted, which carry a 5% component of the overall evaluation.

Recommended Study Material

1. Krishna Raju, Prestressed concrete, Tata McGraw Hill Education Pvt. Ltd.
2. Ghos, Karuna Moy, Prestressed Concrete: analysis and design practice of members, PHI Learning Private Limited
3. T.Y.Lin , Design of Prestressed Concrete Structures, Wiley India Private Limited
4. N.C. Sinha & S.K. Roy, S.Chand, Fundamentals of Prestressed Concrete
5. Leonhardt F., Wilhelm Ernst and Shon, Berlin, Prestressed Concrete- Design and Construction
6. Freyssinet, Prestressed Concrete
7. Evans, R.H. and Bennett, E.W., Chapman and Hall, Prestressed Concrete
8. Rajagopalan, Prestressed concrete
9. IS:1343-Code for Practice for Prestressed Concrete.
10. IS:3370 Code of Practice Concrete structures for the storage of liquids, Part 3: Prestressed concrete structures

Web Links

- https://archive.nptel.ac.in/courses/105/106/105106118/