



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3170624

SUBJECT NAME: Design of Prestressed Concrete structures
SEMESTER-VII

Type of course: Professional Elective Course

Prerequisite: Mechanics of Solids, Concrete Technology, Structural Analysis- I, Design of Structures

Rationale: This course is an elementary course on Design of Prestressed Concrete Structures. The course is specifically aim to familiarize with the basic concepts of prestressing and to develop understanding of various design philosophies, Indian Standard Codal provisions for the design of statically determinate Prestressed Concrete elements.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	<u>Module 1: Introduction</u> Basic Concepts of Prestressing, Historical Development of prestressing, Materials and systems for prestressing, Types of Prestressing, Advantages and Limitations of Prestressing.	03
2	<u>Module 2: Losses in Prestress</u> Introduction, Losses due to Friction, Losses due to Anchorage Slip, Losses due to Elastic Shortening, Time-Dependent losses due Creep, Shrinkage and Relaxation, Total immediate losses, Total Time-Dependent losses, Illustrative Examples.	05
3	<u>Module 3: Flexural Design of Prestressed Concrete Elements</u> Introduction, Types of Flexural Failures, Selection of concrete section and tendon profile, Strain Compatibility Method, Design of Pre-tensioned Beams, Design of Post-tensioned Beams, Design of Composite Prestressed Concrete Beams, Design of Simply supported Slabs, Camber, Deflection and Crack Control, End Block Design.	16
4	<u>Module 4: Shear and Torsional Strength Design</u> Introduction, Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Horizontal Shear	12



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	strength in Composite Construction, Brackets and Corbels, Torsional behaviour and strength, Design for Combined Shear and Torsion.	
5	<u>Module 5: Prestressed Compression and Tension Members</u> Introduction, Types of prestressed Compression and Tension Members, their behaviour, Analysis and design of prestressed Compression and Tension Members	09

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	10	30	30	20	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. T. Y. Lin and Ned H. Burns, Design of Prestressed Concrete Structures, 3rd Edition, John Wiley and Sons
2. Edward G. Nawy, Prestressed Concrete – A Fundamental Approach, 5th Edition, Pearson Education, Inc.
3. Arthur H. Nilson, Design of Prestressed Concrete, 2nd Edition, John Wiley and Sons
4. Antoine E. Naaman - Prestressed Concrete Analysis and Design – Fundamentals, 2nd Edition, Techno Press 3000
5. N. Krishna Raju, Prestressed Concrete, 6th Edition, McGraw Hill Education (India) Private Limited
6. N. Rajagopalan, Prestressed Concrete, 2nd Edition, Narosa publications
7. IS: 1343 – 2012, Prestressed Concrete – Code of practice

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply the basic concepts of prestressing in various Civil Engineering Structures.	10%
CO-2	Assess the various prestressing losses in prestressed concrete elements as per Indian Standard Codal provisions	15%
CO-3	Analyse and design statically determinate prestressed concrete flexural elements and draught prestressing details.	35%
CO-4	Analyse and design the prestressed concrete elements for Shear and Torsion and draught detailing.	20%
CO-5	Analyse and design Prestressed Compression and Tension Members and draught prestressing details	20%



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List of Experiments:

1. The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.
2. Prepare sketches of structural detailing of Prestressed Concrete Elements in sketch book/A3 size sheet.
3. Experiments may be designed and carried out related to the topics of the course such as Design, casting, prestressing and testing of Prestressed Concrete Elements.
4. Site Visit may be arranged related to the topics of the course such as Post-Tensioned / Pre-Tensioned Prestressed Concrete Beams, PT Slabs, Prestressed Sleepers, Electric Poles, etc.
5. Practical examinations shall consist of oral based on term-work and above course

Major Equipment:

1. Any professional software of Structural analysis such as STAAD-pro, SAP, ETABS, Midas Gen, ADAPT PT, SOFISTIK.
2. Universal testing machine/Compression Testing Machine/ loading frame & loading jack, Prestressing Bed, Concrete Mixture

List of Open Source Software/learning website:

<https://nptel.ac.in/courses/105/106/105106117/>

<https://nptel.ac.in/courses/105/106/105106118/>

<https://www.pci.org/>

<https://www.post-tensioning.org/>