

# GUJARAT TECHNOLOGICAL UNIVERSITY

## CIVIL AND INFRASTRUCTURE ENGINEERING (40)

### PRESTRESSED CONCRETE STRUCTURES

#### SUBJECT CODE:2174005

SEMESTER:

**Type of course: Department Elective**

**Prerequisite:** Fundamental knowledge of Structural Analysis, Concrete Technology, Design of reinforced concrete structure.

**Rationale:** students may be able:

1. To understand utility of prestressing and types of prestressing concrete members
2. To analyse prestressing forces acting on different members
3. To understand possible failure patterns of prestressed members
4. To design prestressed concrete beams and slabs

#### Teaching and Examination Scheme :

Teaching Scheme			Credits C	Examination Marks						Total Marks	
L	T	P		Theory Marks		Practical Marks					
			ESE (E)	PA (M)	PA (V)		PA (I)				
					ESE	OEP	PA	RP			
3	2	0	5	70	30	20	10	10	10	10	150

ESE- End Semester Exam, PA-Progressive Assessment, E-External, M-Mid Semester, V-Viva (External), I-Internal, ALA-Active Learning Assignment, OEP-Open Ended Problem

#### Content:

Sr. No	Topics	Teaching Hrs.	Module Weightage
1.	<b>INTRODUCTION - THEORY AND BEHAVIOUR:</b> Basic concepts, Advantages, Materials required etc., Systems and methods of prestressing, Analysis of sections, Stress concept, Strength concept, Load balancing concept, Effect of loading on the tensile stresses in tendons, Effect of tendon profile on deflections, Factors influencing deflections, Calculation of deflections, Short term and long term deflections, Losses of prestress, Estimation of crack width.	9	25%
2	<b>DESIGN FOR FLEXURE AND SHEAR:</b> Basic assumptions for calculating flexural stresses, Permissible stresses in steel and concrete as per I.S.1343 Code, Design of sections of Type I and Type II post-tensioned and pre-tensioned beams, Check for strength limit based on I.S. 1343 Code, Layout of cables in post-tensioned beams, Location of wires in pre-tensioned beams, Design for shear based on I.S. 1343 Code.	9	25%
3	<b>DEFLECTION AND DESIGN OF ANCHORAGE ZONE:</b> Factors influencing deflections, Short term deflections of uncracked members, Prediction of long term deflections due to creep and shrinkage, Check for serviceability limit state of deflection.	8	20%

	Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343 code, design of anchorage zone reinforcement, Check for transfer bond length in pre-tensioned beams.		
4	<b>COMPOSITE BEAMS AND CONTINUOUS BEAMS:</b> Analysis and design of composite beams, Methods of achieving continuity in continuous beams, Analysis for secondary moments, Concordant cable and linear transformation, Calculation of Stresses, Principles of design.	7	15%
5	<b>MISCELLANEOUS STRUCTURES:</b> Design of tension and compression members – Tanks, pipes and poles. Partial prestressing: Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.	7	15%

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	25	30	20	10	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:**

- Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012
- Pandit.G.S. and Gupta.S.P, "Prestressed Concrete", CBS Publishers and Distributors Pvt. Ltd, 2012.
- Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
- Dayaratnam.P, "Prestressed Concrete Structures", Oxford and IBH, 2013.
- Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi.
- IS 1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi.
- IS 3370 – 3:1967, Code of Practice for Concrete Structures for the Storage of Liquids, New Delhi.

**Course outcomes**

- By the end of this course students will have the capability/knowledge of prestressing elements.
- Student shall have a knowledge on methods of prestressing and able to design various prestressed concrete structural elements.

**List of Experiments: - NIL**

**Term work:**

Design based problem/ Open ended problem may also considered as a part of Term-work: A group of students has to undertake one open ended problem/case study. Few examples of the same are given below:

- Advance Techniques of Prestressing.
- Application of Circular prestressing
- Prestressing in Slab
- Prestressing in Bridge Girder

- Failure study: during prestressing and at service
- Development of spread sheets for design of various structural elements of bridges.
- Design of any one type of structure from the course using any open-source / professional software and/or self-developed spread sheet/programs.
- Failure studies: during and/or after construction

**Field Visit: Site visit related to prestressing practice and report preparation.**

**List of Open Source Software/learning website:**

1. <http://nptel.ac.in>
2. <http://www.icri.org>
3. <http://www.nbmcw.com>

**ACTIVE LEARNING ASSIGNMENTS:**

Preparation of power-point slides: which include videos, animations, pictures, graphics for better understanding theory and practical work. The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus can be covered. The power-point slides should be put up on the website of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.