



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-6 (B. Tech.)

Subject: Pre-stressed Concrete – BETCV16330
Type of Course: Professional Elective
Prerequisite: Knowledge of Concrete Technology, Design of Structures

Rationale: Prestressed Concrete forms a vital part of modern construction where longer spans, thinner sections, and improved durability are required. It involves understanding the principles and methods of prestressing, analysis of structural behavior, and design of various members such as beams, slabs, and tanks. The subject equips civil engineers with the knowledge to design efficient, economical, and durable structures like bridges, buildings, and industrial units, thereby meeting the growing demands of sustainable and advanced infrastructure.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.



Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
1	Introduction of prestress Structure Member Basic Concepts of Prestressing, Historical Development of prestressing, Materials and systems for prestressing, Types of Prestressing, Advantages and Limitations of Prestressing	05	10
2	Losses in Prestress Structure Member 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	20
3	Flexural Design of Prestressed Concrete Elements 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.	15	30
4	Shear and Torsional Strength Design Introduction, Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Horizontal Shear strength in Composite Construction, Brackets and Corbels, Torsional behavior and strength, Design for Combined Shear and Torsion	10	20
5	Prestressed Compression and Tension Members Introduction, Types of prestressed Compression and Tension Members, their behavior, Analysis and design of prestressed Compression and Tension Members	10	20

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	Field Visits on Prestressed Concrete Structures Faculty will organize industrial visits to nearby Prestressed Concrete structures. Students will observe prestressing techniques, anchorage systems, tendons, and construction methods, and interact with engineers to understand practical applications. A reflection report must be prepared and submitted on the GMIU Web Portal.	10
2	Case Study Analysis of Prestressed Concrete Structures Faculty will assign case studies on real Prestressed Concrete applications such as long-span bridges, precast floor systems, PSC water tanks, metro viaducts. (2-3 Students in groups) will analyze the structure's purpose, design parameters, construction techniques, and service performance. The findings will be compiled as PowerPoint presentations and submitted to the GMIU Web Portal.	10



3	Mini-Projects on Prestressed Concrete Applications Students will undertake mini-projects comparing Reinforced Concrete (RC) and Prestressed Concrete (PSC) sections using models to evaluate cost and efficiency. The project presentation must be completed and submitted on the GMIU Web Portal.	10
TOTAL		30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	15%	25%	30%	30%	-	-

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.

Course Outcome:

After learning the course, the students should be able to:

CO1	Understand the fundamental concepts, materials, systems, and types of prestressing along with their advantages and limitations.
CO2	Calculate various prestress losses including friction, anchorage slip, elastic shortening, creep, shrinkage, and relaxation.
CO3	Design prestressed concrete flexural members such as beams and slabs using pre-tensioned and post-tensioned systems.
CO4	Analyse and design prestressed concrete members for shear, torsion, and combined actions with appropriate reinforcement.
CO5	Analyse and design Prestressed Compression and Tension Members and draught prestressing details

List of Practical

Sr. No.	Descriptions	Unit No.	Hrs.
01	Identify and prepare a report on different types of steel tendons, anchorage devices, and prestressing systems.	01	04
02	For a given span and load, compare the required section sizes of a reinforced concrete beam and a prestressed concrete beam.	01	04
03	Calculate losses due to elastic shortening, anchorage slip, creep, shrinkage, and relaxation for a simple pre-tensioned beam.	02	02
04	Using a simple pulley-and-cable model, demonstrate how friction affects prestressing force. Record and tabulate variations	02	04



05	Design a rectangular pre-tensioned concrete beam for a given span and loading. Show tendon layout and compute stresses.	03	02
06	Perform the design of a post-tensioned beam for a specified span and live load. Present tendon profile and anchorage details.	03	02
07	Draw stress-strain and load-deflection curves to illustrate different types of flexural failure in prestressed beams.	03	02
08	Calculate initial camber and long-term deflection for a simply supported prestressed beam. Compare results with deflection limits.	04	02
09	For a given prestressed beam section, compute shear stresses and check torsional strength. Suggest reinforcement requirements.	04	04
10	Prepare a small design case study including purpose, prestressing method used, tendon layout, and service considerations	05	04
TOTAL			30

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

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

