COURSE CONTENT

DESIGN OF PRESTRESSED CONCRETE STRUCTURES								
III Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BSTD26	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Reinforced Concrete Structures Design and Drawing								

I. COURSE OVERVIEW:

Introduction to prestressed concrete-prestressing concepts; pre-tensioning and post-tensioning; full and partial prestress; the need for prestress; advantages and disadvantages; methods of prestressing. Forces imposed by prestressing (straight, draped and kinked tendon profiles). Load balancing. Introductory examples. Design requirements: strength and serviceability. Material properties. Design for serviceability: stress limits; serviceability criteria; determination of prestress and eccentricity; cable profiles; cracked section analysis; decompression and cracking moment; effect of cracking at service loads; short-term deflection calculations; crack control; design for strength: limit state design. Rectangular stress block. Ultimate moment capacity. Effect of non-prestressed steel; ductility; transfer strength; design for shear-effect of prestress on shear; stirrup design. Special problems in prestressing: losses; effect of creep and shrinkage; end block design-bursting and spalling forces in post anchorages; transmission lengths in pre-tensioned members. Statically indeterminate beams: introduction to continuous prestressed concrete beams; secondary moments.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The concepts of prestressed concrete structures and the behaviour of these structures subjected to loads for the design purpose.
II. The design of structural elements necessary for creating efficient and economic prestressed concrete structures.
III. The design and drawing of multi storeyed industrial and residential structures including bridges for creating high performance and durable structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the concept of methods of pre and post tensioning and the systems of prestressing for the designing of prestressed concrete structural elements.
CO 2 Estimate the losses in the prestress and post tensioned members for the efficient design of prestressed concrete structures.
CO 3 Analyse prestressed concrete structural elements subjected to flexure for the design purpose.
CO 4 Design prestressed concrete structural elements subjected to shear using Indian standard code method.

CO 5 Apply the concepts of transfer of prestress in pre and post tensioned members through bond for effective utilisation of prestressing force

CO 6 Design the composite prestressed concrete structural elements subjected to flexure and shear for designing multi storied structures

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO PRESTRESSED CONCRETE (10)

Historic development- General principles of pre-stressing pre-tensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of pre-stressing Materials- high strength concrete and high tensile steel their characteristics. Methods and Systems of prestressing: Pre-tensioning and Post-tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.

MODULE-II: LOSSES OF PRESTRESS (09)

Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses.

MODULE-III: FLEXURE AND SHEAR IN PSC (10)

Analysis of sections for flexure, beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams, Elastic design of PSC beams of rectangular and I section Kern line, Cable profile and cable layout.

Shear: General Considerations, Principal tension and compression, improving shear resistance of concrete by horizontal and vertical pre-stressing and by using inclined or parabolic cables, Analysis of rectangular and I-beam for shear, Design of shear reinforcements- Bureau of Indian Standards (BIS) Code provisions.

MODULE-IV: TRANSFER OF PRE-STRESS IN PRE-TENSIONED MEMBERS (09)

Transmission of pre-stressing force by bond, Transmission length, Flexural bond stresses, IS code provisions, Anchorage zone stresses in post tensioned members, stress distribution in End block, Analysis by Guyon, Magnel, Zielinski and Rowe's methods, Anchorage zone reinforcement, BIS Provisions.

MODULE-V: ACOMPOSITE BEAMS AND DEFLECTIONS (10)

Different Types: Propped and unpropped, stress distribution, Differential shrinkage, Analysis of composite beams, General design considerations. Deflections: Importance of control of deflections, Factors influencing deflections, short term deflections of uncracked beams, prediction of longtime deflections, BIS code requirements, introduction to pre-fabrication technology.

V. TEXT BOOKS:

1. Krishnaraju N, "Prestressed Concrete", Tata McGraw Hill, New Delhi, 6th edition, 2018.
2. Lin T.Y, "Design of Prestressed Concrete Structures", Asia Publishing House, 1st edition, 1955.

VI. REFERENCE BOOKS:

1. GuyanY, "Limited State Design of Prestressed Concrete", Applied Science Publishers, 1972.
2. IS: 1343- Code of Practice for Prestressed Concrete.
3. IRC: 112- code for concrete road bridges

VII. ELECTRONICS RESOURCES:

1. http://nptel.ac.in/courses/105106117/
2. http://textofvideo.nptel.ac.in/105106118/lec17.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation