INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DESIGN OF PRESTRESSED CONCRETE STRUCTURES								
III Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE26	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Design of RC Structural Elements								

I. COURSE OVERVIEW:

A prestressed concrete structure is different from a conventional reinforced concrete structure due to the application of an initial load on the structure prior to its use. In prestressed concrete high strength concrete and high strength steel are combined such that the full section is effective in resisting tension and compression. This is an active combination of the two materials. This subject provides students an understanding and ability to analyse and design prestressed concrete structural elements. The primary topics includes the concept and principles of prestressing, methods of prestressing concrete, stress limits, losses of prestress, selection of section, serviceability and strength requirements. Students will also be able to complete analysis and design procedure of simply supported prestressed concrete non-composite and composite beams.

II. COURSE OBJECTIVES:

The students 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. Design procedure for structural elements necessary for creating efficient and economic prestressed concrete structures.

III. 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 Analyze 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 utilization 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 PCS (9)
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 PRE-STRESS (9)
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 (9)
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 (9)
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: COMPOSITE BEAMS AND DEFLECTIONS (9)
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.

V. TEXTBOOKS:

1. N. Krishna Raju, "*Pre-stressed Concrete*", Tata McGraw Hill Book Education Pvt. Ltd, 6th Edition, 2018.
2. N. Rajagopalan, "*Prestressed Concrete*", Alpha Science International Ltd, 2nd edition, 2005.

VI. REFERENCE BOOKS:

1. Lin, T. Y., and Ned H. Burns. "*Design of Prestressed Concrete Structures".* John Wiley & Sons, 3rd edition, 1981.
2. Ramamrutham, S. "*Prestressed Concrete".* Dhanpat Rai Publishing Company (P) Ltd., 1975.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105106118
2. https://odp.inflibnet.ac.in/index.php/moduledetails?course=prestressed%20concrete%20structures&source=swayam&subsource=NPTEL

VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation