INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

COURSE DESCRIPTOR

Course Title	**DESIGN OF PRESTRESSED CONCRETE STRUCTURES**				
Course Code	BSTB22				
Programme	M.Tech				
Semester	III	ST			
Course Type	Elective				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. CH.Venugopal Reddy, Assistant Professor				
Course Faculty	Mr. CH.Venugopal Reddy,Assistant Professor				

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 PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	-	-	Reinforced concrete structures design & drawing.	-

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIAExamination	Total Marks
Design of Prestressed concrete structures	70 Marks	30	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✘	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✘	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	TS&P	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 3	Capable to apply the core, multidisciplinary knowledge for understanding the problems in structural engineering and allied fields.	3	Assignments,Tutorials
PO 4	Apply appropriate techniques, resources, modern engineering and Information Technology (IT) tools including predictions, modeling of complex structural engineering activities.	2	Assignments
PO 6	Conceptualize and design civil engineering structures considering various socio-economic factors.	3	Assignments
PO 7	Ability to demonstrate in-depth knowledge of Structural Engineering and build capability to apply that knowledge to real problems.	3	Presentation on realworld problems

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Find out losses in the prestressed concrete.
II	Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes..
III	Analyze prestressed concrete deck slab and beam/girders.
IV	Design prestressed concrete deck slab and beam/girders.

VIII. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand different types of prestressing, losses, analysis of PSC flexural members and Codal provisions.	CLO 1	Understand the concept of pre-stressing and the behaviour of concrete structures.
		CLO 2	Recognize the general principles, methods of pre-stressing, and pre-stressing devices for pre- tensioning and post-tensioning.
		CLO 3	Determine losses of pre-stress in pre-stressed concrete structures.
		CLO 4	Apply the provisions of IS-1343(1980) code to the design of pre-stressed concrete structures for flexure and shear.
CO 2	Understand ultimate and serviceability limit states for flexure, design for shear, transmission force for pretensioning and post tensioning and anchorage zone stresses.	CLO 5	Understand the ultimate & serviceability limit states for flexure.
		CLO 6	Design the shearreinforcements for pre-stressed concrete beams.
		CLO 7	Understand the transmission force for pretensioning and posttensioning.
		CLO 8	Understand Anchorage zone stresses for post tension members.
CO 3	Understand the determinacy of plane , space truss, analysis and design for plane , space truss, analysis and design of continuous beams and frames and cable profile linear transformation.	CLO 9	Understand the determinacy of plane and space trusses.
		CLO 10	Understand the structural analysis for plane trussand space truss..
		CLO 11	Understand the analysis and design of continuous beams and frames.
		CLO 12	Understand the cable profile and linear transformation.
CO 4	Understand composite construction with precast PSC beams , cast insitu R.C slab, analysis, design of composite beams, calculation of creep, shrinkage and crack width.	CLO 13	Understand the method of composite construction with precast PSC beams and cast insitu RC slab.
		CLO 14	Analysis and design of composite beams.
		CLO 15	Calculate the effects creep and shrinkage and parital prestressing.
		CLO 16	Able to calculate crack width.
CO 5	Analysis and design of prestressed concrete pipes, columns with moments.	CLO 17	Analysis of prestressed concrete pipes with moments.
		CLO 18	Analysis of prestressed columns with moments.
		CLO 19	Design of prestressed concrete pipes with moments.
		CLO 20	Design of prestressed columns with moments.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
BSTB22.01	CLO 1	Understand the concept of pre-stressing and the behaviour of concrete structures.	PO 3	3
BSTB22.02	CLO 2	Recognize the general principles, methods of pre-stressing, and pre-stressing devices for pre-tensioning and post-tensioning	PO 3	3
BSTB22.03	CLO 3	Determine losses of pre-stress in pre-stressed concrete structures.	PO 3	3
BSTB22.04	CLO 4	Apply the provisions of IS-1343(1980) code to the design of pre-stressed concrete structures for flexure and shear.	PO 3	3
BSTB22.05	CLO 5	Understand the ultimate & serviceability limit statesfor flexure.	PO 3	3
BSTB22.06	CLO 6	Design the shear reinforcements for pre-stressed concrete beams.	PO 6, PO 7	3
BSTB22.07	CLO 7	Understand the transmission force for pretensioningand posttensioning.	PO 3	3
BSTB22.08	CLO 8	Understand Anchorage zone stresses for post tension members.	PO 3	3
BSTB22.09	CLO 9	Understand the determinacy of plane and space trusses.	PO 3	3
BSTB22.10	CLO 10	Understand the structural analysis for plane trussand space truss.	PO 3	3
BSTB22.11	CLO 11	Understand the analysis and design of continuous beams and frames.	PO 3, PO 4, PO 6, PO 7	3
BSTB22.12	CLO 12	Understand the cable profile and linear transformation.	PO 3, PO 4, PO 6, PO 7	3
BSTB22.13	CLO 13	Understand the method of composite construction with precast PSC beams and cast insitu RC slab.	PO 3, PO 6	3
BSTB22.14	CLO 14	Analysis and design of composite beams.	PO 3, PO 4 PO 6, PO 7	3
BSTB22.15	CLO 15	Calculate the effects creep and shrinkage and parital prestressing.	PO 3	3
BSTB22.16	CLO 16	Able to calculate crack width.	PO 3	3
BSTB22.17	CLO 17	Analysis of prestressed concrete pipes with moments.	PO 3, PO 4 PO 6, PO 7	3
BSTB22.18	CLO 18	Analysis of prestressed columns with moments.	PO 3, PO 4 PO 6, PO 7	3
BSTB22.19	CLO 19	Design of prestressed concrete pipes with moments.	PO 3, PO 4 PO 6,PO 7	3
BSTB22.20	CLO 20	Design of prestressed columns with moments.	PO 3, PO 4 PO 6,PO 7	3

3= High; 2 = Medium; 1 = Low

X. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			
	PO 3	PO 4	PO 6	PO 7
CO 1	3			3
CO 2	3		3	3
CO 3	3	2	3	3
CO 4	3	2	3	3
CO 5	3	2	3	3

3 = High; 2 = Medium; 1 = Low

XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

(CLOs)	Program Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1			3				
CLO 2			3				
CLO 3			3				
CLO 4			3				
CLO 5			3				
CLO 6						3	3
CLO 7			3				
CLO 8			3				
CLO 9			3				
CLO 10			3				
CLO 11			3	2		3	3
CLO 12			3	2		3	3
CLO 13			3			3	
CLO 14			3	2		3	3
CLO 15			3				
CLO 16			3				

(CLOs)	Program Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 17			3	2		3	3
CLO 18			3	2		3	3
CLO 19			3	2		3	3
CLO 20			3	2		3	3

3 = High; 2 = Medium; 1 = Low

XII. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO3, PO4, PO6,PO7	SEE Exams	PO3, PO4, PO6, PO7	Assignments	PO3, PO4, PO6, PO7	Seminars	-
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XIII. ASSESSMENT METHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIV. SYLLABUS

UNIT-I	**INTRODUCTION TO PRESTRESSED CONCRETE**
Types of prestressing,systems and devices, materials, losses in prestress, Analysis of PSC flexural members ,basic concepts,stresses at transfer and service loads, ultimate strength in flexure , code provisions.	
UNIT-II	**STATICALLY DETERMINATE PSC BEAMS**
Design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion,code provisions. Transmission of prestressing, pretensioned members:Anchorage zone stresses for post tensioned members.	
UNIT-III	**STATICALLY INDETERMINATE STRUCTURES**
Plane truss-Determinacy and Analysis method,Structural Analysis-Plane truss and space truss. Analysis and design –continuous beams and frames,choice of cable profile, lineartransformation and concordancy.	
UNIT-IV	**COMPOSITE CONSTRUCTION**
Composite construction with precast PSC beams and cast in-situ RC slab-Analysis and design. Creep and shrinkage effects, Partial prestressing-principles, analysis anddesign concepts,crack width calculations.	
UNIT-V	**ANALYSIS AND DESIGN**
Analysis and design of prestressed concrete pipes,columns with moments.	

Text Books:
1. Lin T.Y."Design of Prestressed Concrete Structures".Asia Publishing House, 1955. 2. Krishnaraju N. "Prestressed Concrete". Tata McGraw Hill , New Delhi,1981.
Reference Books:
1. Guyan Y." 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.
Web References:
1. http://nptel.ac.in/courses/105106117/
E-Text Books:
1. http://textofvideo.nptel.ac.in/105106118/lec17.pdf

XV. COURSE PLAN:

Lecture No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1-2	Types of prestressing ,systems and devices	CLO 1	T2:5-10
3-4	Materials, losses in prestress	CLO 2	T2:11-20
5-6	Analysis of PSC flexural members .	CLO 3	T2:21-28
7-9	Basic concepts,stresses at transfer and service loads, ultimate strength in flexure code provisions	CLO 4	T2:29-45
10-12	Design for ultimate and serviceability limit states for flexure.	CLO 4	T2:50-65
13-16	Analysis and design for shear and torsion,code provisions.	CLO 5	T2:66-75
16-17	Transmission of prestressing, pretensioned members	CLO 6	T2:75-85
18-19	Anchorage zone stresses for post tensioned members.	CLO 7	T2:90-110
20-21	Plane truss-Determinacy and Analysis method,Structural Analysis-Plane truss and space truss.	CLO 9	T2:115-130
22-24	Analysis and design –continuous beams and frames	CLO 10	T2:131-145
25-27	Choice of cable profile, linear transformation and concordancy.	CLO 11	T2:146-160
28-30	Composite construction with precast PSC beams and cast in-situ RC slab.	CLO 12	T2:161-180
31-33	Analysis and design, Creep and shrinkage effects.	CLO 13	T2:181-200
34-36	Partial prestressing-principles, analysis and design concepts, crack width calculations.	CLO 14	T2:201-215
37-41	Analysis and design of prestressed concrete pipes.	CLO 18	T2:217-240
42-46	Analysis and design of prestressed concrete columns with moments.	CLO 20	T2:240--270

XVI. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S no	Description	Proposed Actions	Relevancewith POs
1	Analysis and design of continuous beams and frames	Seminars / NPTEL	PO 3, PO 4 PO 6, PO 7
2	Analysis and design of prestressed concrete pipes,columns with moments.	Seminars / NPTEL	PO 3, PO 4 PO 6, PO 7

Prepared by:
Mr. CH Venugopal Reddy, Assistant Professor

HOD, CE