Ref No:

# Sri Krishna Institute of Technology, Bangalore

## COURSE PLAN

## Academic Year 2019-2020

| | |
|---|---|
| Program: | B E – Civil Engineering |
| Semester : | 8 |
| Course Code: | 15CV82 |
| Course Title: | Design of Pre-stressed Concrete Elements |
| Credit / L-T-P: | 4 / 4-0-0 |
| Total Contact Hours: | 50 |
| Course Plan Author: | MOHAN K T |

Academic Evaluation and Monitoring Cell

Sri Krishna Institute of Technology
#29,Chimney hills,Hesaraghata Main road, Chikkabanavara Post
Bangalore – 560090, Karnataka, INDIA
Phone / Fax :08023721477/28392221/23721315
Web: www.skit.org.in , e-mail: skitprinci@gmail.com

# Table of Contents

# A. COURSE INFORMATION

## 1. Course Overview

| | | | |
|---|---|---|---|
| Degree: | BE | Program: | CV |
| Semester: | 8 | Academic Year: | 2019-20 |
| Course Title: | Design of prestressed concrete elements | Course Code: | 15CV82 |
| Credit / L-T-P: | 4 / 4-0-0 | SEE Duration: | 180 Minutes |
| Total Contact Hours: | 50 Hours | SEE Marks: | 80 Marks |
| CIA Marks: | 20 Marks | Assignment | 1 / Module |
| Course Plan Author: | MOHAN K T | Sign .. | Dt: |
| Checked By: | | Sign .. | Dt: |
| CO Targets | CIA Target : 90 % | SEE Target: | 85% |

**Note:** Define CIA and SEE % targets based on previous performance.

## 2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

| Module | Content | Teaching Hours | Blooms Learning Levels |
|---|---|---|---|
| 1 | **Introduction and Analysis of Members:** Concept of Prestressing - Types of Prestressing - Advantages - Limitations –Prestressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete and prestressed concrete - Force concept - Load balancing concept - Kern point -Pressure line. | 10 | L4, |
| 2 | **Losses in Prestress:** Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel. Deflection and Crack Width Calculations of Deflection due to gravity loads Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width. | 10 | L4 |
| 3 | **Design of Sections for Flexure:** Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1members | 10 | L4 |
| 4 | **Design for Shear:** Analysis for shear - Components of shear resistance – Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement | 10 | L4 |
| 5 | **Anchorage zone stresses and design of anchorages. Composite Sections:** Types of composite construction - Analysis of composite sections - Deflection –Flexural and shear strength of composite sections | 10 | L4 |
| - | **Total** | | |

## 3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

| Modules | Details | Chapters in book | Availability |
|---|---|---|---|
| **A** | **Text books (Title, Authors, Edition, Publisher, Year.)** | **-** | **-** |
| 1 | Krishna Raju, N. "Prestressed Concrete", Tata McGraw Hill Publishing | 1,3, 4 | In Lib / In Dept |

| | | | |
|---|---|---|---|
| | Company, New Delhi 2006 | | |
| 2 | Krishna Raju. N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt.Ltd., New Delhi | 2, 4 | In Lib/ In dept |
| **B** | **Reference books** | **-** | **-** |
| 1 | Praveen Nagarajan, "Advanced Concrete Design", Person | | In Lib |
| 2 | P. Dayaratnam, "Prestressed Concrete Structures", Oxford & IBH-Pubs Company, Delhi, 5th Edition | | Not Available |
| 3 | Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York | | In lib |
| **C** | Others (Web, Video, Simulation, Notes etc.) | **-** | **-** |
| | | | |
| C1 | https://www.youtube.com/watch?v=4KYPltsNAWs | | |
| C2 | https://www.youtube.com/playlist?list=PLB50EF6A79D1F8C14 | | |
| C3 | http://www.digimat.in/nptel/courses/video/105106118/L31.html | | |
| C4 | http://www.digimat.in/nptel/courses/video/105106118/L25.html | | |
| C5 | http://www.digimat.in/nptel/courses/video/105106118/L04.html | | |
| C6 | http://www.digimat.in/nptel/courses/video/105106118/L08.html | | |
| C7 | http://www.digimat.in/nptel/courses/video/105106118/L09.html | | |
| C8 | http://www.digimat.in/nptel/courses/video/105106118/L09.html | | |
| C9 | http://www.digimat.in/nptel/courses/video/105106118/L40.html | | |
| C10 | http://www.digimat.in/nptel/courses/video/105106118/L36.html | | |
| C11 | https://www.youtube.com/watch?v=PZi50Miapc8 | | |
| C12 | https://www.youtube.com/watch?v=PZi50Miapc8 | | |
| C13 | https://www.youtube.com/watch?v=ztiFxoi-O-Y | | |
| C14 | http://www.digimat.in/nptel/courses/video/105106118/L02.html | | |
| C15 | http://www.digimat.in/nptel/courses/video/105106118/L19.html | | |
| C16 | http://www.digimat.in/nptel/courses/video/105106118/L24.html | | |
| C17 | http://www.digimat.in/nptel/courses/video/105106118/L17.html | | |
| C18 | http://www.digimat.in/nptel/courses/video/105106118/L07.html | | |
| C19 | http://www.digimat.in/nptel/courses/video/105106118/L12.html | | |
| C20 | http://www.digimat.in/nptel/courses/video/105106118/L39.html | | |
| C21 | http://www.digimat.in/nptel/courses/video/105106118/L23.html | | |
| C22 | http://www.digimat.in/nptel/courses/video/105106118/L16.html | | |
| C23 | http://www.digimat.in/nptel/courses/video/105106118/L16.html | | |
| C24 | http://www.digimat.in/nptel/courses/video/105106118/L30.html | | |
| C25 | http://www.digimat.in/nptel/courses/video/105106118/L37.html | | |
| C26 | http://www.digimat.in/nptel/courses/video/105106118/L34.html | | |
| C27 | http://www.digimat.in/nptel/courses/video/105106118/L26.html | | |
| C28 | http://www.digimat.in/nptel/courses/video/105106118/L28.html | | |
| C29 | https://cosmolearning.org/video-lectures/design-of-members-for-flexure-type-1-members/ | | |
| C30 | https://www.youtube.com/watch?v=vg-0a5wouls | | |
| C31 | https://www.youtube.com/watch?v=zYEjDnVnnHs | | |
| C32 | https://www.youtube.com/watch?v=nKUiEjUhXw4 | | |
| C33 | https://www.youtube.com/watch?v=BIJTWBlguHs | | |
| | | | |
| | | | |
| **D** | **Recent Developments for Research** | **-** | **-** |
| | https://www.iith.ac.in/~prestressed/ | | |
| | https://doi.org/10.1680/iicep.1957.1949 | | |
| | https://doi.org/10.1680/iicep.1966.9077 | | |
| | https://doi.org/10.1680/ijoti.1944.14069 | | |
| | | | |
| **F** | **Others (Web, Video, Simulation, Notes etc.)** | **-** | **-** |
| | | | |
| | | | |

## 4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

| Modules | Course Code | Course Name | Topic / Description | Sem | Remarks | Blooms Level |
|---|---|---|---|---|---|---|
| 1 | 15CV61 | Design of RC structural elements | Knowledge on beam design | 6 | Gap<br>A seminar on beam design | Analyze L4 |
| | | | | | | |

## 5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

| Modules | Topic / Description | Area | Remarks | Blooms Level |
|---|---|---|---|---|
| 1 | Concept of Prestressing | Higher Education | | Understand L2 |
| 2 | Stress-Strain curve for High strength concrete. | GATE | | Understand L2 |
| | | | | |
| | | | | |

# B. OBE PARAMETERS

## 1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

| Modules | Course Code.# | Course Outcome **At the end of the course, student should be able to . . .** | Teach. Hours | Instr Method | Assessment Method | Blooms' Level |
|---|---|---|---|---|---|---|
| 1 | 15CV82.1 | Understand the requirement of PSC members for present scenario. | 10 | Lecture | Assignment | L4 |
| 2 | 15CV82.2 | Analyse the losses in PSC element during transfer at working. | 10 | Lecture/ Tutorial | Assignment | L4 |
| 3 | 15CV82.3 | Analyzing the PSC element for flexure and finding its efficiency. | 10 | Lecture | Assignment | L4 |
| 4 | 15CV82.4 | Analyzing the PSC element for shear and finding its efficiency. | 10 | Lecture | Assignment | L4 |
| 5 | 15CV82.5 | Analyzing the PSC element for anchorage zone and adopting suitable design. | 10 | Lecture | Assignment | L4 |
| **-** | **-** | **Total** | **50** | **-** | **-** | **L2-L4** |

## 2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

| Modules | Application Area<br>Compiled from Module Applications. | CO | Level |
|---|---|---|---|
| 1 | Used to select the High strength concrete and steel, He can beable to know the | CO1 | L4 |

| | | | |
|---|---|---|---|
| | advantages and construction process of PSC compared to RCC. | | |
| 2 | Designing of PSC members he will be able to find the losses in both pre tensioning and post tensioning process. | CO2 | L4 |
| 3 | Designing of PSC members he will be able to solve for flexure in both pre tensioning and post tensioning process. | CO3 | L4 |
| 4 | Designing of PSC members he will be able to solve for shear in both pre tensioning and post tensioning process. | CO4 | L4 |
| 5 | Designing of PSC members he will be able to solve for stress in anchorage in both pre tensioning and post tensioning process. | CO5 | L4 |

## 3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

| - | - | Course Outcomes | Program Outcomes | | | | | | | | | | | | | | - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Modules | CO.# | **At the end of the course student should be able to . . .** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | Level |
| 1 | CO1 | Understand the requirement of PSC members for present scenario. | 3 | - | - | - | - | 2 | 1 | 1 | 3 | 3 | - | 2 | | | | L4 |
| 2 | CO2 | Analyse the losses in PSC element during transfer at working. | 3 | 3 | - | - | - | 2 | 1 | 1 | 3 | 1 | - | 2 | | | | L4 |
| 3 | CO3 | Analyzing the PSC element for flexure and finding its efficiency. | 3 | - | - | - | - | 2 | 1 | 1 | 3 | 3 | - | 2 | | | | L4 |
| 4 | CO4 | Analyzing the PSC element for shear and finding its efficiency. | 3 | 3 | - | - | - | 2 | 1 | 1 | 3 | 1 | - | 2 | | | | L4 |
| 5 | CO5 | Analyzing the PSC element for anchorage zone and adopting suitable design. | 3 | 3 | - | - | - | 2 | 1 | 1 | 3 | 3 | - | 2 | | | | L4 |
| **-** | **15CV82.** | Average | **3** | **3** | **-** | **-** | **-** | **2** | **1** | **1** | **3** | **2.2** | **-** | **2** | | | | **-** |
| - | *PO, PSO* | *1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design* | | | | | | | | | | | | | | | |

## 4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

| Modules | Gap Topic | Actions Planned | Schedule Planned | Resources Person | PO Mapping |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |

# C. COURSE ASSESSMENT

## 1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

| Modules | Title | Teach. Hours | No. of question in Exam | | | | | | CO | Levels |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CIA-1 | CIA-2 | CIA-3 | Asg | Extra Asg | SEE | | |
| 1 | Introduction and Analysis of Members: | 10 | 2 | - | - | 1 | 1 | 2 | CO1 | L2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Losses in Prestress and deflection | 10 | 2 | - | - | 1 | 1 | 2 | CO2 | L4 |
| 3 | Design of Sections for Flexure | 10 | - | 2 | - | 1 | 1 | 2 | CO3 | L4 |
| 4 | Design for Shear | 10 | - | 2 | - | 1 | 1 | 2 | CO4 | L4 |
| 5 | Anchorage zone stresses and design of anchorages | 10 | - | - | 4 | 1 | 1 | 2 | CO5 | L4 |
| **-** | **Total** | **50** | **4** | **4** | **4** | **5** | **5** | **10** | **-** | **-** |

## 2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

| Modules | Evaluation | Weightage in Marks | CO | Levels |
|---|---|---|---|---|
| 1, 2 | CIA Exam – 1 | 15 | CO1, CO2, | L4 |
| 3, 4 | CIA Exam – 2 | 15 | CO3, CO4 | L4 |
| 5 | CIA Exam – 3 | 15 | CO5. | L4 |
| | | | | |
| 1, 2 | Assignment - 1 | 05 | CO1, CO2, | L4 |
| 3, 4 | Assignment - 2 | 05 | CO3, CO4 | L4 |
| 5 | Assignment - 3 | 05 | CO5. | L4 |
| | | | | |
| 1, 2 | Seminar - 1 | | - | - |
| 3, 4 | Seminar - 2 | | - | - |
| 5 | Seminar - 3 | | - | - |
| | | | | |
| 1, 2 | Quiz - 1 | | - | - |
| 3, 4 | Quiz - 2 | | - | - |
| 5 | Quiz - 3 | | - | - |
| | | | | |
| 1 - 5 | Other Activities – Mini Project | - | | |
| | **Final CIA Marks** | **20** | **-C01-C05** | **L4** |

# D1. TEACHING PLAN - 1

## Module - 1

| Title: | Introduction and Analysis of Members: | Appr Time: | 10 Hrs |
|---|---|---|---|
| **a** | ***Course Outcomes*** | **CO** | **Blooms** |
| | The student should be able to: | | |
| 1 | Understand the requirement of PSC members for present scenario. | CO1 | L2 |
| | | | |
| **b** | ***Course Schedule*** | - | - |
| **Class No** | **Portion covered per hour** | **-** | **-** |
| 1 | **Introduction and Analysis of Members:** Concept of Prestressing | CO1 | L2 |
| 2 | Types of Prestressing - Advantages - Limitations . | CO1 | L2 |
| 3 | Prestressing systems - Anchoring devices | CO1 | L2 |
| 4 | Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete. | CO1 | L2 |
| 5 | Analysis of members at transfer . | CO1 | L2 |
| 6 | Stress concept - Comparison of behavior of reinforced concrete and prestressed concrete | CO1 | L2 |
| 7 | Force concept - Load balancing concept | CO1 | L2 |
| 8 | Kern point -Pressure line. | CO1 | L2 |
| 9 | Problems. | CO1 | L4 |
| 10 | Problems. | CO1 | L4 |
| | | | |
| **c** | **Application Areas** | | |

| | | | |
|---|---|---|---|
| - | Students should be able employ / apply the Module learnings to . . . | | |
| 1 | Used to select the High strength concrete and steel, He can beable to know the advantages and construction process of PSC compared to RCC. | co1 | L2 |
| 2 | | | |
| | | | |
| **d** | **Review Questions** | | |
| - | | | |
| 1 | Distinguish between pretensioning and post tensionong and state advantages of these methods. | co1 | L2 |
| 2 | Explain the necessity of using high strength concrete and high tensile steel in PSC.? | co1 | L2 |
| 3 | Define pressure line or thrust line. Explain the significance. | co1 | L2 |
| 4 | Define pre stressed concrete? State its advantages over reinforced concrete? | co1 | L2 |
| 5 | Explain with neat sketches, Freyssinet system of pre-stressing? | co1 | L2 |
| 6 | Explain with neat sketch "Hoyer's Long line "System of pre-tensioning? | co1 | L2 |
| 7 | Define 1} Uni axial and Biaxial Pre-stressing. 2} Concentric and eccentric Pre-stressing? | co1 | L2 |
| 8 | Explain the concept of load balancing? | co1 | L2 |
| 9 | Aprestressed conctrete beam 500mm wide and 650mm deep is provided with a tendon having parabolic cable profile with zero eccentricity at ends and 100mm at centre of span 6m. If the load including self weight is 35kN/m on the whole span, Calculate the extreme stresses for the midspan section. This tendons carry a prestressing force of 1000kN.? | co1 | L4 |
| 10 | A pre-stressed concrete T beam Having a cross- section of flange 1200mm wide and 200mm thick, the rib is 240mm wide and 1000mm deep. The beam carries a load of 12kN/m due to its own weight at the initial stage over a span of 16m. Determine the prestressing force and its eccentricity to produce net stress equal to zero and 12MPa ai the top and bottom fibers. | co1 | L4 |
| | | | |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | CO1 | L2 |
| 2 | | | |

## Module – 2

| Title: | Losses in Prestress and deflection | Appr Time: | 10 Hrs |
|---|---|---|---|
| **a** | ***Course Outcomes*** | **CO** | **Blooms** |
| - | The student should be able to: | - | **Level** |
| | Analyse the losses in PSC element during transfer at working. | CO2 | L4 |
| | | | |
| | | | |
| **b** | ***Course Schedule*** | - | - |
| **Class No** | **Portion covered per hour** | **-** | **-** |
| 11 | **Losses in Prestress:** Loss of Prestress due to Elastic shortening, Friction, | CO2 | L2 |
| 12 | Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel. | CO2 | L2 |
| 13 | Numerical Problems. | CO2 | L4 |
| 14 | Numerical Problems. | CO2 | L4 |
| 15 | Numerical Problems. | CO2 | L4 |
| 16 | Deflection and Crack Width Calculations of Deflection due to gravity loads Deflection due to prestressing force -Total deflection . | CO2 | L2 |
| 17 | Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width. | CO2 | L2 |
| 18 | Numerical Problems. | CO2 | L4 |
| 19 | Numerical Problems. | CO2 | L4 |

| | | | |
|---|---|---|---|
| 20 | Numerical Problems. | CO2 | L4 |
| | | | |
| **c** | **Application Areas** | **-** | **-** |
| - | Students should be able employ / apply the Module learnings to . . . | - | - |
| 1 | Designing of PSC members he will be able to find the losses in both pre tensioning and post tensioning process. | CO2 | L4 |
| 2 | | | |
| | | | |
| **d** | **Review Questions** | - | - |
| - | | | |
| 1 | Explain the different types of losses in pre stressed concrete? | | |
| 2 | A post tensioned concrete beam, simply supported over a span of 12m is of cross section 230x750mm and is prestressed with 10 numbers of 7mm diameter parabolic cable bars with zero eccentricity at the support and 200mm at midspan. Calculate the loss due to different causes for the following data.<br>Grade of concrete = M40.<br>Initial Prestress = 1000N/mm$^2$.<br>Co-efficient of curvature effect = 0.50.<br>Wobble coefficient k = 0.003/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 3%, $E_s$=210 kN/mm$^2$, $E_c$=37.50 kN/mm$^2$.<br>Calculate the total percentage of loss and the jacking force required. | | |
| 3 | A prestressed concrete beam 200mm wide and 300mm deep is prestressed with wires of c/s area $A_s$ 320mm$^2$ located at a constant eccentricity of 50mm and carring an initialstress of 1000 N/mm$^2$ . The span of the beam of the beam is 10m. Calculate the % loss of stress in wires if the beam is post-tensioned using following data:.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$.Wobble coefficient k = 0.0015/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 5%,<br>Calculate the total percentage of loss and the jacking force required. | | |
| 4 | A simply supported post-tensioned concrete beam of span 15 m has a rectangular cross section 300 x 800 mm. The prestress at ends is 1300kN with zero eccentricity at the supports and 250mm at the centre the cable profile being parabolic. Assuming k=0.15 per 100 m and mue= 0.35. Determine the loss of stress due to friction at the centre of the beam? | | |
| 5 | A pretensioned beam 250mm wide and 300mm deep in prestressed by 12 wires each of 7mm diameter initially stressed to 1200 N/mm2 with their centroids located at 100mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using IS 1343.<br>Relaxation of steel stress= 90N/mm2.<br>Creep coefficient = 1.6<br>Residual shrinkage strain =3 x $10^{-4}$.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$. | | |
| 6 | What is deflection and what are the factors influencing deflections? | | |
| 7 | What is pre and post crack condition? | | |
| 8 | Deflection of beam with straight tendons? | | |
| 9 | Deflection of beam with Parabolic tendons? | | |
| 10 | Deflection of beam with sloping tendons? | | |
| 11 | Deflection of beam with Trapezoidal tendons? | | |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | CO3 | L2 |
| 2 | | | |

# E1. CIA EXAM – 1

## a. Model Question Paper - 1

| Crs Code | 15CV82 | Sem: | VIII | Marks: | 30 | Time: | 70 Mins | | |
|---|---|---|---|---|---|---|---|---|---|
| Course: | Design of Pre Stressed Concrete Elements. | | | | | | | | |
| **-** | **-** | **Note: Answer all questions, each carry equal marks. Module : 1, 2** | | | | | **Marks** | **CO** | **Level** |
| 1 | a | Distinguish between pretensioning and post tensionong and state advantages of these methods. | | | | | 5 | CO1 | L2 |
| | b | Explain with neat sketch "Hoyer's Long line "System of pre-tensioning? | | | | | 5 | CO1 | L2 |
| | c | Define 1} Uni axial and Biaxial Pre-stressing. 2} Concentric and eccentric Pre-stressing? | | | | | 5 | CO1 | L2 |
| | | **OR** | | | | | | | |
| 2 | a | Explain the concept of load balancing? | | | | | 5 | CO1 | L2 |
| | b | Aprestressed conctrete beam 500mm wide and 650mm deep is provided with a tendon having parabolic cable profile with zero eccentricity at ends and 100mm at centre of span 6m. If the load including self weight is 35kN/m on the whole span, Calculate the extreme stresses for the midspan section. This tendons carry a prestressing force of 1000kN.? | | | | | 10 | CO1 | L4 |
| | | | | | | | | | |
| 3 | a | A prestressed concrete beam 200mm wide and 300mm deep is prestressed with wires of c/s area $A_s$ 320mm$^2$ located at a constant eccentricity of 50mm and carring an initialstress of 1000 N/mm$^2$ . The span of the beam of the beam is 10m. Calculate the % loss of stress in wires if the beam is post-tensioned using following data:.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$.Wobble coefficient k = 0.0015/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 5%,<br>Calculate the total percentage of loss and the jacking force required. | | | | | 15 | CO2 | L4 |
| | | **OR** | | | | | | | |
| 4 | a | A simply supported post-tensioned concrete beam of span 15 m has a rectangular cross section 300 x 800 mm. The prestress at ends is 1300kN with zero eccentricity at the supports and 250mm at the centre the cable profile being parabolic. Assuming k=0.15 per 100 m and mue= 0.35. Determine the loss of stress due to friction at the centre of the beam? | | | | | 15 | CO2 | L4 |

## b. Assignment -1

| Model Assignment Questions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Crs Code | 15CV82 | Sem: | VIII | Marks: | 30 | Time: | 70 Mins | | |
| Course: | Design of Pre Stressed Concrete Elements. | | | | | | | | |
| | | | | | | | | | |
| **SNo** | **Assignment Description** | | | | | | **Marks** | **CO** | **Level** |
| 1 | Distinguish between pretensioning and post tensionong and state advantages of these methods. | | | | | | 5 | CO1 | L2 |
| 2 | Explain the necessity of using high strength concrete and high tensile steel in PSC.? | | | | | | 5 | CO1 | L2 |
| 3 | Define pressure line or thrust line. Explain the significance. | | | | | | 5 | CO1 | L2 |
| 4 | Define pre stressed concrete? State its advantages over reinforced concrete? | | | | | | 5 | CO1 | L2 |
| 5 | Explain with neat sketches, Freyssinet system of pre-stressing? | | | | | | 5 | CO1 | L2 |
| 6 | Explain with neat sketch "Hoyer's Long line "System of pre-tensioning? | | | | | | 5 | CO1 | L2 |
| 7 | Define 1} Uni axial and Biaxial Pre-stressing. 2} Concentric and eccentric Pre-stressing? | | | | | | 5 | CO1 | L2 |
| 8 | Explain the different types of losses in pre stressed concrete? | | | | | | 5 | CO2 | L2 |
| 9 | A post tensioned concrete beam, simply supported over a span of 12m is | | | | | | 16 | CO2 | L4 |

| | | | | |
|---|---|---|---|---|
| | of cross section 230x750mm and is prestressed with 10 numbers of 7mm diameter parabolic cable bars with zero eccentricity at the support and 200mm at midspan. Calculate the loss due to different causes for the following data.<br>Grade of concrete = M40.<br>Initial Prestress = 1000N/mm$^2$.<br>Co-efficient of curvature effect = 0.50.<br>Wobble coefficient k = 0.003/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 3%, $E_s$=210 kN/mm$^2$, $E_c$=37.50 kN/mm$^2$.<br>Calculate the total percentage of loss and the jacking force required. | | | |
| 10 | A prestressed concrete beam 200mm wide and 300mm deep is prestressed with wires of c/s area $A_s$ 320mm$^2$ located at a constant eccentricity of 50mm and carring an initialstress of 1000 N/mm$^2$ . The span of the beam of the beam is 10m. Calculate the % loss of stress in wires if the beam is post-tensioned using following data:.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$.Wobble coefficient k = 0.0015/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 5%,<br>Calculate the total percentage of loss and the jacking force required. | 16 | CO2 | L4 |
| 11 | A simply supported post-tensioned concrete beam of span 15 m has a rectangular cross section 300 x 800 mm. The prestress at ends is 1300kN with zero eccentricity at the supports and 250mm at the centre the cable profile being parabolic. Assuming k=0.15 per 100 m and mue= 0.35. Determine the loss of stress due to friction at the centre of the beam? | 16 | CO2 | L4 |
| 12 | A pretensioned beam 250mm wide and 300mm deep in prestressed by 12 wires each of 7mm diameter initially stressed to 1200 N/mm2 with their centroids located at 100mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using IS 1343.<br>Relaxation of steel stress= 90N/mm2.<br>Creep coefficient = 1.6<br>Residual shrinkage strain =3 x 10$^{-4}$.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$. | 16 | CO2 | L4 |
| 13 | What is deflection and what are the factors influencing deflections? | 8 | CO2 | L4 |
| 14 | What is pre and post crack condition? | 8 | CO2 | L4 |
| 15 | Deflection of beam with straight tendons? | 8 | CO2 | L4 |
| 16 | Deflection of beam with Parabolic tendons? | 8 | CO2 | L4 |
| 17 | Deflection of beam with sloping tendons? | 8 | CO2 | L4 |
| 18 | Deflection of beam with Trapezoidal tendons? | 8 | CO2 | L4 |
| | | | | |

# D2. TEACHING PLAN - 2

## Module – 3

| Title: | Design of Sections for Flexure | Appr Time: | 10 Hrs |
|---|---|---|---|
| **a** | ***Course Outcomes*** | **CO** | **Blooms** |
| - | At the end of the topic the student should be able to . . . | - | **Level** |
| 1 | Analyzing the PSC element for flexure and finding its efficiency. | CO3 | L4 |
| | | | |
| | | | |
| **b** | ***Course Schedule*** | | |
| **Class No** | **Portion covered per hour** | **-** | **-** |

| | | | |
|---|---|---|---|
| 21 | **Design of Sections for Flexure:** Analysis of members at ultimate strength - Preliminary Design | CO3 | L2 |
| 22 | Numerical Problems. | CO3 | L4 |
| 23 | Numerical Problems. | CO3 | L4 |
| 24 | Numerical Problems. | CO3 | L4 |
| 25 | Numerical Problems. | CO3 | L4 |
| 26 | Final Design for Type 1members | CO3 | L2 |
| 27 | Numerical Problems. | CO3 | L4 |
| 28 | Numerical Problems. | CO3 | L4 |
| 29 | Numerical Problems. | CO3 | L4 |
| 30 | Numerical Problems. | CO3 | L4 |
| | | | |
| **c** | **Application Areas** | **-** | **-** |
| - | Students should be able employ / apply the Module learnings to . . . | - | - |
| 1 | Designing of PSC members he will be able to solve for flexure in both pre tensioning and post tensioning process. | CO3 | L4 |
| | | | |
| | | | |
| **d** | **Review Questions** | - | - |
| - | The attainment of the module learning assessed through following questions | - | - |
| 1 | A post tensioned unbounded beam section 120mm x 300mm is pre-stressed by 7 wires of 5mm diameter with an effective cover of 50mm and effective stress of 1200 N/mm2 . The beam is of 7.5m span. If M40 concrete is used and fp = 1600 MPa, find the ultimate flexural strength of the section. | CO3 | L4 |
| 2 | A post tensioned bounded Tee section has a flange width of 800mm and thickness of 250mm. The thickness of web is 200mm. The area of high tensile wire is 4000 mm2 located at 1200mm from top of flange. The characteristic strength of steel and concrete are 1500 N/mm2 and 40 N/mm2 respectively. Calculate the ultimate moment capacity of the section using IS 1343 recommendation. | CO3 | L4 |
| 3 | Design a pre-stressed concrete beam as Type-1 member to carry a superimposed load of 12 kN/m over a simply supported span of 25m. The permissible stress in compression for concrete at transfer and working loads are 14 N/mm2 and 12 N/mm2 respectively. Initial stress in pre-stressing cable is 1000 N/mm2 . Loss of pre-stress is 20%. Adopt Freyssenet cables each of 12 wires of 5mm diameter | CO3 | L4 |
| 4 | List the different types of flexural failures in a PSC beam. Explain failure of under reinforced sections. | CO3 | L2 |
| 5 | A post tensioned beam with unbounded tendons is of rectangular section 400mm wide with an effective depth of 800mm. The C/S area of the pre-stressing steel is 2840 mm2 . The effective pre-stress in the steel after all losses is 900 N/mm2 . The effective span of the beam is 16m. If fck = 40 N/mm2 , Estimate the ultimate moment of resistance of the section using IS code provisions. | CO3 | L4 |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | CO6 | L2 |
| 2 | | | |

## Module – 4

| Title: | Design for Shear | Appr Time: | 10 Hrs |
|---|---|---|---|
| **a** | ***Course Outcomes*** | **CO** | **Blooms** |
| - | At the end of the topic the student should be able to . . . | - | **Level** |
| 1 | Analyzing the PSC element for shear and finding its efficiency. | CO4 | L4 |
| | | | |
| | | | |

| | | | |
|---|---|---|---|
| **b** | ***Course Schedule*** | | |
| **Class No** | **Portion covered per hour** | **-** | **-** |
| 31 | **Design for Shear:** Analysis for shear - Components of shear resistance . | CO4 | L2 |
| 32 | Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement. | CO4 | L2 |
| 33 | Numerical Problems. | CO4 | L4 |
| 34 | Numerical Problems. | CO4 | L4 |
| 35 | Numerical Problems. | CO4 | L4 |
| 36 | Numerical Problems. | CO4 | L4 |
| 37 | Numerical Problems. | CO4 | L4 |
| 38 | Numerical Problems. | CO4 | L4 |
| 39 | Numerical Problems. | CO4 | L4 |
| 40 | Numerical Problems. | CO4 | L4 |
| | | | |
| **c** | **Application Areas** | **-** | **-** |
| - | Students should be able employ / apply the Module learnings to . . . | - | - |
| 1 | Designing of PSC members he will be able to solve for shear in both pre tensioning and post tensioning process. | CO4 | L4 |
| | | | |
| **d** | **Review Questions** | - | - |
| - | The attainment of the module learning assessed through following questions | - | - |
| | | | |
| 1 | Explain types of shear cracks ? | CO4 | L2 |
| 2 | A' PSC beam 250mm wide 150mm deep is subjected to SF 900 kN fiber stress under working load is 4 N/mm2 effective pre-stress is 1000 N/mm 2 and area of cable is 1500 min - . Design shear reinforcement slope of cable at support is (1/6) | CO4 | L4 |
| 3 | A pre-stressed concrete beam of span 10m, cross section 120mm x 300mm is prestressed by a cable carrying a force of 180 kN the beam support a UDL 5 kN/m including self weight compare the magnitude of principal tension with and without axial pre-stress. Estimate the reduction in principal stress. Also find % reduction if a parabolic cable used with e = 50 mm at mid span and zero at support | CO4 | L4 |
| 4 | Explain different methods of improving shear resistance of PSC members. | CO4 | L2 |
| 5 | Explain the mechanism of shear failure in PSC beam | CO4 | L2 |
| 6 | A support reaction of PSC beam 120 x 250mm is required to carry an uitimate shear force of 70kN. The compressive stress at the centroidal axis is 5MPa and fck= 40 Mpa. Fy= 415MPa cover to reinforcement =50mm. Design the suitable shear reinforcement at the section as per IS-1343 recommondations? | CO4 | L4 |
| 7 | Differentiate between web shear, flexural and flexural shear cracks in PSC member with neat sketch? | CO4 | L2 |
| 8 | A PSC beam 300mm x 1000mm is subjected to a shear force of 500kN under working loads near support section. The effective pre stressing force in the tendon is 800kN. The cable is parabolic with zero eccentricity at support and 300mm below centroidal axis at mid span. The span of the beam is 12m. If M40 concrete is used estimate the principal tension in concrete at support section and if required design the shear reinforcement? | CO4 | L4 |
| | | | |
| | | | |
| | | | |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | | |
| 2 | | | |

# E2. CIA EXAM – 2

## a. Model Question Paper - 2

| Crs Code | 15CV82 | Sem: | VIII | Marks: | 30 | Time: | 70 Mins | | |
|---|---|---|---|---|---|---|---|---|---|
| Course: | Design of Pre Stressed Concrete Elements. | | | | | | | | |
| **-** | **-** | **Note: Answer all questions, each carry equal marks. Module : 3, 4** | | | | | **Marks** | **CO** | **Level** |
| | | | | | | | | | |
| 1 | a | A post tensioned unbounded beam section 120mm x 300mm is pre-stressed by 7 wires of 5mm diameter with an effective cover of 50mm and effective stress of 1200 N/mm2 . The beam is of 7.5m span. If M40 concrete is used and fp = 1600 MPa, find the ultimate flexural strength of the section. | | | | | 15 | CO3 | L4 |
| | | **or** | | | | | | | |
| 2 | a | A post tensioned beam with unbounded tendons is of rectangular section 400mm wide with an effective depth of 800mm. The C/S area of the pre-stressing steel is 2840 mm2 . The effective pre-stress in the steel after all losses is 900 N/mm2 . The effective span of the beam is 16m. If fck = 40 N/mm2 , Estimate the ultimate moment of resistance of the section using IS code provisions. | | | | | 15 | CO3 | L4 |
| | | | | | | | | | |
| 3 | a | Explain types of shear cracks ? | | | | | 3 | CO4 | L2 |
| | b | A' PSC beam 250mm wide 150mm deep is subjected to SF 900 kN fiber stress under working load is 4 N/mm2 effective pre-stress is 1000 N/mm 2 and area of cable is 1500 min - . Design shear reinforcement slope of cable at support is (1/6) | | | | | 6 | CO4 | L4 |
| | c | A pre-stressed concrete beam of span 10m, cross section 120mm x 300mm is prestressed by a cable carrying a force of 180 kN the beam support a UDL 5 kN/m including self weight compare the magnitude of principal tension with and without axial pre-stress. Estimate the reduction in principal stress. Also find % reduction if a parabolic cable used with e = 50 mm at mid span and zero at support | | | | | 6 | CO4 | L4 |
| | | **or** | | | | | | | |
| 4 | a | Differentiate between web shear, flexural and flexural shear cracks in PSC member with neat sketch? | | | | | 5 | CO4 | L2 |
| | b | A PSC beam 300mm x 1000mm is subjected to a shear force of 500kN under working loads near support section. The effective pre stressing force in the tendon is 800kN. The cable is parabolic with zero eccentricity at support and 300mm below centroidal axis at mid span. The span of the beam is 12m. If M40 concrete is used estimate the principal tension in concrete at support section and if required design the shear reinforcement? | | | | | 10 | CO4 | L4 |
| | | | | | | | | | |

## b. Assignment – 2

| Model Assignment Questions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Crs Code | 15CV82 | Sem: | VIII | Marks: | 30 | Time: | 70 Mins | | |
| Course: | Design of Pre Stressed Concrete Elements. | | | | | | | | |
| | | | | | | | | | |
| **SNo** | **Assignment Description** | | | | | | **Marks** | **CO** | **Level** |
| 1 | A post tensioned unbounded beam section 120mm x 300mm is pre-stressed by 7 wires of 5mm diameter with an effective cover of 50mm and effective stress of 1200 N/mm2 . The beam is of 7.5m span. If M40 concrete is used and fp = 1600 MPa, find the ultimate flexural strength of the section. | | | | | | 15 | CO3 | L4 |
| 2 | A post tensioned beam with unbounded tendons is of rectangular section 400mm wide with an effective depth of 800mm. The C/S area of the pre- | | | | | | 15 | CO3 | L4 |

| | | | | |
|---|---|---|---|---|
| | stressing steel is 2840 mm2 . The effective pre-stress in the steel after all losses is 900 N/mm2 . The effective span of the beam is 16m. If fck = 40 N/mm2 , Estimate the ultimate moment of resistance of the section using IS code provisions. | | | |
| 3 | Design a pre-stressed concrete beam as Type-1 member to carry a superimposed load of 12 kN/m over a simply supported span of 25m. The permissible stress in compression for concrete at transfer and working loads are 14 N/mm2 and 12 N/mm2 respectively. Initial stress in pre-stressing cable is 1000 N/mm2 . Loss of pre-stress is 20%. Adopt Freyssenet cables each of 12 wires of 5mm diameter | 15 | CO3 | L4 |
| 4 | Explain types of shear cracks ? | 3 | CO4 | L2 |
| 5 | A' PSC beam 250mm wide 150mm deep is subjected to SF 900 kN fiber stress under working load is 4 N/mm2 effective pre-stress is 1000 N/mm 2 and area of cable is 1500 min - . Design shear reinforcement slope of cable at support is (1/6) | 6 | CO4 | L4 |
| 6 | A pre-stressed concrete beam of span 10m, cross section 120mm x 300mm is prestressed by a cable carrying a force of 180 kN the beam support a UDL 5 kN/m including self weight compare the magnitude of principal tension with and without axial pre-stress. Estimate the reduction in principal stress. Also find % reduction if a parabolic cable used with e = 50 mm at mid span and zero at support | 6 | CO4 | L4 |
| 7 | Differentiate between web shear, flexural and flexural shear cracks in PSC member with neat sketch? | 5 | CO4 | L2 |
| 8 | A PSC beam 300mm x 1000mm is subjected to a shear force of 500kN under working loads near support section. The effective pre stressing force in the tendon is 800kN. The cable is parabolic with zero eccentricity at support and 300mm below centroidal axis at mid span. The span of the beam is 12m. If M40 concrete is used estimate the principal tension in concrete at support section and if required design the shear reinforcement? | 10 | CO4 | L4 |
| 9 | A support reaction of PSC beam 120 x 250mm is required to carry an uitimate shear force of 70kN. The compressive stress at the centroidal axis is 5MPa and fck= 40 Mpa. Fy= 415MPa cover to reinforcement =50mm. Design the suitable shear reinforcement at the section as per IS-1343 recommondations? | 10 | CO4 | L4 |
| 10 | Explain the mechanism of shear failure in PSC beam | 5 | CO4 | L2 |
| | | | | |

# D3. TEACHING PLAN - 3

## Module – 5

| Title: | Anchorage zone stresses and design of anchorages | Appr Time: | 10 Hrs |
|---|---|---|---|
| **a** | ***Course Outcomes*** | **CO** | **Blooms** |
| - | At the end of the topic the student should be able to . . . | - | **Level** |
| 1 | Analyzing the PSC element for anchorage zone and adopting suitable design. | CO5 | L4 |
| | | | |
| **b** | ***Course Schedule*** | - | - |
| **Class No** | **Portion covered per hour** | **-** | **-** |
| 41 | **Anchorage zone stresses and design of anchorages. Composite Sections:** Types of composite construction - Analysis of composite sections . | CO5 | L2 |
| 42 | Deflection –Flexural and shear strength of composite sections | CO5 | L2 |
| 43 | Numerical Problems. | CO5 | L4 |
| 44 | Numerical Problems. | CO5 | L4 |
| 45 | Numerical Problems. | CO5 | L4 |
| 46 | Numerical Problems. | CO5 | L4 |
| 47 | Numerical Problems. | CO5 | L4 |

| | | | |
|---|---|---|---|
| 48 | Numerical Problems. | CO5 | L4 |
| 49 | Numerical Problems. | CO5 | L4 |
| 50 | Numerical Problems. | CO5 | L4 |
| | | | |
| **c** | **Application Areas** | **-** | **-** |
| - | Students should be able employ / apply the Module learnings to . . . | - | - |
| 1 | Designing of PSC members he will be able to solve for stress in anchorage in both pre tensioning and post tensioning process. | CO5 | L4 |
| | | | |
| | | | |
| **d** | **Review Questions** | - | - |
| - | The attainment of the module learning assessed through following questions | - | - |
| | | | |
| 1 | Explain stress distribution in End Block. | CO5 | L2 |
| 2 | Explain Indian Standard Code IS-1343 method for calculation of Burstire force. | CO5 | L2 |
| 3 | The end block of a post tensioned pre-stressed concrete beam 300mm x 300mm is subjected to a pre-stressing force 832.8 kN. Anchorage area 11720 mm 2 . Design suitable anchorage reinforcement. | CO5 | L4 |
| 4 | Explain composite construction in PSC members. | CO5 | L2 |
| 5 | A composite T beam is made up of pre tensioned web 100mm wide 200mm deep and a cast insitu slab 400mm wide 40mm thick having a modulus of elasticity 28 kN/mm 2 . If the differential shrinkage is 100x 1 V' units determined shrinkage stresses developed in the precast and cast insitu units. | CO5 | L4 |
| 6 | Write a note on anchorage zone stresses? | CO5 | L2 |
| 7 | Explain end zone reinforcement? | CO5 | L2 |
| 8 | The end block of a post tensioned beam 500mm x 1000mm is prestressed 2 each cable comparing of 5 wires of 7mm diameter. The cable is anchoraged by square anchore plates 400x400mm with their center located at 250mm from top and bottom edges of the beam. The jacking force in the cable is 3000kN. Design a suitable anchorage zone reinforcement as per IS -1343 code Provision? | CO5 | L4 |
| 9 | A Pre tensioned rectangular beam of size 120mm x 240mm is simply supported over a span of 6m. The beam is prestressed by tendons carrying on initial pre-stressing force of 225kN at a constant eccentricity of 40mm. The loss of pre-stress is assumed to be 15° . The beam is incorporated in a composite T-beam by casting a top flange of 450mm wide and 40mm thick. Live load on composite beam is 8kN/m² . Calculate the resultant stress developed in the beam assuming the pre tensioned beam is unpropped during casting of top fiange if the modulus of elasticity of the flange portion and the pre tensioned beam are 28kN/mm² and 35kN/mm² respectively. Also check the composite T-beam for limit state of deflection. | CO5 | L4 |
| 10 | The end block of a prestressed concrete girder is 200mm wide by 300mm deep. The beam is post tensioned by two freyssinet anchorages each of 100mm diameter with their centres located at 75mm from top and bottom of the beam. The force transmitted by each anchorage being 2000kN. Compute the bursting force and design suitable reinforcements according to indian standards IS1343 code provisions. Sketch the arrangement of anchorage zone reinforcement? | CO5 | L4 |
| | | | |
| **e** | **Experiences** | - | - |
| 1 | | | |
| 2 | | | |

# E3. CIA EXAM – 3

## a. Model Question Paper - 3

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Crs Code | 15CV82 | Sem: | VIII | Marks: | 30 | Time: | 70 Mins |
| Course: | Design of Pre Stressed Concrete Elements. | | | | | | |

| - | - | **Note: Answer all questions, each carry equal marks. Module : 5** | **Marks** | **CO** | **Level** |
|---|---|---|---|---|---|
| 1 | a | Explain stress distribution in End Block. | 4 | CO5 | L2 |
| | b | Explain Indian Standard Code IS-1343 method for calculation of Burstire force. | 4 | CO5 | L2 |
| | c | The end block of a post tensioned pre-stressed concrete beam 300mm x 300mm is subjected to a pre-stressing force 832.8 kN. Anchorage area 11720 mm 2 . Design suitable anchorage reinforcement. | 9 | CO5 | L4 |
| | | **OR** | | | |
| 2 | a | The end block of a prestressed concrete girder is 200mm wide by 300mm deep. The beam is post tensioned by two freyssinet anchorages each of 100mm diameter with their centres located at 75mm from top and bottom of the beam. The force transmitted by each anchorage being 2000kN. Compute the bursting force and design suitable reinforcements according to indian standards IS1343 code provisions. Sketch the arrangement of anchorage zone reinforcement? | 16 | CO5 | L4 |
| | | | | | |
| 3 | a | The end block of a post tensioned beam 500mm x 1000mm is prestressed 2 each cable comparing of 5 wires of 7mm diameter. The cable is anchoraged by square anchore plates 400x400mm with their center located at 250mm from top and bottom edges of the beam. The jacking force in the cable is 3000kN. Design a suitable anchorage zone reinforcement as per IS -1343 code Provision? | 16 | CO5 | L4 |
| | | **OR** | | | |
| 4 | a | A Pre tensioned rectangular beam of size 120mm x 240mm is simply supported over a span of 6m. The beam is prestressed by tendons carrying on initial pre-stressing force of 225kN at a constant eccentricity of 40mm. The loss of pre-stress is assumed to be 15° . The beam is incorporated in a composite T-beam by casting a top flange of 450mm wide and 40mm thick. Live load on composite beam is 8kN/m² . Calculate the resultant stress developed in the beam assuming the pre tensioned beam is unpropped during casting of top fiange if the modulus of elasticity of the flange portion and the pre tensioned beam are 28kN/mm² and 35kN/mm² respectively. Also check the composite T-beam for limit state of deflection. | 16 | CO5 | L4 |
| | | | | | |

## b. Assignment – 3

| Model Assignment Questions | | | | | | | |
|---|---|---|---|---|---|---|---|
| Crs Code | 15CV82 | Sem: | VIII | Marks: | 30 | Time: | 70 Mins |
| Course: | Design of Pre Stressed Concrete Elements. | | | | | | |

| **SNo** | **Assignment Description** | **Marks** | **CO** | **Level** |
|---|---|---|---|---|
| 1 | Explain stress distribution in End Block. | 5 | CO5 | L2 |
| 2 | Explain Indian Standard Code IS-1343 method for calculation of Burstire force. | 5 | CO5 | L2 |
| 3 | The end block of a post tensioned pre-stressed concrete beam 300mm x 300mm is subjected to a pre-stressing force 832.8 kN. Anchorage area 11720 mm 2 . Design suitable anchorage reinforcement. | 10 | CO5 | L4 |
| 4 | Explain composite construction in PSC members. | 5 | CO5 | L2 |
| 5 | A composite T beam is made up of pre tensioned web 100mm wide 200mm deep and a cast insitu slab 400mm wide 40mm thick having a modulus of elasticity 28 kN/mm 2 . If the differential shrinkage is 100x 1 V' units determined shrinkage stresses developed in the precast and cast insitu units. | 10 | CO5 | L4 |
| 6 | Write a note on anchorage zone stresses? | 4 | CO5 | L2 |
| 7 | Explain end zone reinforcement? | 4 | CO5 | L2 |
| 8 | The end block of a post tensioned beam 500mm x 1000mm is | 16 | CO5 | L4 |

| | | | | |
|---|---|---|---|---|
| | prestressed 2 each cable comparing of 5 wires of 7mm diameter. The cable is anchoraged by square anchore plates 400x400mm with their center located at 250mm from top and bottom edges of the beam. The jacking force in the cable is 3000kN. Design a suitable anchorage zone reinforcement as per IS -1343 code Provision? | | | |
| 9 | A Pre tensioned rectangular beam of size 120mm x 240mm is simply supported over a span of 6m. The beam is prestressed by tendons carrying on initial pre-stressing force of 225kN at a constant eccentricity of 40mm. The loss of pre-stress is assumed to be $15^0$ . The beam is incorporated in a composite T-beam by casting a top flange of 450mm wide and 40mm thick. Live load on composite beam is $8kN/m^2$ . Calculate the resultant stress developed in the beam assuming the pre tensioned beam is unpropped during casting of top fiange if the modulus of elasticity of the flange portion and the pre tensioned beam are $28kN/mm^2$ and $35kN/mm^2$ respectively. Also check the composite T-beam for limit state of deflection. | 16 | CO5 | L4 |
| 10 | The end block of a prestressed concrete girder is 200mm wide by 300mm deep. The beam is post tensioned by two freyssinet anchorages each of 100mm diameter with their centres located at 75mm from top and bottom of the beam. The force transmitted by each anchorage being 2000kN. Compute the bursting force and design suitable reinforcements according to indian standards IS1343 code provisions. Sketch the arrangement of anchorage zone reinforcement? | 16 | CO5 | L4 |
| | | | | |

# F. EXAM PREPARATION

## 1. University Model Question Paper

| Course: | | Design of Pre Stressed Concrete Elements | | | | | Month / Year | | May/2020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crs Code: | | 15CV82 | Sem: | VIII | Marks: | 100 | Time: | | 3 hrs | |
| Module | | Answer all FIVE full questions. All questions carry equal marks. | | | | | | **Marks** | **CO** | **Level** |
| | | **Module-1** | | | | | | | | |
| 1 | a | .Explain the need for High Strength conc and higher grade steel for PSC member. | | | | | | 4 | CO1 | L2 |
| | b | .Define Pre-stressed Concrete. Explain the different types of Pre-stressed Concrete | | | | | | 4 | CO1 | L2 |
| | c | .A PSC inverted T beam section web 300x900mm. Flange 300x600mm simply supported over a span of 15m. The beam is tensioned by 3 cables each containing 12 wires of 7 mm diameter placed at 150mm from soffit at midspan. If the initial prestress is 1000 N/mm calculate the max UDL the beam can carry maximum compressive stress is limited to 15 MPa and tensile stress is limited to 1 MPa. Assume 15% loss of pre stress. | | | | | | 8 | CO1 | L4 |
| | | **or** | | | | | | | | |
| 2 | a | Explain Load Balancing Concept. | | | | | | 2 | CO1 | L2 |
| | b | Explain post tensioning anchorages devices and explain any one in details. | | | | | | 6 | CO1 | L2 |
| | c | A rectangular beam 200x300mm is pre-stressed by 15 wires of 5 mm diameter located at 65mm from bottom and 3 wires of 5mm diameter at 25mm from top initial pre-stress is 840 N/mm Calculate stress at midspan. | | | | | | 8 | CO1 | L2 |
| | | **Module-2** | | | | | | | | |
| 3 | a | .Define loss of pre-stress. Explain different loss of pre-stress with suitable example. | | | | | | 6 | CO2 | L2 |
| | b | A post tensioned concrete beam 100x300mm span 10m is pre-stressed successively, tensioned and anchored by 3 cables each having C/S area | | | | | | 10 | CO2 | L4 |

| | | | | | |
|---|---|---|---|---|---|
| | | 200 mm 2 . Initial pre stress is 1200 N/mm 2 . First cable is parabolic with e = 50mm at mid span and e = 50mm above NA at 52 .support. Second cable is parabolic with e = 50 at midspan and zero at support. Third cable is d , 3 t straight cable with 50mm eccentricity. Find the loss of pre-stress due to elastic deformation. Take m = 6. | | | |
| | | **or** | | | |
| 4 | a | Derive the expression for deflection for a beam of length / subjected to point load at mid span, UDL. Two point load symmetrically placed at middle third point. Prestress P applied on a straight cable with e as eccentricity and a parabolic cable with e = 0 at support and e at mid span. | 6 | CO2 | L4 |
| | b | A simply supported beam having span 6m is post tensioned by 2 cable both having e = 50mm at mid span. First cable is parabolic and anchored 100mm above CG at support. Second cable is straight. C/s of each cable is 200mm2 and initial prestress is 1200 N/mm 2 . O Area of cone 2x104 mm2 radius of gyration 120mm. The beam support a two point load each 20 kN at middle third point Ec 38 kN/mm 2 . Calculate (i) Short term deflection (ii) Long term deflection .Take 4 = 2, Loss of prestress 20%. | 10 | CO2 | L4 |
| | | **Module-3** | | | |
| 5 | a | An unsymmetrical I section having top flange 750x200mm bottom flange 450x250mm thickness of web 150mm overall depth 1000mm. If permissible tensile and compressive stress at transfer and working load are not to exceed zero in tension 15 N/mm 2 in compression. Determine P and e to resist self weight and applied moment 1012 kNm and 450 kNm. Assume loss of pre stress 15%. | 16 | CO3 | L4 |
| | | **or** | | | |
| 6 | a | Design a post tensioned girder which is spaced 2.4 m c/c and has an effective span of 9m. Live load 15 kN/m 2 , DL(3 kN/m2 + Self weight). Compressive stress at transfer and working load are 14 Nimm2 and 12 N/mm2 tension is 1 N/mm2 at all stages of loading loss Ratio 0.8. Determine number of 7mm diameter wires required if permissible tension is 1000 N/mm 2 . Assume cover as 100 mm. | 16 | CO3 | L4 |
| | | **Module -4** | | | |
| 7 | a | Explain types of shear cracks. | 4 | CO4 | L2 |
| | b | A' PSC beam 250mm wide 150mm deep is subjected to SF 900 kN fiber stress under working load is 4 N/mm2 effective pre-stress is 1000 N/mm 2 and area of cable is 1500 min - . Design shear reinforcement slope of cable at support is (1/6). | 12 | CO4 | L4 |
| | | **or** | | | |
| 8 | a | A pre-stressed concrete beam of span 10m, cross section 120mm x 300mm is prestressed by a cable carrying a force of 180 kN the beam support a UDL 5 kN/m including self weight compare the magnitude of principal tension with and without axial pre-stress. Estimate the reduction in principal stress. Also find % reduction if a parabolic cable used with e = 50 mm at mid span and zero at support | 16 | CO4 | L4 |
| | | **Module -5** | | | |
| 9 | a | Explain stress distribution in End Block.? | 4 | CO5 | L2 |
| | b | Explain Indian Standard Code IS-1343 method for calculation of Burstire force. | 4 | CO5 | L2 |
| | c | The end block of a post tensioned pre-stressed concrete beam 300mm x 300mm is subjected to a pre-stressing force 832.8 kN. Anchorage area 11720 mm 2 . Design suitable anchorage reinforcement. | 8 | CO5 | L4 |
| | | **or** | | | |
| 10 | a | Explain composite construction in PSC members. | 6 | CO5 | L2 |
| | b | A composite T beam is made up of pre tensioned web 100mm wide 200mm deep and a cast insitu slab 400mm wide 40mm thick having a modulus of elasticity 28 kN/mm 2 . If the differential shrinkage is 100x 1 V' units determined shrinkage stresses developed in the precast and cast insitu units. | 10 | CO5 | L4 |
| | | | | | |

## 2. SEE Important Questions

| Course: | | Design of Pre Stressed Concrete Elements | | | | | | Month / Year | May/2020 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crs Code: | | 15CV82 | Sem: | VIII | Marks: | 100 | | Time: | 3 hrs | |
| | **Note** | Answer all FIVE full questions. All questions carry equal marks. | | | | | | - | - | |
| Module | Qno. | Important Question | | | | | | **Marks** | **CO** | **Year** |
| 1 | 1 | Distinguish between pretensioning and post tensionong and state advantages of these methods. | | | | | | 5 | CO1 | L2 |
| | 2 | Explain the necessity of using high strength concrete and high tensile steel in PSC.? | | | | | | 5 | CO1 | L2 |
| | 3 | Define pressure line or thrust line. Explain the significance. | | | | | | 5 | CO1 | L2 |
| | 4 | Define pre stressed concrete? State its advantages over reinforced concrete? | | | | | | 5 | CO1 | L2 |
| | 5 | Explain with neat sketches, Freyssinet system of pre-stressing? | | | | | | 5 | CO1 | L2 |
| | 6 | Explain with neat sketch "Hoyer's Long line "System of pre-tensioning? | | | | | | 5 | CO1 | L2 |
| | 7 | Define 1} Uni axial and Biaxial Pre-stressing. 2} Concentric and eccentric Pre-stressing? | | | | | | 5 | CO1 | L2 |
| 2 | 8 | Explain the different types of losses in pre stressed concrete? | | | | | | 5 | CO2 | L2 |
| | 1 | A post tensioned concrete beam, simply supported over a span of 12m is of cross section 230x750mm and is prestressed with 10 numbers of 7mm diameter parabolic cable bars with zero eccentricity at the support and 200mm at midspan. Calculate the loss due to different causes for the following data.<br>Grade of concrete = M40.<br>Initial Prestress = 1000N/mm$^2$.<br>Co-efficient of curvature effect = 0.50.<br>Wobble coefficient k = 0.003/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 3%, $E_s$=210 kN/mm$^2$, $E_c$=37.50 kN/mm$^2$.<br>Calculate the total percentage of loss and the jacking force required. | | | | | | 16 | CO2 | L4 |
| | 2 | A prestressed concrete beam 200mm wide and 300mm deep is prestressed with wires of c/s area $A_s$ 320mm$^2$ located at a constant eccentricity of 50mm and carring an initialstress of 1000 N/mm$^2$ . The span of the beam of the beam is 10m. Calculate the % loss of stress in wires if the beam is post-tensioned using following data:.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$.Wobble coefficient k = 0.0015/m.<br>Anchorage slip = 5mm at jacking end.<br>Creep coefficient = 1.6, Shrinkage of concrete=0.0002.<br>Relaxation of steel stress= 5%,<br>Calculate the total percentage of loss and the jacking force required. | | | | | | 16 | CO2 | L4 |
| | 3 | A simply supported post-tensioned concrete beam of span 15 m has a rectangular cross section 300 x 800 mm. The prestress at ends is 1300kN with zero eccentricity at the supports and 250mm at the centre the cable profile being parabolic. Assuming k=0.15 per 100 m and mue= 0.35. Determine the loss of stress due to friction at the centre of the beam? | | | | | | 16 | CO2 | L4 |
| | 4 | A pretensioned beam 250mm wide and 300mm deep in prestressed by 12 wires each of 7mm diameter initially stressed to 1200 N/mm2 with their centroids located at 100mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using IS 1343.<br>Relaxation of steel stress= 90N/mm2.<br>Creep coefficient = 1.6<br>Residual shrinkage strain =3 x 10$^{-4}$.<br>Es=210 kN/mm$^2$.<br>Ec= 35 kN/mm$^2$. | | | | | | 16 | CO2 | L4 |

| | | | | | |
|---|---|---|---|---|---|
| | 5 | What is deflection and what are the factors influencing deflections? | 8 | CO2 | L4 |
| | 6 | What is pre and post crack condition? | 8 | CO2 | L4 |
| | 7 | Deflection of beam with straight tendons? | 8 | CO2 | L4 |
| | 8 | Deflection of beam with Parabolic tendons? | 8 | CO2 | L4 |
| | 9 | Deflection of beam with sloping tendons? | 8 | CO2 | L4 |
| | 10 | Deflection of beam with Trapezoidal tendons? | 8 | CO2 | L4 |
| 3 | 1 | A post tensioned unbounded beam section 120mm x 300mm is pre-stressed by 7 wires of 5mm diameter with an effective cover of 50mm and effective stress of 1200 N/mm2 . The beam is of 7.5m span. If M40 concrete is used and fp = 1600 MPa, find the ultimate flexural strength of the section. | 15 | CO3 | L4 |
| | 2 | A post tensioned beam with unbounded tendons is of rectangular section 400mm wide with an effective depth of 800mm. The C/S area of the pre-stressing steel is 2840 mm2 . The effective pre-stress in the steel after all losses is 900 N/mm2 . The effective span of the beam is 16m. If fck = 40 N/mm2 , Estimate the ultimate moment of resistance of the section using IS code provisions. | 15 | CO3 | L4 |
| | 3 | Design a pre-stressed concrete beam as Type-1 member to carry a superimposed load of 12 kN/m over a simply supported span of 25m. The permissible stress in compression for concrete at transfer and working loads are 14 N/mm2 and 12 N/mm2 respectively. Initial stress in pre-stressing cable is 1000 N/mm2 . Loss of pre-stress is 20%. Adopt Freyssenet cables each of 12 wires of 5mm diameter | 15 | CO3 | L4 |
| 4 | 1 | Explain types of shear cracks ? | 3 | CO4 | L2 |
| | 2 | A' PSC beam 250mm wide 150mm deep is subjected to SF 900 kN fiber stress under working load is 4 N/mm2 effective pre-stress is 1000 N/mm 2 and area of cable is 1500 min - . Design shear reinforcement slope of cable at support is (1/6) | 6 | CO4 | L4 |
| | 3 | A pre-stressed concrete beam of span 10m, cross section 120mm x 300mm is prestressed by a cable carrying a force of 180 kN the beam support a UDL 5 kN/m including self weight compare the magnitude of principal tension with and without axial pre-stress. Estimate the reduction in principal stress. Also find % reduction if a parabolic cable used with e = 50 mm at mid span and zero at support | 6 | CO4 | L4 |
| | 4 | Differentiate between web shear, flexural and flexural shear cracks in PSC member with neat sketch? | 5 | CO4 | L2 |
| | 5 | A PSC beam 300mm x 1000mm is subjected to a shear force of 500kN under working loads near support section. The effective pre stressing force in the tendon is 800kN. The cable is parabolic with zero eccentricity at support and 300mm below centroidal axis at mid span. The span of the beam is 12m. If M40 concrete is used estimate the principal tension in concrete at support section and if required design the shear reinforcement? | 10 | CO4 | L4 |
| | 6 | A support reaction of PSC beam 120 x 250mm is required to carry an uitimate shear force of 70kN. The compressive stress at the centroidal axis is 5MPa and fck= 40 Mpa. Fy= 415MPa cover to reinforcement =50mm. Design the suitable shear reinforcement at the section as per IS-1343 recommondations? | 10 | CO4 | L4 |
| | 7 | Explain the mechanism of shear failure in PSC beam | 5 | CO4 | L2 |
| 5 | 1 | Explain stress distribution in End Block. | 5 | CO5 | L2 |
| | 2 | Explain Indian Standard Code IS-1343 method for calculation of Burstire force. | 5 | CO5 | L2 |
| | 3 | The end block of a post tensioned pre-stressed concrete beam 300mm x 300mm is subjected to a pre-stressing force 832.8 kN. Anchorage area 11720 mm 2 . Design suitable anchorage reinforcement. | 10 | CO5 | L4 |
| | 4 | Explain composite construction in PSC members. | 5 | CO5 | L2 |
| | 5 | A composite T beam is made up of pre tensioned web 100mm wide 200mm deep and a cast insitu slab 400mm wide 40mm thick having a modulus of elasticity 28 kN/mm 2 . If the differential shrinkage is 100x 1 V' units determined shrinkage stresses developed in the precast and cast | 10 | CO5 | L4 |

| | | | | | |
|---|---|---|---|---|---|
| | | insitu units. | | | |
| | 6 | Write a note on anchorage zone stresses? | 4 | CO5 | L2 |
| | 7 | Explain end zone reinforcement? | 4 | CO5 | L2 |
| | 8 | The end block of a post tensioned beam 500mm x 1000mm is prestressed 2 each cable comparing of 5 wires of 7mm diameter. The cable is anchoraged by square anchore plates 400x400mm with their center located at 250mm from top and bottom edges of the beam. The jacking force in the cable is 3000kN. Design a suitable anchorage zone reinforcement as per IS -1343 code Provision? | 16 | CO5 | L4 |
| | 9 | A Pre tensioned rectangular beam of size 120mm x 240mm is simply supported over a span of 6m. The beam is prestressed by tendons carrying on initial pre-stressing force of 225kN at a constant eccentricity of 40mm. The loss of pre-stress is assumed to be $15^0$ . The beam is incorporated in a composite T-beam by casting a top flange of 450mm wide and 40mm thick. Live load on composite beam is $8kN/m^2$ . Calculate the resultant stress developed in the beam assuming the pre tensioned beam is unpropped during casting of top fiange if the modulus of elasticity of the flange portion and the pre tensioned beam are $28kN/mm^2$ and $35kN/mm^2$ respectively. Also check the composite T-beam for limit state of deflection. | 16 | CO5 | L4 |
| | 10 | The end block of a prestressed concrete girder is 200mm wide by 300mm deep. The beam is post tensioned by two freyssinet anchorages each of 100mm diameter with their centres located at 75mm from top and bottom of the beam. The force transmitted by each anchorage being 2000kN. Compute the bursting force and design suitable reinforcements according to indian standards IS1343 code provisions. Sketch the arrangement of anchorage zone reinforcement? | 16 | CO5 | L4 |

# Course Outcome Computation

**Academic Year:**

**Odd / Even semester**

| **INTERNAL TEST** | **T1** | | | | | | **T2** | | | | | | **T3** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Outcome** | **CO 1** | | **CO 2** | | **CO 3** | | **CO 4** | | **CO 5** | | **CO 6** | | **CO7** | | **CO 8** | |
| **QUESTION NO** | **Q1** | **LV** | **Q2** | **LV** | **Q3** | **LV** | **Q1** | **LV** | **Q2** | **LV** | **Q3** | **LV** | **Q1** | **LV** | **Q2** | **LV** |
| MAX MARKS | | | | | | | | | | | | | | | | |
| USN-1 | | | | | | | | | | | | | | | | |
| USN-2 | | | | | | | | | | | | | | | | |
| USN-3 | | | | | | | | | | | | | | | | |
| USN-4 | | | | | | | | | | | | | | | | |
| USN-5 | | | | | | | | | | | | | | | | |
| USN-6 | | | | | | | | | | | | | | | | |
| Average CO Attainment | | | | | | | | | | | | | | | | |

**LV Threshold : 3:>60%, 2:>=50% and <=60%, 1: <=49%**
**CO1 Computation :(2+2+2+3)/4 = 10/4=2.5**

# PO Computation

| Program Outcome | PO1 | PO3 | PO3 | PO1 | PO12 | PO12 | PO6 | PO1 |
|---|---|---|---|---|---|---|---|---|
| Weight of CO - PO | | | | | | | | |
| Course Outcome | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | CO7 | CO8 |
| Test/Quiz/Lab | T1 | | | | T2 | | | | T3 | | | |
| QUESTION NO | Q1 | LV | Q2 | LV | Q3 | LV | Q1 | LV | Q2 | LV | Q3 | LV | Q1 | LV | Q2 | LV |
| MAX MARKS | | | | | | | | | | | | | | | | |
| USN-1 | | | | | | | | | | | | | | | | |
| USN-2 | | | | | | | | | | | | | | | | |
| USN-3 | | | | | | | | | | | | | | | | |
| USN-4 | | | | | | | | | | | | | | | | |
| USN-5 | | | | | | | | | | | | | | | | |
| USN-6 | | | | | | | | | | | | | | | | |
| Average CO Attainment | | | | | | | | | | | | | | | | |