**CV701**

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**M S RAMAIAH INSTITUTE OF TECHNOLOGY**

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE - 560 054

**SEMESTER END EXAMINATIONS - JANUARY 2015**

Course & Branch : **B.E: Civil Engineering** Semester : **VII**  
Subject : **Design of Pre-Stressed Concrete Structure** Max. Marks : **100**  
Subject Code : **CV701** Duration : **3 Hrs**

**Instructions to the Candidates:**

- Answer one full question from each unit.
- Use of IS: 1343:1980 Permitted.
- Any missing data can be assumed suitably

**UNIT - I**

1. a) Explain necessity of high strength concrete and high strength steel in PSC elements. (05)
  - b) A PSC beam is used over an effective span of 30m and has the following cross section dimensional: top flange 1200X150mm, bottom flange 375X375, web thickness 200mm and overall depth of beam is 2000mm. The beam is provided with 3 cables at an effective cover of 200mm at center. Each cable carries an initial pretreating force of 1250kN with a loss factor of 0.2 the beam is subjected to two concentrated load at 10mt interval and the magnitude of each load is 300kN. The cables are concentric over supports. Calculate the stress at center and at the support for following condition,  
i) At transfer and ii) At working condition. (15)
2. a) Explain concept of load balancing and pressure line or Thrust line in Pre-stressed concrete beam, with suitable sketches. (08)
  - b) A rectangular PSC beam 250X300mm in cross section is pre stressed by a force of 540KN at a content eccentricity of 60mm. the beam supports a concentrated load of 68KN @ the center of the span 3mt. Determine the location of the pressure line at the center, quarter span end support sections of the beam, neglect the self-weight of beam. (12)

**UNIT - II**

3. A post-tensioned beam of 50m span is subjected to a transfer pre-stressing force of 9.38MN. Transfer of force is @ 28 days strength, profile of cable is "parabolic" with more eccentricity @ mid span section as 1100mm. Determine the loss of pre stress and find the jacking force required. The beam is subjected to a line load of 24kN/m and jacking is done @ both ends of beam. (20)  
The data is given below:  
Area of concrete  $A_s = 947100\text{mm}^2$   
Area of steel  $A_s = 8930\text{mm}^2$   
 $I = 6224 \times 10^8 \text{mm}^4$   
Anchorage slip = 2.5mm/Anchorage  
Loss due to Relaxation of steel = 2%



Creep co-efficient  $\mu=0.25$

Wobble coefficient  $k=0.0015/\text{m}$ .

$E_c=38.2\text{Gpa}$ .  $E_s=210\text{Gpa}$ . Take density of  $24\text{kN/m}^3$ .

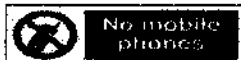
4. a) List and Explain various factors influencing the loss of pre-stress in post-tensioned beam. (05)
- b) A pre-stressed concrete beam of rectangular cross section  $150\times400\text{mm}$  is stretched by 4 cables each carrying an effective force of  $250\text{kN}$  and the span of beam is  $12\text{M}$ . The 1st cable is parabolic with eccentricity of  $50\text{mm}$  below the centroidal axis @ mid span and  $50\text{mm}$  above the centroidal axis @ supports. The 2nd cable is also parabolic with zero eccentricity @ supports and an eccentricity of  $50\text{mm}$  @ the mid span. The 3rd and 4th cables are straight with uniform eccentricity  $50\text{mm}$  below the centroidal axis. If the beam supports UDL of  $10\text{kN/m}$  and  $E_c=40\text{kN/mm}^2$ , estimate the instantaneous deflection @ the following stages. (15)
- i) Pre stress + self-weight of beam
  - ii) Pre stress + self-weight + live load
- The loss ratio is  $0.8$  and creep co-efficient is  $1.6$ , estimate the short and long term deflection.

### UNIT - III

5. a) Write briefly the modes of failure due to flexure. (08)
- b) A symmetrical double T section has flange width of  $1200\text{mm}$  (total) and  $140\text{mm}$  thick. The overall depth of the beam is  $1700\text{mm}$  and thickness of each rib is  $150\text{mm}$ . The member is pre stressed with an effective pre stressing force of  $7500\text{kN}$  through the cable located @ a distance of  $150\text{mm}$  from the soffit. The characteristic strength of concrete is  $40\text{N/mm}^2$ . Assuming that grouting is  $100\%$  effective, determine the ultimate moment of resistance of the section, adopt IS code provision. (12)
6. a) Discuss the IS method of determining the ultimate moment of resistance of rectangular and flanged sections. (05)
- b) A concrete beam of rectangular section  $200\times650\text{mm}$  is pre stressed by a parabolic cable located @ an eccentricity of  $120\text{mm}$  at mid span and zero at the supports. If the beam has a span of  $12\text{m}$  and carries a uniformly distributed live load of  $4.5\text{kN/m}$ , find the effective force necessary in the cable for zero shear stress @ the support section. For this condition calculate the principal stress and assume density of concrete is  $24\text{kN/m}^3$ . (15)

### UNIT - IV

7. a) Define transmission length and mention the factors influencing transmission length. (06)
- b) The end block of a post tensioned beam is  $300\text{mm}$  wide and  $400\text{mm}$  deep. A pre-stressing wires  $12.5\text{mm}$  and 10 numbers are stressed to  $1200\text{N/mm}^2$ . The wires are located at constant eccentricity of  $100\text{mm}$  below the centroidal axis. Design the end block and sketch the reinforcement. If the anchorage plate is  $200\times200\text{mm}$  and diameter of the duct is  $100\text{mm}$ , permissible stress in concrete at transfer  $f_{ci}=20\text{N/mm}^2$ , permissible shear stress in steel  $94.5\text{N/mm}^2$  determine the thickness of anchorage plate. (14)



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8. The end block of post tensioned beam is 750mm square with 4 cables and each (20)  
carrying a force of 1200kN are anchored by plate anchorages 150x150mm,  
located with their centers at 150mm from the edges of the block. Cable duct  
diameter is 60mm,  $f_{ck}=50\text{MPa}$  and cube strength at transfer is 35MPa.  
Permissible bearing stress behind anchorages shall confirm to IS-1343 code.  
Design suitable anchorages for the end block using 415 steel and also sketch  
the reinforcement details.

**UNIT - V**

9. A Post tensioned PSC Beam 300mm wide is to be designed as rectangular beam (20)  
to support a UDL of 20kN/m over a simply supported span of 18m. The stress in  
the concrete must not exceed 16MPa in compression & 1.2MPa in tension at any  
stage of loading. Assuming average loss of Pre-stress = 17%. Design the beam,  
calculating depth, Pre-stressing force & Eccentricity (e).
10. A post tensioned girder having a span of 25m between two bearings imposed (20)  
load on the girder is 15kN/m, grade of concrete is M50 with cube strength at  
transfer = 30MPa. The pre-stress is to be provided by 6 wires 15mm strands  
tensioned to 1150kN housed in cable ducts 60mm, loss ratio= 0.8. Design the  
following as per IS-1343 codal provisions.  
i) Cross-section dimension of unsymmetrical I-section.  
ii) Suitable cable profile.  
iii) Pre stressing force and eccentricity.

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