No mobile phones

CV745

USN	1	M	S							

M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)
BANGALORE – 560 054

SEMESTER END EXAMINATIONS – JANUARY 2012

Course & Branch	:	**B.E. – Civil Engineering**	**Semester**	:	**VII**
Subject	:	**Design of Prestressed Concrete Structures**	**Max. Marks**	:	**100**
Subject Code	:	**CV745**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

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

UNIT – I

1. a) Explain the load carrying mechanisms of PSC and RCC. (05)

   b) A PSC beam is used over an effective span of 30m and has the following c/s dimensions: Top flange – 1200x150; Bottom flange – 375x375 Web thickness – 200 and total depth of beam is 2000. The beam is provided with 3 cables at an effective cover of 200mm at centre. Each cable carries an initial prestressing force of 1250 kN with a loss factor of 0.2. The beam is subjected to three concentrated loads at 10m interval and the magnitude of each load is 300kN. The cables are concentric over supports. Calculate the stresses at centre and at support due to (15)

   i) Prestress + Self weight (Density of concrete = 25 kN/m^3) and

   ii) Prestress + Self weight + LL

   Sketch stress diagrams.

2. a) Explain the concept of centre of thrust and obtain equations to calculate the stresses in PSC beams. (05)

   b) Locate the pressure line ordinates for problem (1b) at centre, quarter span and support and hence calculate the stresses due to Prestress + Self weight + LL. Sketch the pressure line. Assume the cable profile to be parabolic. Sketch stress diagram. (15)

UNIT – II

3. A Post Tensioned beam is used over an effective span of 30m and has the following c/s dimensions: Top flange – 1500 x 200; Bottom flange – 500 x300; Web thickness – 250 and total depth of Beam is 1800mm. The beam is provided with 3 cables at an effective cover of 150mm at centre. The cables are stressed together and anchored. The cables are parabolic with one cable at 300 mm above centroid at support, second cable concentric at support and the third cable 300mm below centroid at support. Each cable carries an initial prestressing force of 1500kN with an initial stress of 1200MPa. ($0.8f_p$). Assuming that prestressing (20)

strands are moving on smooth concrete, coefficient for wave effect = $40x10^{-4}$/m, age of concrete at transfer = 14 days, Anchorage slip = 3 mm and creep coefficient=1.4, grade of concretes is M40. Calculate all the losses as applicable, percentage loss and final prestressing force.

4. A PSC beam used over an effective span of 30m has the C/S as shown in Fig.4. The beam is provided with 6 cables at centre with an effective cover of 100mm. The cables are parabolic with 3 cables in each web at the support arranged symmetrically with respect to the centroidal axis with C/C distance between each cable = 250mm. The initial prestressing force in each cable is 2300kN and the final prestressing force in each cable is 1800kN. The beam carries 3 concentrated loads of 500kN each at intervals of 7.5m symmetrically arranged. Assuming the grade of concrete as M 40, calculate the following deflections due to (20)

i) Prestress alone
ii) Prestress + Self weight + LL
iii) Long term deflections using a creep coefficient of 1.4

iii) Long term deflections using a creep coefficient of 1.4

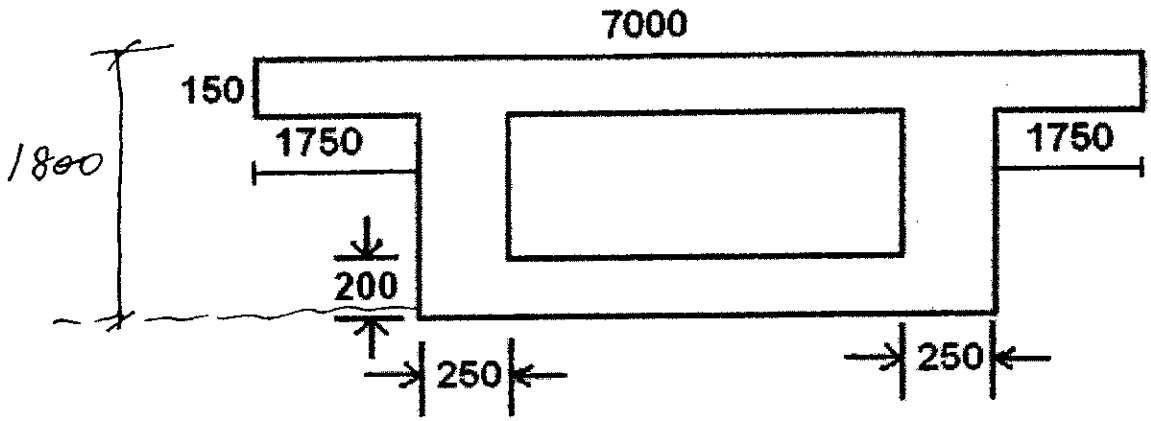

Fig.4

UNIT –III

5. An unsymmetrical I – section has the following dimensions: Top flange – 1500 x 200; Bottom flange – 500 x 300; Web thickness – 250 and total depth of beam is 1800mm. Area of prestressing steel is 6000 mm^2 with an effective cover of 150mm. Estimate the flexural strength at collapse for the following cases: (20)

i) Beam is post tensioned and bonded and
ii) Beam is post tensioned and unbonded

Characteristic strength of concrete and prestressing steel is 50 and 1600MPa respectively. Effective prestress is 1000 MPa and effective span is 25m.

6. a) Explain clearly the two different types of shear cracks with sketches and how the ultimate shear resistance is calculated in each case. (10)

   b) The support section of a PSC beam is 400 x1200mm and carries a shear force of 1000kN at service condition. The compressive stress at centroid is 10MPa with f_{ck} = 50MPa and f_y = 415MPa. Design the shear reinforcements and sketch the details. (10)

UNIT – IV

7. a) What is transmission length in pretensioned members and list the factors influencing the same. (10)

   b) A pre tensioned beam of span 12 m has flanges 200x50 and web 100mm thick with total depth = 500mm. The member is prestressed by 10 wires of 5mm diameter located at an eccentricity of 100 mm. f_p=1600MPa, f_{pi}=0.8 fp and the concrete strength at transfer is 40MPa. Determine the maximum vertical tensile stress in the transmission zone and design suitable reinforcements assuming a permissible stress of 230MPa. (10)

8. The end block of a post tensioned PSC beam is 750mm square. Four cables, each carrying a force of 1200kN are anchored by plate anchorages, 150 x150 mm, located with their centres at 150mm from the edges of the block. Cable duct diameter is 60mm ; f_{ck}=50MPa and the cube strength at transfer is 35 MPa. Permissible bearing stress behind the anchorages shall confirm to IS code. Design suitable anchorages for the end block using Fe415 steel. Sketch the detail of the reinforcements. (20)

UNIT – V

9. Design a simply supported slab for a bridge deck using the following data: (20)

   i) Span = 12m
   ii) Permissible compressive stresses in concrete = 15MPa (transfer and service)
   iii) Class I member
   iv) Safe stress in prestressing steel = 960MPa
   v) IL on slab = 12kN/m^2
   vi) Loss of prestress – 20%

   Design the prestressing force, depth of slab and eccentricity. Suggest suitable cable profile

10. A post tensioned girder having a span of 30m between the bearings is required for an aircraft hanger. IL on the girder is 15kN/m. Grade of concrete is M 50 with cube strength at transfer = 30MPa. The prestress is to be provided by seven wire 15 mm strand tensioned to 1200kN, housed in cable ducts 65mm. Loss ratio = 0.80. Design the following (20)

    i) C/S of an unsymmetrical I section ii) Cable profile
    iii) Prestressing force and eccentricity

    Adopt the stresses as per IS code

****