**CV745**

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# M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

## SEMESTER END EXAMINATIONS – January 2013

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

**Instructions to the Candidates:**

- Answer one full question from each unit.
- IS 1343:1980 is permitted

### UNIT – I

1. a) Write necessity of High strength steel and high strength concrete for PSC structures. (06)

   b) A beam of unsymmetrical I-section is used to support a liveload of 5kN/m along an effective span of 7m. The details of the I-section are ,Top flange-300mm wide and 60mm thick, Bottom flange-200mm wide and 100mm thick, web-400mm deep and 60mm wide. (14)

   Determine :

   i) The concentric force applied at the centroidal axis of the section to nullify bottom fibre stress,

   ii) The eccentric force applied at 50mm from the soffit to nullify bottom fibre stress.

2 a) With neat sketch, explain jacks and jacking force. (06)

   b) A Pre-Stressed beam of rectangular section 80mm×120mm is to be designed to support concentrated loads of 4kN each at one-third span points over an effective span of 3m.The permissible stresses in concrete are limited to Zero and 14MPa tension at transfer and working load respectively. If 3mm diameter wires are initially stressed to 1400 $N/mm^2$ are used, find the number of wires required and the eccentricity of the prestressing force, assume 20% loss in prestress. Density of the concrete=24 $kN/m^3$. (14)

## UNIT – II

3 a) Explain Partial prestressing and Load balancing. (06)

b) A PSC beam with a single overhang has a span of 8m between the simple supports and an overhanging length of 2m, cross section of the beam is 300mm×900mm.The total UDL(Including Selfwt.) on the beam is 4kN/m. Determine the profile of the cable for an effective prestressing force of 500kN which balances dead load and live load (14)

4 a) List out the factors influencing deflections of PSC members. (06)

b) A PSC beam of rectangular cross section 150mm wide and 400 mm deep is stressed by 4 cables each carrying an effective force of 250 kN. The span of the beam is 12 m, the first cable is parabolic with an eccentricity of 60 mm below centroidal axis at mid span and 50 mm above the centroidal axis at supports. The second cable is also parabolic with zero eccentricity at supports and eccentricity of 50 mm at mid span. The third and fourth cables are straight with a constant eccentricity of 50 mm below the centroidal axis. The beam carries a load of 10 kN/m and $E_C$= 40kN/mm$^2$.Estimate (14)

i. Deflection due to pre-stress and self-weight

ii. Deflection due to pre-stress + self-weight + live load if the loss ratio is 0.8 and creep co-efficient is 1.6. Estimate the long term deflection

## UNIT – III

5. a) Write the procedure to find ultimate moment of resistance for T or I sections by IS code method. (06)

b) A PSC-Tee beam of flange 1200 mm x 150 mm with effective depth of 1600 mm thickness of web is 300 mm, area of pre-stressing cable is 4700 mm$^2$ take $f_{ck}$=40 N/mm$^2$ and $f_p$=1000 N/mm$^2$. Calculate ultimate moment of resistance of the section. (14)

6. a) Write the IS code recommendations for flexure and shear of PSC structures. (06)

b) The cross section of a symmetrical I section Pre-stressed beam is 300mm×750mm overall with flanges and web 100mm thickness, the beam is pretensioned by cables containing 48 wires of 5mm diameter high tensile steel wires at an eccentricity of 250mm. The concrete strength is 40 N/mm$^2$ and tensile strength of wires is 1700 N/mm$^2$. Assuming that the grouting of the tendons is 100% effective, determine the ultimate moment of the section according to IS 1343. (14)

## UNIT – IV

7. a) Explain End block with neat sketch. (06)

   b) The end block of a post tensioned beam is 80mm wide and 160mm deep. A prestressing wire of 7mm in diameter is stressed to 1200 $N/mm^2$ has to be anchored against the end block at the centre. The anchorage plate is 50mm×50mm.The wire bears the on the plate through a hole of 20mm diameter. Given the permissible stress in the concrete at transfer as $20N/mm^2$, and permissible shear stress in the steel as $94.5N/mm^2$. Determine the thickness of the anchorage plate (14)

8. a) What is transmission length? Explain with a neat sketch. (06)

   b) A prestressed concrete beam of span 10m with the dimension of 120mm×300mm is axially prestressed by a cable carrying an effective force of 180kN.The beam supports a total UDL of 5kN/m which includes the self weight of the member. Compare the magnitude of Principal tension developed in the beam with and without axial prestress. (14)

## UNIT – V

9. Design a simply supported slab for a bridge deck using the following data: Span=12m, Permissible compressive stress in concrete=15MPa, Safe stress in steel=960MPa, Imposed load on the slab=10 $kN/m^2$, Loss of prestress=18%. Design Pre-Stressing force and eccentricity. (20)

10. Write a short note on the following 5×4=20

    a) Bearing force and bursting tensile force.

    b) Cable profile for PSC structures

    c) Eccentricity in PSC structures

    d) Limiting zone of Prestressing force

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