Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 1037240

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV / DEC 2024
Seventh Semester
Civil Engineering
U20CE731 – PRE- STRESSED CONCRETE STRUCTURES
(Regulation 2020)

Time: Three Hours | Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. List out the advantages of pre-stressed concrete.
2. Enumerate load balance concept.
3. Under what situations and types of structures would you recommend the use of unboned tendons?
4. At what quantities do the crack width of a flexural crack depends on?
5. What are the needs of pre-stressing in compression members?
6. Draw a sketch showing the stress distribution in end block by double anchor plate.
7. How do you evaluate the shrinkage and resultant stress in composite member?
8. Relationships between propped and unpropped composite construction?
9. Write the general failures of pre-stressed concrete tanks?
10. What is the main function of longitudinal prestressing?

PART – B (5 x 16 = 80 Marks)

11. (a) A pre-stressed pre-tensioned beam of 200mm x 300mm deep is pre-stressed by 10 wires each of 7mm diameter, initially stressed to 1200Mpa with their centroids located 100mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation. Assume relaxation of steel = 60MPa, Es=210GPa, Ec=36.9GPa, Residual shrinkage strain = 300 x 10^{-6}, creep co-efficient = 1.6. (16)

(OR)

(b) A pre-stressed concrete beam of section 125mm wide and 300mm deep is used over an effective span of 6.25m support a udl of 4.5KN/m including self weight. The beam is pre-stressed by a straight cable carrying a force of 190KN and located at an eccentricity of 50mm. Determine the location of the thrust line in the beam and plot its position. (16)

12. (a) A PSC T-section has 1800mm x 200mm flange, 450mm x 1500mm rib and 100 numbers of 8mm HTS wires located at 1600mm from the top of flange. Calculate the flexural strength of beam using M40 and Fe1600. (16)

(OR)

(b) Outline the factors influencing the ultimate shear resistance of PSC sections with flexure shear cracks. (16)

13. (a) A pre-stressed concrete pipe of 1.2m diameter having a core thickness of 75mm is required to withstand a service pressure intensity of 1.2N/mm2.Examine the pitch of 5mm diameter high tensile wire winding if the intial stress is limited to 1000N/mm2. Permissible stresses in concrete are being 12 N/mm2 in compression in zero in tension. The loss ratio is 0.8, if the direct tensile strength of concrete is 2.5N/mm2. Estimate the load factor against cracking. (16)

(OR)

(b) Examine and design a pre-stressed concrete pipe of internal diameter 900mm to withstand the internal pressure of 0.8 N/mm2. The maximum permissible compressive stress in concrete is 18N/mm2 and no tensile stress is to be permitted. Modular ratio between steel and concrete is 5.8. Adopt 5mm diameter high tensile wires which can be stressed to 1100 N/mm2. Expected loss of prestress is 15%. (16)

14. (a) Design a composite slab for the bridge deck using a standard inverted T-section. The top flange is 300mm wide and 110mm thick. The bottom flange is 550mm wide and 250mm thick. The web thickness is 100mm and the overall depth of the inverted T-section is 655mm. The bridge deck has to support a characteristic imposed load of 70KN/m2, over an effective span of 12m. Grade 40Concrete is specified for the precast pretensioned T-with a compressive strength at transfer of 34N/mm2. Concrete of grade 30 is used for the insutu part. Calculate the minimum prestress necessary and check for safety under serviceability limit state. (16)

(OR)

(b) A precast pretensional beam of rectangular section has a breadth of 100mm and depth of 200mm. the beam with an effective span of 5m is prestressed by the tendons with their centroids coinciding with the bottom kern. The initial force in the tendon is 150KN. The loss of prestress is 15%. The top flange width is 400mm with the thickness of 40mm. If the composite beam supports a liveload of 7KN/m2. Calculate the resultant stresses developed if the section is unpropped. M40 and M20 concrete are used for pretensioned and in-situ concrete. (16)

15. (a) A cylinder PSC water tank of internal diameter 30m is required to store water over a depth of 7.5m. The permissible compressive stress in concrete at transfer is 13 N/mm2 and the minimum compressive stress under working pressure is 1 N/mm2. The loss ratio is 0.75. Wires of 5mm diameter with an initial stress of 1000 N/mm2 are available for circumferential winding and Freyssinet cables made up of 12 wires of 8mm diameter stressed to 1200 N/mm2 are to be used for vertical prestressing. Design the tank walls assuming the base as fixed. The cube strength of concrete is 40N/mm2. (16)

(OR)

(b) Design a electric pole 12m high to support wires at its top at which can exert a reversible horizontal force of 3KN. The tendons are initially stressed to 1000N/mm2 and the loss of stress due to shrinkage and creep is 20%. Maximum compressive stress in concrete is limited to 12N/mm2. Assume modular ratio=6, angle of repose=30° and the specific weight of the soil is 18KN/mm3. (16)

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