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M.Tech. (Civil Engineering) (2016 Onwards) (Sem.–1) PRE-STRESSED CONCRETE STRUCTURES Subject Code : CE-504

M.Code : 35205

Time : 3 Hrs. INSTRUCTIONS TO CANDIDATES : Max. Marks : 100

- 1. Attempt any FIVE questions out of EIGHT questions.
- 2. Each question carries TWENTY marks.
- 3. Use of BIS 1343 is allowed.
- 4. Assume suitable data if required.
- Design a post-tensioned symmetrical I-section for an effective span of 35 m to support an superimposed load of 6 kN/m and deaH load of 2 kN/m (excluding self weight). Concrete cube strength = 50 N/mm2, Tensile strength of concrete = 1.7 N/mm2, Ec = 38 kN/mm2, loss ratio = 0.8

Permissible stresses :

At transfer : Compressive stress = 15 N/mm2, Tensile stress = 1 N/mm2

At working : Compressive stress = 17 N/mm2, Tensile stress = 0

8 mm high tensile wires having an ultimate tensile strength of 1600 N/mm2 are available for use. Design the beam and check the safety against deflection only.

- 2. A flat slab, 10 m by 8 m in overall size is supported by 4 columns which are so placed as to form a symmetrical grid of 8m by 6m with cantilever of lm on all sides. The imposed load on the slab is 1.5 kN/m2. Prestressing cables consisting of four wires of 4mm diameter and stressed to 1000 N/mm2 are available for the use. Design the number of cables required and indicate their arrangement in the two principal directions. A post tensioned bonded prestressed
- 3. beam of rectangular section 500 mm wide by 650mm deep, is subjected to a service load B.M of 180 kNm, torsional moment of 45.5 kNm, and shear force of 66.5 kN. The section has an effective prestressing force 550 kN at an eccentricity of 150 mm, provided by 5 bars of 12.5 mm stress -relieved strands of cross sectional area 505 mm2 with an ultimate tensile stress of 1820 N/mm2. If cube strength of concrete is 40 N/mm2, design the longitudinal and transverse reinforcement in the beam using skew-bending theory.
- 4. The deck slab of road bridge of span 12m is to be designed as one way slab with parallel post tensioned cables. Force in each cable at transfer is 600KN. If the slab is required to support L.L=30 KN/m2 with compressive and tensile stresses in concrete at any stage not to exceed 14 and 0 MPa respectively. Find the maximum horizontal spacing of cables and its position at mid span. Consider loss ratio as 0.75.

- 5. Design a suitable section for a tie member of a truss to support maximum design force of 550KN. The permissible compressive stress in the concrete is 15 MPa and no tension is permitted at working load. The loss ratio is 0.8. 7mm dia. Wires of ultimate strength 1700 N/mm2 with an initial stress of 950 N/mm2 may be used. The direct tensile strength of concrete is 3mPa.
- 6. The end block of PC beam rectangular in section 130 × 350 deep. The prestressing force of 280KN is transmitting to the concrete by a distribution plate 25 mm wide & 75mm deep, concentrically located at the ends. Calculate the position and magnitude of maximum tensile stresses on the horizontal section through the center of the end block using Guyon's method. Compute the bursting tension on these horizontal planes and required reinforcement for the same. Consider the following data :

Dist. ratio I	Position of zero stress I	Position of max stress	Ratio of max. stress to avg. stress
0.2	0.14	0.30	0.36
0.3	0.16	0.36	0.33
0.4	0.18	0.39	0.27

7. Explain the following :

a) Comparison between prestressed and reinforced concrete.

- b) Which are various systems of prestressing? Explain any one in detail.
- c) How the losses in prestress are broadly classified? Enumerate the losses in pre & post tensioning.
- d) Explain the concept of kern point and kern zone in PSC section
- 8. A prestressed concrete I-beam has its upper flange 750 × 200mm deep, lower flange 400mm wide and 300mm deep and web of depth 500mm and width 150mm. It is supported over a span of 30m and carries a udl of 4 KN/m exclusive of self wt., it is prestressed with 120 wires of 5mm dia with their centroid located at 100mm above the bottom edge and initially tensioned to IKN/mm2. Assuming 15% losses in the prestress, determine the extreme fiber stresses at mid span at various stages.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.