M.E. Second Semester (Civil (Structural Engineering)) (New - CGS)

13094 : Design of Prestressed Concrete Structure : 2 SFSE 4

P. Pages : 2 | AU - 3452

Time : Four Hours | Max. Marks : 80

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Notes :
1. Answer **two** question from Section A and **two** question from Section B.
2. Due credit will be given to neatness and adequate dimensions.
3. I.S.I. Hand book for structural Steel section, I.S. Code 800/1962 or 1964, I.S. 456 (Revised) I.S. 875 may be consulted.
4. I.S.I. Hand book IS 1343, I.S. 3370, I.S. 1678 and I.S. 784 may be consulted.
5. Use of pen Blue/Black ink/refill only for writing the answer book.
6. Illustrate your answers wherever necessary with the help of neat sketches.

SECTION - A

1. a) State assumption made in the Design of prestressed concrete member. 4

   b) A pre-tensioned concrete beam of 300×600 mm c/s is stressed by $20-8\phi$ wires located at 300 mm below the centre line of the section. If the characteristic strength of concrete is $50\,N/mm^2$ & $fp = 1450\,N/mm^2$. Calculate the ultimate moment of resistance of section. 8

   c) A rectangular beam of 300 mm × 400 mm c/s is pre-stressed by means of 18 wires of 6ϕ located at 70 mm from bottom and 2 wires of 6ϕ located at 25 mm from top. Assuming the residual prestressed in steel as $840\,N/mm^2$. Calculate the extreme fibre stresses for the mid - span, section. The simply supported beam is 6 m long and supports an imposed load of 5 kN/m (excluding self-weight). 8

2. a) The end block of post - tensioned beam is 600 mm × 1200 mm deep. Two cables, each comprising $55-8\phi$ high tensile wires carrying a force of 2900 kN are anchored using 300×300 size anchor plates. The plates centres are located symmetrically at 300 mm from top and 300 mm from bottom edge of the beam. Using I.S. code recommendation design suitable reinforcement in the end blook using Fe - 415 grade steel. Also check for bearing stresses if the concrete grade is M : 50. 14

   b) Define 'Transmission length' & explain in brief the concept of transfer bond in pre - tensioned concrete. 6

3. a) A 10 m span pre-stress concrete beam of uniform rectangular c/s supports total imposed load of 250 kN (excluding self weight) which is uniformly spread over the span. Design for M : 40 grade concrete, if the effective pre - stress in tendons is $1100\,N/mm^2$. Assume TYPE 1 structure. Only basic design for flexure is required. Check for shear and ultimate load is not necessary. Draw detail, including un-tensioned steel. 14

   b) State advantages in using precast prestressed units in association with the in situ concrete. 6

SECTION - B

4. A pre-stressed concrete circular pipe of 1000 mm internal dia is required to carry water at working pressure of $1.5\,N/mm^2$. Length of each pipe is 6 m. Concrete grade is M : 50. Use 5ϕ wires having $f_s = 1000\,N/mm^2$ for circular pre-stressing. Residual compressive stress must be $2\,N/mm^2$. Take losses = 20%. Design as per I.S. : 784. Draw detail. **20**

5. An electric line pole is 8 m in length and is subjected to 1800 N wind force at a height 6.5 m above G.L. The pole projects 0.3 m above the level of wires and embedded 1.2 m into the ground. Design the pre tensioned pole such that it can withstand. 1800 N wind force on the wires and 450 N force along with direction of wires. **20**

Take : $f_{ck} = 40\,MPa$ and $f_p = 1600\,MPa$.

Design the pole as a TYPE I structure.

6. Design a post - tensioned pre - stressed concrete girder, simply supported at its ends for the following data : **20**

i) Effective Span = 20 m
ii) Superimposed D.L. = 25 kN/m (excluding self-weight)
iii) Superimposed L.L = 18 kN/m
iv) Concrete grade M : 40
v) Losses = 15%
vi) Assume TYPE 3 structure
vii) $f_p = 1500\,N/mm^2$

Design an I - section and check it for limit state of flexure alone. Draw detail. End block design is not necessary.

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