AQ–2914

Faculty of Engineering & Technology

M.E. Civil (Structural Engg.) Sem–II (F.T.) (New–CGS)

DESIGN OF PRESTRESSED CONCRETE STRUCTURE

Paper—2 SFSE 4

Sections—A & B

Time : Four Hours] [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) Answer **TWO** questions from Section A and **TWO** questions from Section B.

(2) Assume suitable data wherever necessary.

(3) Use of electronic calculators is permitted.

(4) I.S.I. Hand book IS : 1343, IS : 3370, IS : 1678 & IS: 784 may be consulted.

(5) Use pen of Blue/Black ink/refill only for writing the answer book.

SECTION—A

1. (a) Make a comparison between pre-tensioned & post-tensioned concrete. 4

(b) A pre-tensioned concrete beam of 150*340mm c/s is concentrically pre-stressed by 10-5ϕ wires; five on each face. If the characteristic strength of concrete is 50 N/mm^2 & if f_p = 1600 N/mm^2, calculate the ultimate moment of resistance of the section in both directions. Assume a clear cover of 20 mm.

Assume 30% losses.

Also, check the ultimate shear resistance of the uncracked section in its stronger direction if Vu = 10 k N.

Check the crack width by using Beeby & Taylors or the IS Code formula by assuming the member to be Type–III. 10

(c) A symmetrical I-section is 900 mm deep & 300 mm wide. Both the flanges are 150 deep whereas the web is 100 thick. The beam carries an imposed load of 12 kN/m throughout.

(Contd.)

It is pre-stressed by using 4 nos. 12/5 standard Fryssinet cables with an initial pre-stress of 1000 N/mm^2 . Cables are straight & are placed at an eccentricity of 200mm from beam centre. The 16m span simply supported beam is a TYPE I structure. Calculate the final stresses at top & bottom at mid span by taking 15% losses. 6

2. (a) Define "Transmission length". 2

(b) The end block of a post-tensioned beam is 250mm*750mm deep. Two cables, carrying an effective force of 800 kN each, are anchored using 150*275 size anchor plates. The plate centres are located symmetrically from top & bottom edge of the beam. Using IS code recommendations, design suitable reinforcement in the end block using Fe-415 grade steel. The jacking force can be taken 20% higher. Also check for bearing stresses if the concrete grade is M : 50. 14

(c) Enlist factors affecting the deflection of a pre-stressed concrete beam. 4

3. (a) A 14m span pre-stress concrete beam of uniform rectangular c/s supports total imposed load of 240kN (excluding self-weight) which is uniformly spread over the span. Design for M : 50 grade concrete, if the effective pre-stress in tendons is 1100 N/mm^2. Assume TYPE I structure. Only basic design for flexure is required. Check for shear & ultimate load is not necessary. Draw detail, including un-tensioned steel. 10

(b) A two span continuous pre-stressed concrete beam ABC comprises of two identical spans of 15m each. Supports A & C are roller supports. The beam c.s is 250mm*600mm throughout. The cable carrying an effective pre-stressing force of 500kN is parallel to the axis of the beam & located at an eccentricity of 200mm.

(i) Determine the secondary & resultant moment developed at the mid support B.

(ii) If the beam supports an imposed load of 2.4 kN/m, calculate the resultant stresses developed at the top & bottom of the beam at B. Also calculate the resultant line of thrust. 10

SECTION—B

4. Design a 45 lac litre circular water tank having rigid base. The base slab rests over firm ground. Concrete grade is M : 55. Take D/H = @4 for the tank. Use wires having f_p = 1400 N/mm^2 for circular pre-stressing. Use 12×7ϕ standard Freyssinet cables having f_p = 1400 N/mm^2 for vertical pre-stressing. Take losses = 22%. Draw detail. 20

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

1. Effective span = 14m
2. Superimposed D.L. = 25kN/m excluding self-weight
3. Superimposed L.L. = 20kN/m

4. Concrete grade M : 45
5. Losses = 18%
6. Assume TYPE 3 structure
7. f_p = 1500 N/mm²

Design an I-section for limit state of flexure alone. Draw detail. End block design is not necessary. 20

6. (a) What are the advantages & disadvantages of pre-stressed concrete poles ? 4

(b) Check the design of a standard Indian railways monoblock sleeper as per the specifications of RDSO. Sleeper c/s just below the rail (& at centre) is shown in Fig Q6. Maximum service moment at that location can be taken as 12.77 kN-m sagging whereas the ultimate shear force under the wheel can be taken as 75 kN. The following data is to be noted :

1. Concrete grade M : 52.5
2. f_p = 1850 N/mm²
3. 35% losses
4. TYPE II Structure

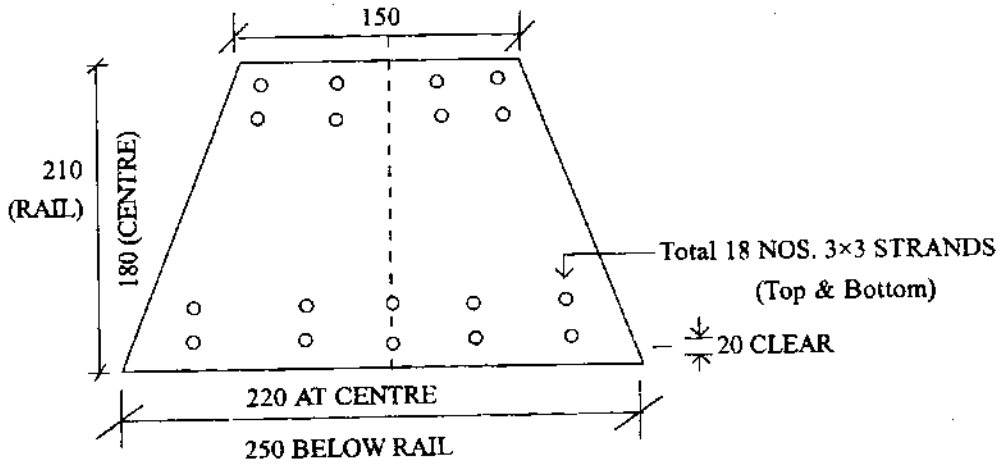

Fig. Q6

16