ACHARYA INSTITUTE OF TECHNOLOGY
Bangalore - 560090

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10CT72

Seventh Semester B.E. Degree Examination, Dec.2016/Jan.2017
Design of Structures (Steel and PSC)

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting TWO question from each part.*
2. Use of IS 800 –P6 or steel tables and IS 1343 are permitted.

PART – A

1 a. Discuss the various loads and load combinations acting on a steel structures as per IS – standards. **(10 Marks)**

b. Bring out the advantages and disadvantages of steel structures. **(10 Marks)**

2 a. What are the advantages of bolted connection? **(05 Marks)**

b. Design a bolted connection between the flange of a column ISHB – 450 @ 907 N/m and a bracket plate 15 mm thickness. The bracket plate is supporting a load of 150 kN at an eccentricity of 350 mm. Adopt HSFG bolts of property class 8·8 (Assume any missing data required) **(15 Marks)**

3 a. Explain any three types of welds, with neat sketches. **(06 Marks)**

b. A bracket plate is used to transfer the reaction of a beam to a column flange as shown in Fig. Q3(b). A fillet weld of 6 mm is used to connect the plate and column flange. Find the maximum load that can be taken by the bracket connection at an eccentricity of 100 mm. **(14 Marks)**

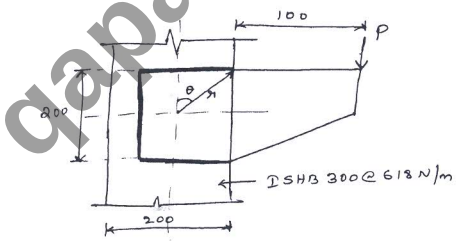

Fig. Q3(b)

4 a. Discuss the different types of tension members. **(06 Marks)**

b. Design a double angle section connected back to back with a gusset plate of 12 mm thick for discontinuous strut to carry a load of 200 kN. The length of the member is 3.5 m. **(14 Marks)**

PART – B

5 a. Discuss the evolution of pre-stressed concrete over last 50 years. **(10 Marks)**

b. Explain how pre – stressed concrete is different from reinforced cement concrete. **(10 Marks)**

6 a. Explain the Freyssinet hydraulic jack system of pre – tensioning, with a neat sketch. **(05 Marks)**

b. An unsymmetrical I – section beam is used to support an imposed load of 2 kN/m over a span of 8m. The sectional details are top flange, 300 mm wide and 60 mm thick ; bottom flange, 100 mm wide and 60 mm thick ; thickness of the web = 80 mm, overall depth of the beam = 400 mm. At the centre of the span, the effective pre-stressing force of 100 kN is located at 50 mm from the soffit of the beam. Estimate the stresses at the centre of span section of the bema for the following load conditions :

i) Pre-stress + self – weight
ii) Pre-stress + self weight + live load. **(15 Marks)**

7 a. A pre-tensioned, T-section has a flange which is 30 mm wide 200 mm thick. The rib is 150 mm wide by 350 mm deep. The effective depth of the cross-section is 500 mm. Given A_p = 200 mm^2, f_{ck} = 50 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate moment capacity of the T – section using IS code regulations. **(10 Marks)**

b. A post –tensioned bridge girder with unbonded tendons is of box section of overall dimensions 1200 mm wide by 1800 mm deep, with wall thickness of 150 mm. The high – tensile steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm. The effective pre-stress in steel after all losses is 1000 N/mm^2 and the effective span of the girder is 24 m. If f_{ck} = 40 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate flexural strength of the section. **(10 Marks)**

8 a. Explain the following losses in pre-stresses with relevant formulae :
i) Loss due to elastic deformation of concrete
ii) Loss due to shrinkage of concrete
iii) Loss due to creep of concrete
iv) Loss of stress due to friction. **(12 Marks)**

b. A rectangular concrete beam 300 × 200 mm, is pre-stressed by means of 15–5 mm dia wires located at 65 mm from bottom of beam and 3–5 mm wires located at 25 mm from top of the beam. If the wires are initially tensioned to a stress of 840 N/mm^2, calculate the percentage loss of steel immediately after transfer E_s = 210 kN/mm^2 and E_c = 31.5 kN/mm^2. **(08 Marks)**

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