B.E. (CE) Part-III 5th Semester Examination, 2007

Design of Structures-I

(CE-502)

Time : 3 hours   Full Marks : 100

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
The questions are of equal value.
Two marks are reserved for neatness in each half.
Assume any suitable data, not given.

FIRST HALF

1. A bracket is subjected to a load of 150 kN at a distance of 250 mm from the face of column flange. The bracket angle is connected to flange of column by 16 nos. 20 mm diameter p.d.s. rivets, arranged equally is two vertical columns, at a pitch of 60 mm c/c. Assume an edge distance of 40 mm. Check the safety of the rivetted connection joining the bracket angles 2-ISA-100-100-8 with column flange if rivets are COLD DRIVEN.

2. An ISHB 250 @ 54.7 kg/m with cover plates 300 mm x 20 mm is used as a column for supporting an all inclusive axial load of 1600 kN. Design a gusseted base and draw a detailed sketch for the same. Use 18 mm. diameter p.d.s. rivets, 16 mm gusset plate and ISA 150 x 115 x 12 angles for connection. Given, (i) bearing strength of concrete = 4 MPa, (ii) Properties of ISHB 250 are : $b_f = 250$ mm, $t_f = 9.7$ mm, $t_w = 8.8$ mm.

3. A built-up column consists of 2-ISMC 250 @ 30.4 kg/m placed back-to-back. Determine the maximum allowable load for the column if the channels are so placed as to give the column equal resistance to bending about either axis. The effective length of column is 4.5 m. Also, design a single LACING SYSTEM for this column. Take σ_{ac} (allowable) = 110 MPa for column and 60 MPa for lacing bars. Properties for 1-ISMC 250 are : a = 38.67 cm^2, I_{XX} = 3816.8 cm^4, I_{YY} = 219.1 cm^4, C_Y = 23 mm, g = 45 mm, r_{XX} = 9.94 cm, r_{YY} = 2.38 cm.

4. A plated beam, simply supported over a span of 10 m, consists of one ISMB 500 @ 86.9 kg/m with a cover plate 300 mm x 16 mm welded to each flange. The compression flange is unrestrained against lateral bending but restrained against torsion at ends. Assume width of support = 250 mm. Check whether it will be safe to place a u.d.l. of 50 kN/m on this beam. Given,
    i) For ISMB 500 : A = 110.74 cm^2, I_{XX} = 45218.3 cm^4, I_{YY} = 1369.8 cm^4, D = 500 mm, b_f = 180 mm, h_1 = 424 mm, t_w = 10.2 mm, t_f = 17.2 mm,