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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. - Civil Engineering

Semester End Examination; Dec. - 2015

Design of Steel Structures

Time: 3 hrs

Max. Marks: 100

Note: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.
ii) Use of IS Code 800 -2007 and Steel Table permitted.

PART - A

- 1 a. What do you mean by mechanism? List the various possible mechanisms. 7
- b. State the conditions to be satisfied for the plastic methods of analysis. 3
- c. A propped cantilever ABCD is loaded as shown in Fig. (1). Find the collapse load if the beam is of uniform cross section. 10
- 2 a. Explain the special considerations that are required in the steel design. 8
- b. A single-bolted double cover butt joint is used to connect two plates which are 8 mm thick. Assuming 16 mm diameter bolts of grade 4.6 and cover plates to be 6 mm thick, calculate the strength and efficiency of the joint, if the 4 bolts are provided in the bolt line at a pitch of 45 mm as shown in Fig. (2). 12
- 3 a. What do you mean by prying forces? Explain with a sketch. Also state the code provision for calculating prying forces. 6
- b. Design a bracket connection to transfer an end reaction of 225 kN due to factored loads as shown in Fig. (3). The end reaction from the girder acts at an eccentricity of 300 mm from the face of the column flange. Design bolted joint connecting the T. Flange with the column flange. Steel in grade Fe 410 and bolts of grade 4.6. 14
- 4 a. Explain the various defects in welds. 6
- b. A bracket plate 10 mm thick is used to transmit a reaction of 140 kN at an eccentricity of 100 mm from the column flange as shown in Fig. (4). Design (i) Groove weld (ii) Fillet weld. 14

PART - B

- 5 a. Explain the types of failure of a tension member. 6
- b. A single unequal angle 100 x 75 x 6 is connected to a 10 mm thick gusset plate at the ends with six-16 mm-diameter bolts to transfer tension as shown in Fig. (5). Assume that the yield and the ultimate stress of steel used are 250 MPa and 410 MPa. Determine the design tensile strength of the angle: 14
- (i) If the gusset is connected to the 100 mm leg
- (ii) If the gusset is connected to the 75 mm leg.

- 6 a. Explain the ways in which a compression member buckles when it is axially loaded. 6
- b. Design a double angle discontinuous strut to carry a factored load of 135 kN. The length of the strut is 3.0 m between intersections. The two angled are placed back to back (with long legs connected) and are tack bolted. Use steel of grade Fe 410, 14
- (i) Angles are placed on opposite sides of 12 mm gusset plate
- (ii) Angles are placed on same side of 12 mm gusset plate.
- 7 a. Draw a neat sketch of a slab base and gusseted base. 6
- b. A column ISHB 300 @ N/m is to support a factored load of 900 kN. The column section is to be spliced at a height of 2.5 m. Design the splice plate and connections using 4.6 grade bolts. Use Steel of grade Fe 410. 14
8. Design a simply supported beam of 7 m span carrying a reinforced concrete floor capable of providing lateral restraint to the top compression flange. The total udl is made up of 100 kN dead load including self weight plus 150 kN imposed load. In addition, the beam comes a point load at mid span made up of 50 kN dead load and 50 kN imposed load (assuming a stiff bearing length of 75 mm). 20




