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

(An Autonomous Institution affiliated to VTU, Belagavi)

Seventh Semester, B.E. - Civil Engineering

Semester End Examination; Jan. / Feb. - 2021

## Design of Steel Structures

Time: 3 hrs

Max. Marks: 100

**Note:** i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.

ii) Use of IS 800-2007 and steel tables are permitted.

iii) Missing data, if any, may suitably be assumed.

### UNIT - I

- 1 a. Explain briefly 'Limit state method' for design of structures. 6
- b. Explain the concept of Partial safety factors in design of steel structures. 6
- c. Explain the advantages and disadvantages of steel structures. 8
- 2 a. Explain briefly the different types of bolts with neat sketches. 8
- b. Calculate the strength of 20 mm diameter bolt of grade 4.6 for the following cases: 12
- i) Lap Joint                      ii) Single cover butt joint with a cover plate of 10 mm thickness
- The main plates to be joined are 12 mm thick and are made of Fe410 grade steel.

### UNIT - II

- 3 a. Explain any four modes of failure of bolted connections with neat sketches. 8
- b. Design the bolted bracket connection to support a factored load of 120 kN as shown in Fig. Q3(b). Use ordinary bolts of grade 4.6. The thickness of flange in column is 10.6 mm and that of bracket is 10 mm. The grade of structural steel is Fe410. Use M20 bolts. 12
- 4 a. List out different types of welding and explain any two with neat sketches. 8
- b. A 100 mm × 10 mm steel plate is to be welded to another plate 150 mm × 10 mm by fillet weld on three sides as shown in Fig. Q4(b). The size of weld is 6 mm and grade of steel is Fe410. 12
- Find the necessary overlap of the plate for full strength of the joint.

### UNIT - III

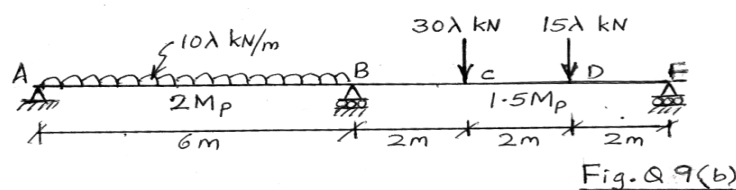
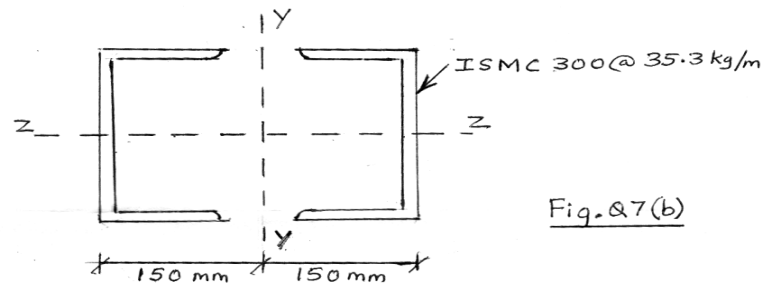
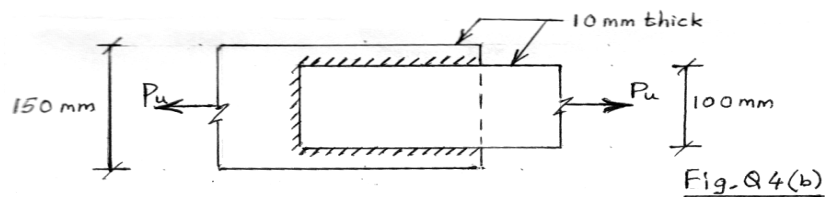
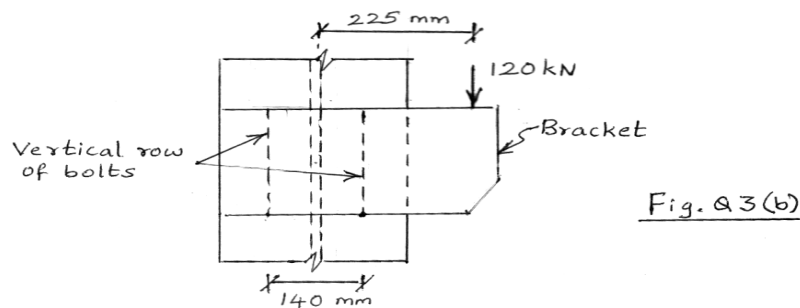
- 5 a. Explain the different modes of failure of tension members. 6
- b. Design a single angle tension member to carry a design tensile load of 400 kN. The gusset plate is 8 mm thick. Adopt 20 mm diameter black bolts for the connection. The length of the member is 2 m. 14
- 6 a. Define effective length of column. Discuss the effective length of column for various end conditions. 6
- b. Find the design compressive strength of column made of ISHB300@58.8 kg/m of length 5 m. Assume one end is fixed and the other end is hinged. The yield strength of material is 250 MPa. 14
- Take;  $E = 200$  GPa.

UNIT - IV

- 7 a. Explain Laced and Battered columns with neat sketches. 6
- b. Find the design compressive strength of the built up column shown in Fig. Q7(b), which comprises of two channel sections connected toe to toe using lacing system. The height of the column is 8 m. Take both ends as fixed. Assume  $f_y = 250$  MPa and  $E = 200$  GPa. 14
- 8 a. With neat sketch, briefly explain the components of a gusseted base. 4
- b. A column section ISHB300@577 N/m is carrying a factored axial load of 600 kN, factored moment of 30 kN-m and factored shear force of 60 kN. Design a suitable column splice. Assume the ends are milled. 16

UNIT - V

- 9 a. Explain the terms; i) Plastic hinge ii) Shape factor iii) Collapse mechanism. 6
- b. Determine the plastic moment capacity for the continuous beam shown in Fig. Q9(b). Take load factor  $\lambda = 1.7$ . 14
- 10. Design a simply supported beam for an effective span of 6 m subjected to a factored uniformly distributed load of 20 kN/m. The beam is laterally supported throughout. Apply the necessary checks. 20



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