Reg. No. : | E | N | G | G | T | R | E | E | . | C | O | M |

Question Paper Code : 50543

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Sixth Semester

Civil Engineering

CE 3601 – DESIGN OF STEEL STRUCTURAL ELEMENTS

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

- Use of IS 800-2007, IS 875 Part-I, II and III and Structural steel tables are permitted
- Unless otherwise specified use Fe410 grade steel and assume suitable data wherever necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between the pitch and gauge for a bolted joint.
2. List the advantages of a welded connection over a bolted connection.
3. Differentiate between gross section yielding and net section rupture.
4. Why are unequal angles preferred in gusset base designs?
5. State the assumptions made in the analysis of laterally unrestrained beams.
6. Why intermediate stiffeners are necessary for a plate girder?
7. Draw a neat sketch of a steel roof truss and indicate the components.
8. List the load combinations used when designing the roof truss.
9. Define the shape factor.
10. What is meant by plastic hinge?

PART B — (5 × 13 = 65 marks)

11. (a) A tension member of a truss is subjected to factored tension of 750 kN. It consists of a channel ISMC 350 @ 413 N/m has to be connected to a 10 mm thick gusset plate. The overlap length of the member with the gusset plate is limited to 300 mm. Design the fillet welded connection, assuming site welding.

Or

(b) Determine the safe load and efficiency of a double cover butt joint. The main plates are 12 mm thick connected by the 18 mm diameter bolts at a pitch of 100 mm. Design the cover plate also. What is the percentage reduction in the efficiency of the joint if the plates are lap jointed?

12. (a) A column consisting of ISHB 400 carries a factored axial load of 870 kN in the plane of the web. Design a slab base for the column. The grade of concrete pedestal under the base plate is M25. Provide the welded connection between the column and base plate.

Or

(b) (i) Brief about shear lag effect in the flanged sections with examples. (5)

(ii) Determine the design axial load capacity of the column ISHB 300 @ 577 N/m, if the length of the column is 3.2 m and it's both ends pinned. (8)

13. (a) A welded plate girder has to be designed for a superimposed load (inclusive of dead load) of factored intensity 60 kN/m for a simply supported span of 18 m. Design the girder with a provision of intermediate stiffeners. The compression flange of the girder is laterally restrained throughout.

Or

(b) Design a simply supported beam of effective span 9 m, carrying a total factored load of 50 kN/m throughout the length of beam. The depth of the beam should not exceed 500 mm. The compression flange of the beam is laterally supported by floor construction. Assume stiff end bearing as 75 mm.

14. (a) Explain in detail the various steps involved in the analysis and design of a gantry girder.

Or

(b) Design a purlin for a roof truss having the following data: Span of the truss = 6 m, spacing of truss = 3m c/c, inclination of roof = 30°, spacing of purlin = 2 m c/c, wind pressure = 1.5 kN/m², Roof coverage = AC sheeting weighing 200 N/m². Provide a channel section for the purlin.

15. (a) Determine the shape factor and plastic moment capacity of a T section with a 100 mm × 12 mm flange and a 180 mm × 10 mm web. Assume yield stress as 250 MPa.

Or

(b) Determine the value of W at collapse for the portal frame shown in Figure. 1 below. Assume that the plastic moment of resistance (M_p) is same for all the members.

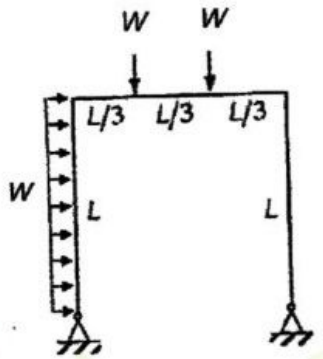

Figure. 1

PART C — (1 × 15 = 15 marks)

16. (a) Design a batten system for the column of 11.5 m long carrying an axial factored load of 1250 kN. The column may be assumed to be restrained in position not in direction at both the ends. Steel is of grade Fe 410 and bolts of grade 4.6. Assume the channels are placed back to back.

Or

(b) Design a bolted bracket connection to transfer a service end reaction of 90 kN at an eccentricity of 125 mm from the face of the column flange. Use 16 mm diameter bolts of grade 4.6. Steel is of grade Fe 410. (Figure. 2)

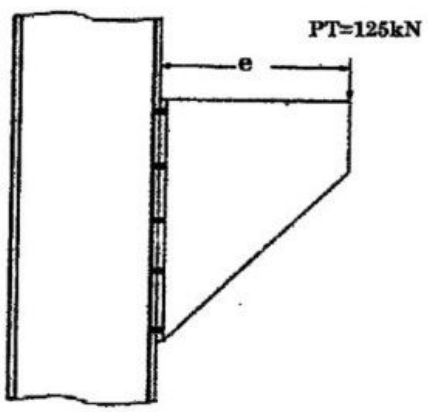

Figure. 2