Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 61351

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Second Semester

Structural Engineering

ST 4201 — ADVANCED STEEL STRUCTURES

(Regulations 2021)

Time : Three hours Maximum : 100 marks

(Use of relevant IS codes is permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by equivalent moment factor? Where it is used?
2. How is the spacing of purlins fixed?
3. Write about the end and edge distances and its limitations as per IS:800-2007?
4. Write the suitability of slab base and gusseted base.
5. What is the impact allowance specified in Indian Standards applied to the various forces transferred to the wheels of an EOT crane and HOT cranes?
6. When are bending moments to be considered in the design of the top chord of trusses?
7. Determine the shape factor for a circular hollow section.
8. How do you estimate the number of plastic hinges necessary to form a complete mechanism?
9. Write the geometric property of the corner portion of CFSS.
10. State the Q factors of CFSS and discuss, State the form factors Qa and Qs which are used in the design of CFSS and discuss.

PART B — (5 × 13 = 65 marks)

11. (a) Verify the adequacy of the beam-column section ISHB400 @ 806.38N/m and effective length 3.5m under the factored loads P-500kN and M_z = 95kN.m, m for its overall member strength alone.

Or

(b) Design a channel purlin for a fink type of rolled steel roof truss for DL and WL combination and detail the arrangement of purlin with the neat sketch using the following data:

(i)	Span of the truss	–	15m
(ii)	Spacing of roof truss	–	4.5m
(iii)	Spacing of purlin along the sloping length	–	1.7m
(iv)	Pitch of the roof	–	¼ of the span
(v)	Weight of sheeting	–	0.131 kN/m^2
(vi)	Wind intensity normal to roof	–	1.5 kN/m^2
			[Suction nature]

12. (a) Design a gusseted base for a column built-up with rolled I section ISHB450 @ 87.2 with a flange plate of dimension 250mm × 15mm on each flange, carrying an axial load 2500kN. The column is expected to rest on a concrete pedestal M25 grade concrete. Use 20mm diameter bolts of grade 8.8 Use ISA 90 × 90 × 10mm as the cleat angle. Also sketch the gusseted base design details.

Or

(b) A beam ISLB © 56.9 kg/m carrying a total udl of 260kN over a span of 7.5m to is to be connected to the flange of steel stanchion ISHB 250 @ 51.0kg/m. An ISA 100 × 75 × 8mm is used as a top and seat angle in a connection. Use M16 grade 4.6 bolts. Check whether this connection angle is adequate. If inadequate provide a suitable connection.

13. (a) A fink-type roof truss is proposed to be constructed in an industrial town at Madurai. The pitch of the roof is 1/5 of the span and the span is 18 m. The trusses are spaced at 4 m c/c. Use G.I. sheeting. The height of the roof above 7 the ground level is 12 m. The maximum length of cladding is 30 m. Consider the permeability as medium and the topography of the site as flat. The configuration of the girder is given in Figure- 1. Estimate the dead load, live load and wind load acting on the truss considering the ISLC125 as purlin. Also, draw the loading diagram.

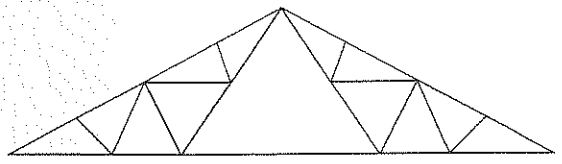

Figure 1

Or

(b) A gantry girder is provided for the mill building to carry an electric overhead travelling crane with the following data

(i)	Centre to centre distance between columns	–	8m
(ii)	Centre to centre distance between gantry girders	–	16m
(iii)	Crane capacity	–	250 kN
(iv)	Self weight of crab alone	–	30 kN

(v) Self weight of crane girder – 150 kN

(vi) Allowable approach of the crane hook from the vertical axis to the gantry girder is 1.2m.

(vii) Distance between the centre of wheels moving on the gantry girder and supporting the crane girder is 3.5m.

(viii) Weight of the rail section attached to the top of the gantry girder 0.3kN/m.

Determine the predominant vertical and horizontal bending moments and shear forces acting on the gantry.

14. (a) Determine the maximum plastic moment to ensure a minimum load factor of A=1.4 for the loaded continuous beam as shown in Figure-2 using the Mechanism method.

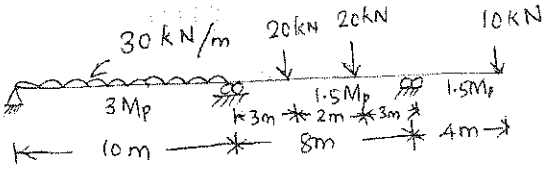

Figure 2

Or

(b) A Two bay single storey frame is shown in Figure-3 subjected to a system of loading as shown. Determine the critical plastic moment capacity and draw the mechanism diagram.

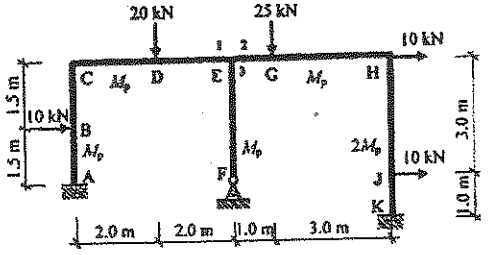

Figure 3

15. (a) Estimate the allowable bending moment of a hat section show in Figure 4, assuming steel grade as Fy is 2400 kgf/sq.cm. The compression flange is adequately laterally restrained.

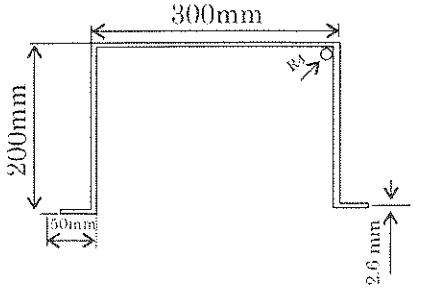

Figure 4

Or

(b) A channel section shown is Figure 5 is used as an axially loaded compression member having an effective length of 4.5m. If it is made of St-42-1079 steel [F_y = 2400 kg/mm², F = 1450 kg/mm²]. Predict the allowable load on the column.

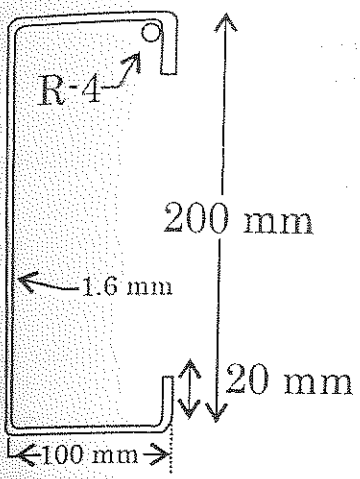

Figure 5

PART C — (1 × 15 = 15 marks)

16. (a) A corner column located in the bottom storey of a braced frame and subjected to factored loads of P-1200kN and Mz – 200kN-m and My – 100 kN –m. The unsupported length of the column is 3.4m. Design the member as a beam column, assuming Fe410 grade steel.

Or

(b) A frame having two bays with unequal storey height is subjected to a system of loading as shown in Figure-6. Determine the critical plastic moment and draw the mechanism diagram.

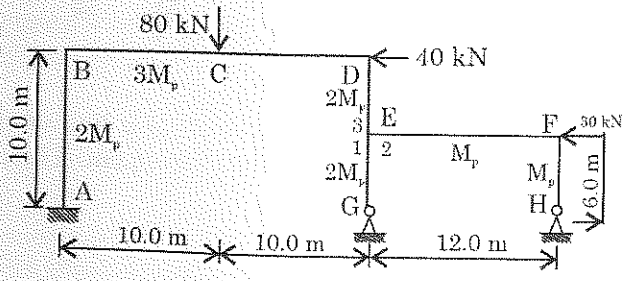

Figure 6