ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR/MAY 2024

CIVIL ENGINEERING
Sixth Semester
CE 5601 Design of Steel Structures
(Regulation 2019)

Instructions: 1. Use of IS 800-2007, IS875-Part 3 and SP 6(1) is permitted.

2. Relevant data may be suitably assumed if found necessary

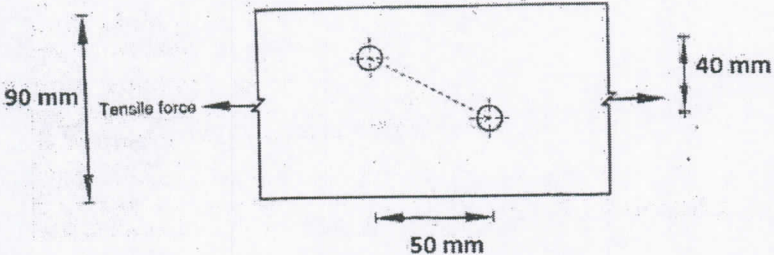Time: 3hrs   Max.Marks: 100

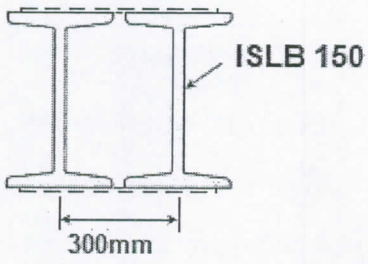| CO 1	Recognize the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths
CO 2	Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria
CO 3	Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams
CO 4	Identify and compute the design loads on Industrial structures, and gantry girder
CO 5	Find out ultimate load of steel beams and portal frames using plastic analysis

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)
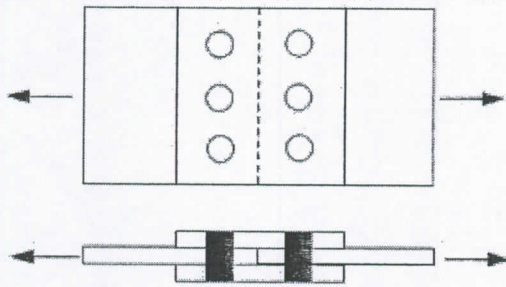
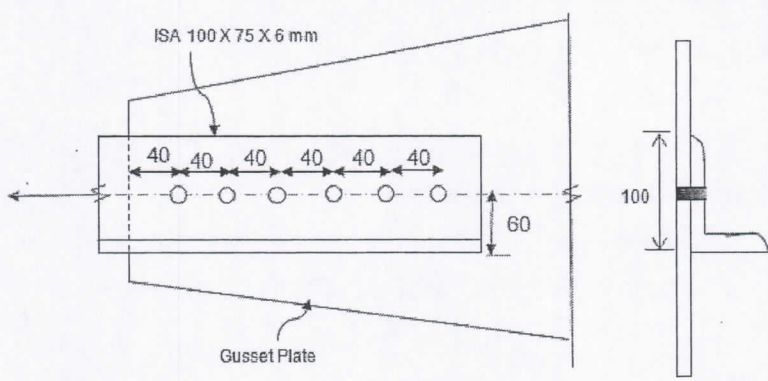## PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	With a neat sketch show a double bolted single cover butt joint.	2	1	L2
2	What is shear lag?	2	1	L2
3	Find the net area of the 16mm thick plate shown in Fig. Q3. The bolts are of 20mm dia. of grade 4.6 **Fig. Q3**	2	2	L1
4	The cross-section of a doubly laced column is shown in Fig. Q4. Find the thickness of the end tie plate.	2	2	L2

ISLB 150

300mm

Fig Q4

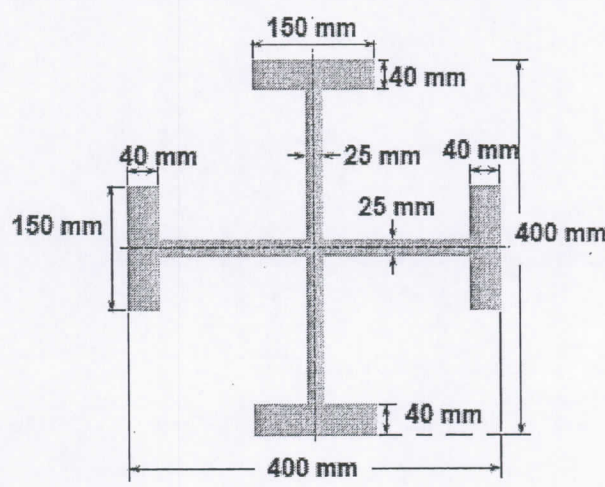| 5	Classify the section ISLC300.	2	3	L1
6	Write short notes on web buckling.	2	3	L2
7	List the loads acting on gantry girders.	2	4	L1
8	Give any two advantages of a pre-engineered building.	2	4	L2
9	What is upper bound theorem?	2	5	L1
10	Define shape factor.	2	5	L2

PART- B (5 x 13 = 65 Marks)
(Use steel plates of grade Fe410. Take fy = 250MPa)
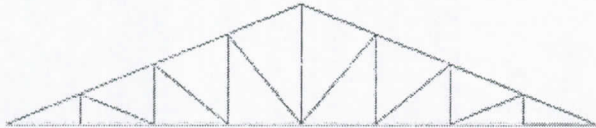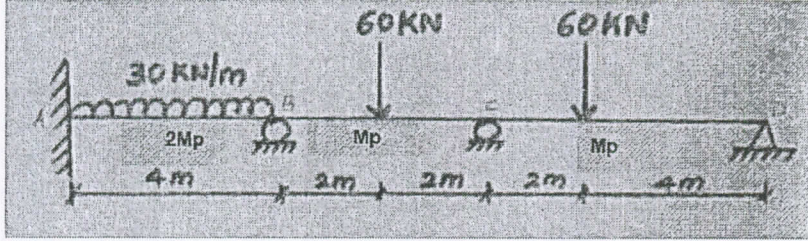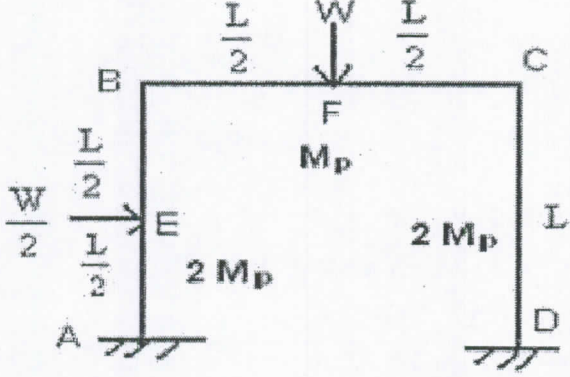
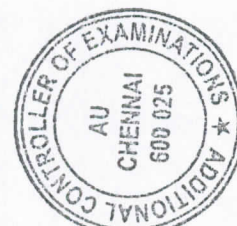| Q. No	Questions	Marks	CO	BL
11 (a)	A double cover butt joint is used to connect two plates which are 16mm thick. Assuming 22 mm diameter bolts of grade 5.6 and cover plates to be 10mm thick, calculate the strength and efficiency of the joint for the arrangement shown in Fig. Q11(a). **Fig. Q11(a)**	13	1	L4
OR				
11 (b)	A tie member ISA 100 x 100 x 10mm is welded to a 12mm thick gusset plate at site. Design the weld to transmit load equal to the design strength of the member. Provide weld on three sides.	13	1	L4
12 (a)	Find the tension capacity of the angle section shown in Fig.Q12(a). 20mm dia. Bolts of grade 4.6 are used.	13	2	L3

ISA 100 X 75 X 6 mm

40 40 40 40 40 40

100

60

Gusset Plate

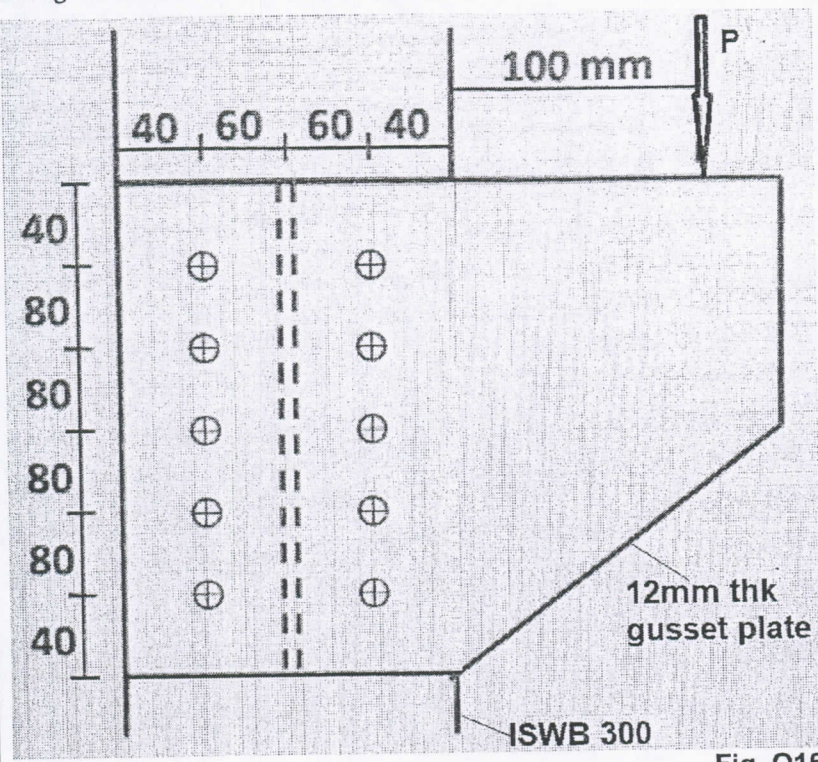**Fig. Q12(a)**

(All Dimensions are in mm)

| OR | | | | |

| 12 (b) | Determine the axial compressive capacity of the column shown in Fig. Q12 (b). The effective length of the column is 10m. | 13 | 2 | L3 |

150 mm

40 mm

40 mm — 25 mm — 40 mm

150 mm

25 mm

400 mm

40 mm

400 mm

Fig. Q12(b)

| 13 (a) | A simply supported beam of effective span 4m is subjected to a dead load udl of intensity 5kN/m and a live load udl of intensity 7kN/m. The beam is laterally restrained. Assume a bearing length of 100mm. Design the beam. | 13 | 3 | L3 |

| OR | | | | |

| 13 (b) | Find the moment and shear capacity of ISMB300. Take the laterally unrestrained span of the beam as 3m. | 13 | 3 | L3 |

| 14 (a) | Design a channel section purlin of span 3m subjected to an udl of 2.5kN/m along the major axis and 1.25 kN/m along the minor axis under service condition. Assume that the purlin is simply supported over the supports and no lateral buckling occurs. | 13 | 4 | L4 |

| OR | | | | |

| 14 (b) | Find the dead load and wind load at the nodes of the truss shown in Fig. Q14(b) to be built in Surat, Gujarat for an industry. Use the | 13 | 4 | L4 |

following data

Span of the truss	-18m
Pitch of the truss	- 1/6
C/c spacing of the truss	- 6m
Self weight of purlins	- 250 N/m^2
Height of columns	- 15m
Roofing and coverings	- AC sheets (170 N/m^2 dead load)
Terrain Category	- 3
Permeability	- Medium

Fig. 14(b)

15 (a)	Determine the plastic moment capacity of the beam loaded as shown in Fig. Q15(a). Use a load factor of 1.5.	13	5	L4

Fig. Q15(a)

OR

15 (b)	Determine the collapse load for the frame loaded as shown in Fig. Q15(b).	13	5	L4

Fig. Q15(b)

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	Determine the safe load P that can be carried by the joint shown in Fig. Q16. Use M16 bolts of grade 5.6.	15	2	L6

Fig. Q16

(All Dimensions are in mm)