B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E.   **Semester: VI**
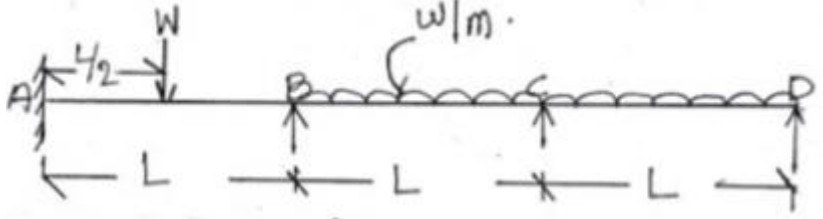
Branch: Civil Engineering   **Duration: 3 hrs.**

Course Code: 23CV6PCDSS   **Max Marks: 100**

Course: Design of Steel Structural Elements and Software Applications Lab

Instructions:
1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of IS 800-2007, SP 6(1) handbook/ Steel tables are permitted

<table>
<tr><td colspan="3" align="center">UNIT - I</td><td><i>CO</i></td><td><i>PO</i></td><td>Marks</td></tr>
<tr><td>1</td><td>a)</td><td>Explain briefly the loads and load combinations considered in the design of steel structures.</td><td><i>CO1</i></td><td></td><td>06</td></tr>
<tr><td></td><td>b)</td><td>Define shape factor and plastic moments with respect to steel sections</td><td><i>C01</i></td><td></td><td>04</td></tr>
<tr><td></td><td>c)</td><td>Evaluate the collapse load for the continuous beam shown in fig Q1.c

Fig Q1.c</td><td><i>CO1</i></td><td><i>P01, 2</i></td><td>10</td></tr>
<tr><td colspan="3" align="center">OR</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>a)</td><td>Explain the advantages and disadvantages of steel structures.</td><td><i>CO1</i></td><td></td><td>05</td></tr>
<tr><td></td><td>b)</td><td>Describe briefly the design considerations adopted in structural steel design with suitable sketches.</td><td><i>CO1</i></td><td></td><td>05</td></tr>
<tr><td></td><td>c)</td><td>Analyze the given continuous beam and determine the required value of plastic moment Mp to ensure a minimum load factor λ=1.7.</td><td><i>C01</i></td><td><i>PO2</i></td><td>10</td></tr>
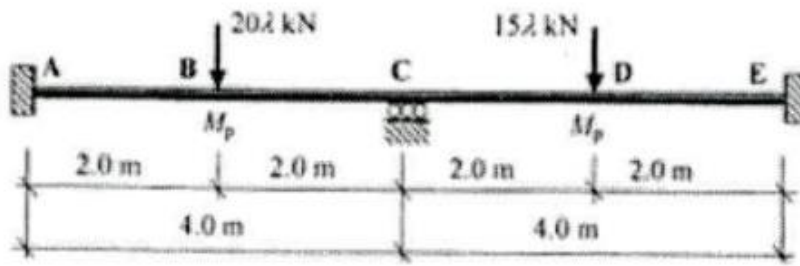</table>

Fig Q2.c

UNIT - II

3	a)	Compare welded connections with bolted connections.	CO1		06
	b)	A double cover butt joint is to be provided to connect two plates of unequal thickness 18 mm and 10 mm with cover plates of 6mm on either side of the plates to resist an axial working force of 400 kN. Assuming HSFG bolts of 20mm diameter and of grade 8.8, Kh = 1.0, μf = 0.3, design the joint. Width of each plate = 210 mm. Sketch the connection	CO1	PO1, PO3	14

OR

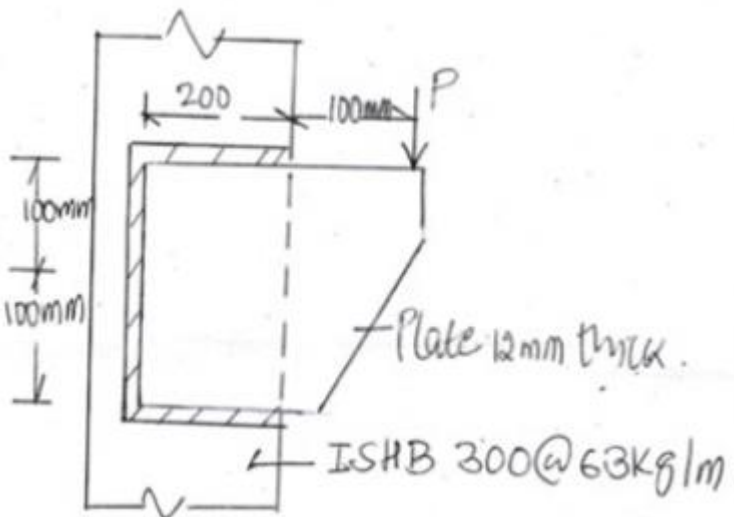| 4	a)	Describe the advantages and disadvantage of welded connections.	CO1		06
	b)	Evaluate the working load that can be resisted by the eccentric welded connection shown in fig Q.4b. Assume 8mm size fillet shop weld.	CO1	PO1, 2	14

Fig Q.4b

UNIT - III

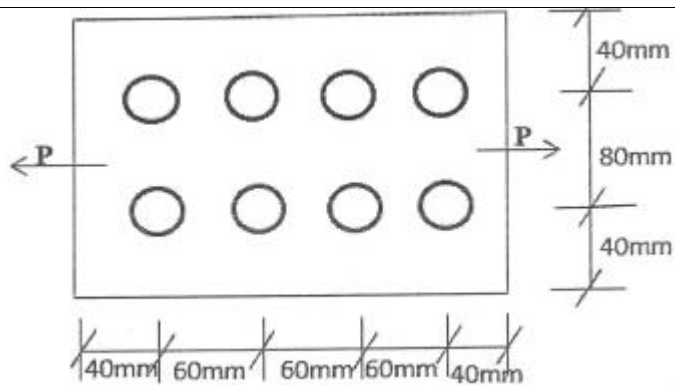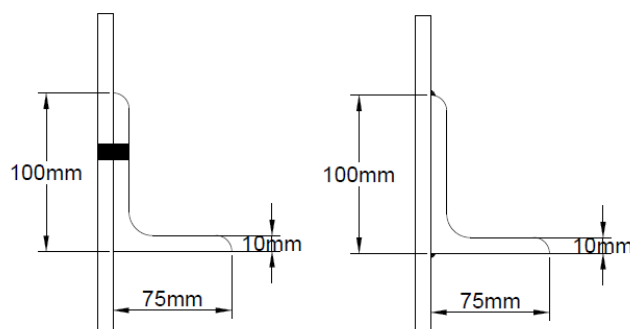| 5	a)	Describe the design principles of a tension member.	CO2		06
	b)	Evaluate the strength of the tension members shown in Fig Q.5b. Assume grade of material for the plate as Fe410 and thickness of plate as 8mm. Assume bolts of diameter 18mm and grade 4.6.	CO2	PO1, PO2	14

Fig Q.5b

		OR			

6	a)	Determine the tensile strength in net section rupture, of a roof truss member ISA100x75x10mm (f_y=260N/mm^2) connected to the gusset plate as shown in the fig Q6.a for the following cases of fasteners.
		
		    i) 20 mm diameter 4.6 grade bearing bolts in one row along the length of the member. The short leg of the angle is kept outstanding.
		
		    ii) 5mm fillet weld, shorter leg is outstanding.
		
		Grade of steel: Fe 410
		
		Fig Q.6a
			CO2	PO3	12

	b)	A single unequal angle ISA 100 x 75 x 8 is provided to a 10 mm thick gusset plate and the connection is through 6mm fillet weld with the longer leg of angle to the gusset plate. Assuming the yield strength of steel = 250 Mpa and ultimate strength of steel = 400 MPa and the length of connection = 300 mm, evaluate the strength of the tension member in block shear only. Steel grade is Fe 410	CO2	PO1, 2	08
		UNIT - IV			
7		Design a built-up compression member comprised of two channels placed toe to toe to resist an ultimate axial load of 1000 kN. The compression member is 10m long and is restrained in	CO2	PO3	20

			position and not in direction at each end. Also design a suitable lacing system for the column. Assume grade of steel as Fe410			
			OR			
	8	a)	Design a double unequal angle discontinuous strut to carry a load of 100 kN. The length of strut is 3.0m between intersections. The strut is connected with the longer legs on one side of 12mm thick gusset plate. Assume 20 mm Φ, 4.6 grade black bolts and Fe 410 steel.	*CO2*	*PO3*	**08**
		b)	Design a stanchion 5m long, in a building, subjected to a factored load of 5000 kN. Both the ends of the stanchion are effectively restrained in direction and position. Use additional plates if required. Grade of steel is Fe 410.	*CO2*	*PO3*	**12**
			UNIT - V			
	9	a)	The roof of a hall measuring 6 m x 9 m inner dimensions consist of 125 mm thick RC slab supported by steel I-beams at 3 m c/c parallel to the shorter side of the hall. Assuming the compression flange to be embedded in concrete, a live load of 2 kN/m^2 and a floor finish of 1kN/m^2, design an intermediate beam. The beams are supported by a 230 mm masonry wall all-round the hall. Assume grade of steel for the beam as Fe410	*CO2*	*PO3*	**14**
		b)	Differentiate between laterally supported and unsupported beams	*CO2*		**06**
			OR			
	10	a)	Evaluate the design bending strength of ISLB 350 @ 486 N/m considering the beam to be laterally unsupported. The span of beam is 4.0 meters and steel is of grade Fe410	*CO2*	*PO1, 2*	**14**
		b)	Describe web bucking and web crippling of steel beams.	*CO2*		**06**

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