

- Q.5 i. What is column bases? Write down type of **4** **2** **1, 12** **1** **1** column bases used in steel structure.
- ii. Design a slab base for 2 column section **6** **5** **1, 2, 3, 4, 5, 6,**
11, 12 **4** **1,**
consisting of one SC250 with two cover plates 300x250 mm carrying an axial load of 2500 kN. The safe bearing capacity of soil is 250 kN/m² and the permissible bearing pressure on concrete is 4000 kN/m².
- OR iii. Solve above numerical using Gusseted base for **6** **5** **1, 2, 3, 4, 5, 6,**
11, 12 **4** **1,**
the column.

- Q.6 Attempt any two:
- i. Describe truss and explain various component **5** **2** **1, 12** **1** **1** of the truss.
- ii. Write a detailed note on:
(a) Lug angle (b) Cleat angle
- iii. List out various types of trusses and write down **5** **2** **1, 12** **1** **1** application of each type.

*Total No. of Questions: 6**Total No. of Printed Pages: 4***Enrolment No.....****Faculty of Engineering****End Sem Examination Dec 2024****CE3CO31 Design of Steel Structures**

Programme: B.Tech.

Branch/Specialisation: CE

Maximum Marks: 60**Duration: 3 Hrs.**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning. Steel table are allowed. IS codes are allowed

- | Marks | BL | PO | CO | PSO |
|----------|----------|--------------|----------|----------|
| 1 | 1 | 1, 12 | 1 | 1 |
| 1 | 2 | 1, 12 | 1 | 1 |
| 1 | 1 | 1, 12 | 1 | 1 |
| 1 | 2 | 1, 12 | 1 | 1 |
| 1 | 2 | 1, 12 | 1 | 1 |
- Q.1 i. Which code is followed for the design of steel structures in India?
(a) IS 456 (b) IS 800
(c) IS 875 (d) IS 1893
- ii. Which of the following affects the efficiency of steel joints?
(a) Material type only
(b) Type of connection (riveted, bolted, welded)
(c) Temperature of the environment
(d) Thickness of paint on the surface
- iii. What does the plastic section modulus represent?
(a) Maximum elastic capacity of a section
(b) Bending strength beyond yield point
(c) Ultimate load-carrying capacity in tension
(d) Maximum deflection under bending
- iv. Lateral stability of beams can be improved by:
(a) Using riveted connections
(b) Increasing the moment of inertia
(c) Adding lateral bracing
(d) Reducing beam depth

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- v. Which of the following is a mode of failure in tension members? **1** 1 1, 12 1 1
 (a) Local buckling
 (b) Shear rupture
 (c) Elastic shortening
 (d) Lateral torsional buckling
- vi. Which parameter is essential for the design of a compression member? **1** 1 1, 12 1 1
 (a) Plastic modulus
 (b) Slenderness ratio
 (c) Bending moment
 (d) Sectional area only
- vii. Which type of column base is used to transfer large axial loads? **1** 1 1, 12 1 1
 (a) Gusseted base (b) Slab base
 (c) Hinged base (d) Continuous base
- viii. What is the primary purpose of lacing in compound columns? **1** 2 1, 12 1 1
 (a) To increase stiffness
 (b) To improve aesthetics
 (c) To reduce weight
 (d) To avoid welding
- ix. What is the role of purlins in roof trusses? **1** 1 1, 12 1 1
 (a) To support the roof covering
 (b) To prevent lateral buckling
 (c) To increase roof height
 (d) To provide drainage
- x. Which element is used to connect purlins to the roof truss? **1** 1 1, 12 1 1
 (a) Lug angle (b) Cleat angle
 (c) Gusset plate (d) Tie beam
- Q.2** i. What are the primary differences between riveted, bolted, and welded connections in steel structures? **3** 2 1, 12 1 1

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- ii. Explain the properties of structural steel and discuss the significance of different structural steel sections as per IS 800 standards. **7** 2 1, 12 1 1
 OR iii. Two plates 12 mm and 10 mm thick are to be joined by a double cover butt joint, assume cover plates of 8 mm thickness. Evaluate efficiency using M20 bolts of grade 4.6. **7** 3 1, 2, 3, 4 2 1
- Q.3** i. Define plastic section modulus and explain its significance in the design of laterally supported beams. **2** 2 1, 12 1 1
 ii. A simply supported steel beam with a span of 6 meters is subjected to a uniform load of 20 kN/m. Calculate the bending strength required for the beam and select a suitable section based on bending strength considerations. **8** 5 1, 2, 3, 4, 5, 6, 11, 12 4 1, 2
- OR iii. Design a laterally supported steel beam with a span of 8 meters, subjected to a central point load of 50 kN. Calculate the plastic section modulus needed to ensure that the beam can resist the applied load within the bending strength limit. Provide step-by-step calculations and suggest an appropriate beam section. **8** 5 1, 2, 3, 4, 5, 6, 11, 12 4 1, 2
- Q.4** i. What are the common modes of failure in tension members? How do they affect design considerations? **2** 2 1, 12 1 1
 ii. Design a tension member to carry a pull of 1000 kN. The member is 4 m long. Select suitable section, assume suitable data if required. **8** 5 1, 2, 3, 4, 5, 6 4 1, 2
- OR iii. A Single angle strut ISA 50x50x6 mm of a roof truss is 1.00 m long. It is connected by one bolt at each end. Determine the safe load this strut can carry. **8** 5 1, 2, 3, 4, 5, 6, 11, 12

Marking Scheme
CE3CO31 Design of Steel Structure

Q.1	i)	Answer: b) IS 800	1	OR	iii	strength required for the beam and select a suitable section based on bending strength considerations. (4) each bending strength& suitable section	8
	ii)	Answer: b) Type of connection	1				
	iii)	Answer: b) Bending strength beyond yield point	1				
	iv)	Answer: c) Adding lateral bracing	1				
	v)	Answer: b) Shear rupture	1		i.	Full marks for correct design	2
	vi)	Answer: b) Slenderness ratio	1		ii.	What are the common modes of failure in tension members, and how do they affect design considerations?	8
	vii)	Answer: a) Gusseted base	1			Design a tension splice to connect two plates of size 300x18 mm and 250x10 mm if the design load is 310 kN.	
	viii)	Answer: a) To increase stiffness	1			Full marks for correct design	
	ix)	Answer: a) To support the roof covering	1		iii.	A Single angle strut ISA 50x50x6 mm of a roof truss is 1.06m long. It is connected by one rivet at each end. Determine the safe load this strut can carry.	8
	x)	Answer: b) Cleat angle	1				
Q.2	i.	What are the primary differences between riveted, bolted, and welded connections in steel structures?	3	OR	i.	What is column bases and write there type of column bases used in steel structure 2 mark for each type	4
	ii	significance structural steel (3)	7		ii.	Design a slab base for 2 column section consisting of one SC250 with two cover plates 300x250 mm carrying an axial load of 2500 kN. The safe bearing capacity of soil is 250 kN/m ² and the permissible bearing pressure on concrete is 4000 kN/m ²	6
		Correct steel sections .(4)				Full marks for correct design	
OR	iii	Design a bolted connection for a steel joint under an eccentric load. Show the steps, assumptions, and calculations involved in determining the connection's efficiency. Each of Full marks for correct solution	7	OR	iii.	Solve above numerical using Gusseted base for the column	6
Q.3	i.	Define plastic section modulus and explain its significance in the design of laterally supported beams.	2	OR	i	1 mark for each component (5 marks)	5
	ii	Full marks for correct answer A simply supported steel beam with a span of 6 meters is subjected to a uniform load of 20 kN/m. Calculate the bending	8		ii	2.5 mark for each correct definition (5 marks)	5
					iii	1 mark for each truss application (5 marks)	5
