# GUJARAT TECHNOLOGICAL UNIVERSITY
### BE- SEMESTER–VII EXAMINATION – WINTER 2025

**Subject Code:3170618**  **Date:20-11-2025**

**Subject Name:Design of Steel Structures**

**Time:10:30 AM TO 01:00 PM**  **Total Marks:70**

**Instructions:**
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**
5. **Use of IS 800:2007, IS 1893, IS:875 and Steel table is permitted.**

|  |  |  | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | What are the advantages and disadvantages of steel as a structural material? | **03** |
|  | **(b)** | Why is a reduction of live loads done for the columns of multistory structures? | **04** |
|  | **(c)** | Derive the Resultant force in Bolted Bracket Connection Type I with neat sketches. | **07** |
| **Q.2** | **(a)** | Enlist various types of trusses used for truss girders. | **03** |
|  | **(b)** | Explain Lateral load due to Wind and Seismic as per I.S. Standard. | **04** |
|  | **(c)** | A fixed ended beam is subjected to load W at 1/3rd span as shown in **Fig. 1**. Evaluate the collapse load. | **07** |



**Fig.1**

**OR**

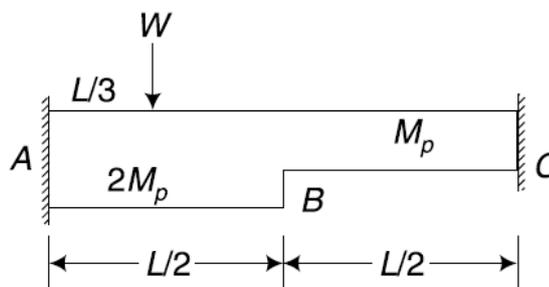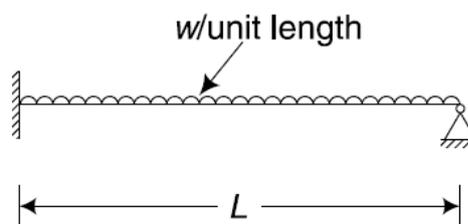| | | | |
|---|---|---|---|
| | **(c)** | Calculate the collapse load for a propped cantilever subjected to a uniformly distributed load w/unit length, as shown in **Fig. 2.** | **07** |



**Fig. 2**

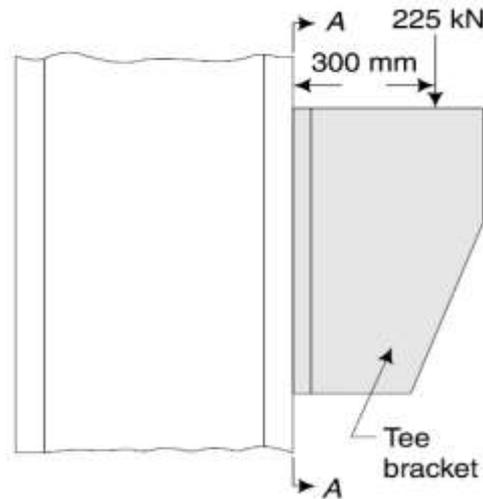| | | | |
|---|---|---|---|
| **Q.3** | **(a)** | Identify the three regions of idealised stress–strain curve of mild steel. Which of these regions is (are) used for limit state design? | **03** |
|  | **(b)** | Explain the design procedure of Plate Girder. | **04** |
|  | **(c)** | Design a bracket connection to transfer an end reaction of 225 kN due to factored loads as shown in **Fig. 3.** The end reaction from the girder acts at an eccentricity of 300 mm from the face of the column flange. Design bolted joint connecting the Tee-flange with the column flange. | **07** |

Steel is of grade Fe 410 and bolts of grade 4.6.



**Fig. 3**

**OR**

| | | | |
|---|---|---|---|
| **Q.3** | **(a)** | Differentiate between surge load and drag load as applied to gantry girders carrying cranes. | **03** |
| | **(b)** | Under what circumstances are stiffeners provided? | **04** |
| | **(c)** | Explain the design procedure for design of Gantry Girder? | **07** |

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | What are external and internal wind pressure co-efficient. Give codal provision for internal wind pressure co-efficient for a building. | **03** |
| | **(b)** | Why are end posts required in plate girders? | **04** |
| | **(c)** | Calculate the shape factor for equilateral triangle having base width 'b' and height 'h'. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | What are the components of Truss Girder Bridges? | **03** |
| | **(b)** | Calculate shape factor and plastic moment capacity of an ISMB 400 about y-y axis. | **04** |
| | **(c)** | Calculate the shape factor and plastic moment capacity of a tee section with a 100 X 12mm flange and 180 X 10mm web. Assume $f_y$ =250 MPa. | **07** |

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | What is a difference between beam and plate girder? | **03** |
| | **(b)** | Explain tension field theory method to calculate nominal shear strength of plate girder. | **04** |
| | **(c)** | Design a cross beam for steel foot bridge for the following data: Type of truss: warren type, Span: 21 m , Width of walk way: 4 m, Panel length = 3m, Flooring = RCC slab 125 mm thick. Live Load: 5 kN/m$^2$ & Floor Finish: 1.5kN/m$^2$. Assume self-weight of cross beam = 0.8 kN/m. Also carry out required checks. | **07** |

**OR**

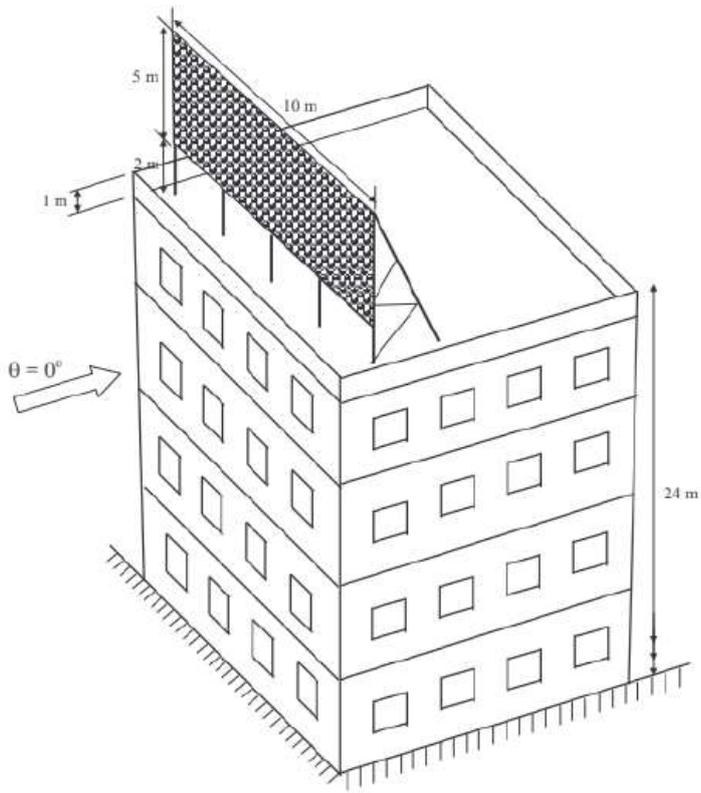| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Distinguish between elastic modulus and plastic modulus. | **03** |
| | **(b)** | Explain the following connections with neat sketches: beam to beam web angle connection, beam to column flange seat angle connection | **04** |
| | **(c)** | Calculate the design wind pressure and design forces on the hoarding 10 m long and 5m high (as shown in **Fig. 4**), to be fixed at the roof of a 24m high building in densely populated area of Ahmadabad. The base of the hoarding board is 2.0m above the roof level. | **07** |

5 m

10 m

2 m

1 m

θ = 0°

24 m

**Fig. 4**

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