Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3170618 Date:08/06/2022

Subject Name:Design of Steel Structures

Time:02:30 PM TO 05:00 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)**	In what sense the force due to wind and those produced by earthquake on structure are different?	**03**
	(b)	Derive the Resultant force in Bolted Bracket Connection Type II with neat sketches.	**04**
	(c)	Calculate the design wind pressure and design forces on the hoarding 10 m long and 5m high (as shown in Fig 1), to be fixed at the roof of a 24m high building near Connaught Palace, New Delhi. The base of the hoarding board is 2.0m above the roof level.	**07**

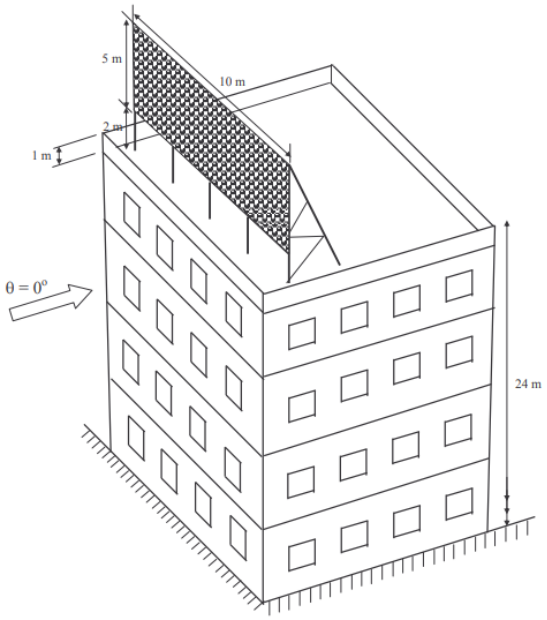

Fig 1

Q.2	**(a)**	Why is the plastic method of design more useful for redundant structures than the determinate structures?	**03**
	(b)	Evaluate the collapse load for the cantilever shown in Fig. 2.	**04**

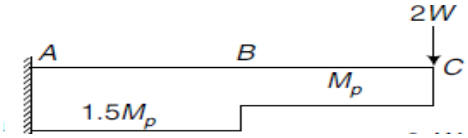

Fig 2

(c) Explain the Plastic Hinge concept. Obtain the length and profile of plastic hinge for simply supported beam subjected to a uniformly distributed load. **07**

OR

(c) A beam fixed at both the ends is subjected to uniformly distributed load W on its right half portion as shown in Fig. 3. Determine the collapse load if the beam has uniform cross section. **07**

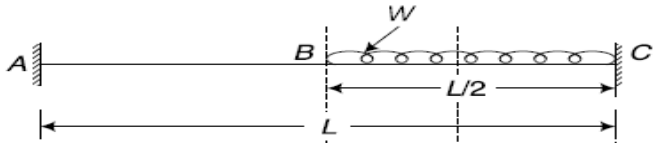

Fig 3

Q.3 **(a)** Differentiate between surge load and drag load as applied to gantry girders carrying cranes. **03**

(b) Explain the design procedure of Plate Girder. **04**

(c) Design a seat connection for a factored beam end reaction of 110 kN. The beam section is ISMB 250 @ 365.9 N/m connected to the flange of column section ISHB 200 @ 365.9 N/m using bolted connections. Steel is of grade Fe 410 and bolts of grade 4.6. **07**

OR

Q.3 **(a)** What are external and internal wind pressure co-efficient. Give codal provision for internal wind pressure co-efficient for a building. **03**

(b) What is diagonal tension field theory? How does pure tension field concept differ from incomplete tension field in plate girders? **04**

(c) Determine the safe load P that can be carried by the joint shown in **Fig. 4**. The bolts used are 20 mm diameter of grade 4.6. The thickness of the flange of I-section is 9.1 mm and that of bracket plate 10 mm. **07**

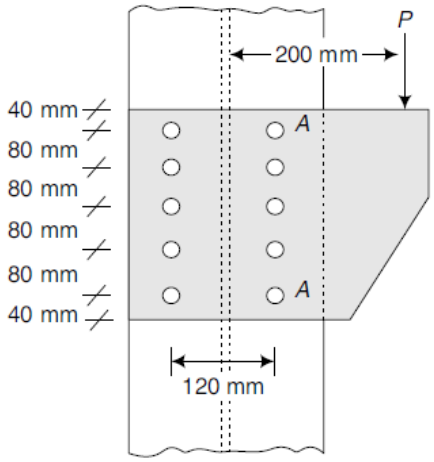

Fig 4

Q.4 **(a)** Explain the load factor, shape factor and collapse load. **03**

(b) What is a foot over bridge? What is the popular geometry of the foot over bridge? **04**

(c) Design a welded plate girder 24 m in span and laterally restrained throughout. It has to support a uniform load of 100 kN/m throughout the span exclusive of self-weight. Design the girder without intermediate transverse stiffeners. The steel for the flange and web plates is of grade Fe 410. Yield stress of steel may be **07**

assumed to be 250 MPa irrespective of the thickness of plates used. Design the cross section only.

OR

Q.4 A gantry girder is to be used in an industrial building carrying a manually operated overhead travelling crane, for the following data:

Crane capacity 200 kN; Self-weight of the crane girder excluding trolley 200 kN; Self-weight of the trolley, electric motor, hook, etc. 40 kN; Approximate minimum approach of the crane hook to the gantry girder 1.20 m; Wheel base 3.5 m; c/c distance between gantry rails 16 m;

c/c distance between columns (span of gantry girder) 8 m; Self-weight of rail section 300 N/m; Diameter of crane wheels 150 mm; Steel is of grade Fe 410.

(a) Evaluate the Maximum shear forces and lateral forces in gantry girder. **03**

(b) Evaluate the Maximum bending moment and suggest preliminary trial section for Gantry girder. **04**

(c) Apply the necessary serviceability design checks for suggested gantry girder for safe design. **07**

Q.5 **(a)** What are risk co-efficient, terrain factor and topography factor ? **03**

(b) Explain simple post critical method to evaluate shear strength of web of plate girder as per IS 800:2007 **04**

(c) Analysis a steel foot bridge for the following data: **07**

Type of truss: Pratt
Span: 35 m
Width of walk way: 3 m,
Truss height = 3.5 m
Flooring: RCC slab 120 mm with finishing 20 mm thick.
Live Load: 5 kN/m^2
Assume Suitable data if required .

OR

Q.5 **(a)** What are the components of Truss Girder Bridges? **03**

(b) Explain the following connections with neat sketches: beam to beam web angle connection, beam to column flange seat angle connection **04**

(c) A simply supported welded plate girder of span 25 m is subjected to service load of 60 kN/m UDL and two fixed point loads of 250 kN each spaced at 8.5 m from each supports. Design stiffener under concentrated load for plate girder. Apply curtailment of flanges. **07**

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