Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2021

Subject Code:3170618 Date:15/12/2021

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, SP 6 (1), IS: 875 (Part I to V) and IS: 1893 is permitted.**

Q.1	**(a)**	Enlist advantages and disadvantages of steel structures.	**03**
	(b)	Explain in brief various types of loads to be considered in the design of steel structure.	**04**
	(c)	A beam ISLB 350 is connected to a flange of column ISHB 400 to transmit end reaction of 175 kN due to factored loads. Design web angle connection using M 20 bolts of 4.6 grade and steel Fe 410.	**07**
Q.2	**(a)**	Explain simple post critical method to calculate nominal shear strength of girder.	**03**
	(b)	Write advantages and disadvantages of plate girders over steel trusses.	**04**
	(c)	The following data refers to a welded plate girder of span 18 m to carry superimposed load of 30 kN/m all over its span and two concentrated loads of 150 kN each at 4.5 m from each end. Assume Self weight of girder = 8 kN/m. Avoid use of bearing and intermediate stiffeners. Use Fe 415 (E250) steel. find out 1. Moment and shear force 2. Depth of web plate. 3. Selection of Flange. 4. Check for moment capacity of the girder. 5. Shear resistance of web.	**07**
		OR	
	(c)	Design a section for welded plate girder for span of 22 m. The girder is laterally restrained throughout and carrying U.D.L. of 44 kN/m (including self-weight) over the entire span with two point loads 170 kN at 5 m from each support. Connections and stiffener's design are not required.	**07**
Q.3	**(a)**	Enlist various types of trusses used for truss girders.	**03**
	(b)	Draw neat sketch of transversely stiffened welded plate girder and show its elements.	**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.3	**(a)**	Differentiate between deck and through type truss bridge.	**03**
	(b)	Design a cross beam for a steel foot bridge with the following data: Type of truss: N-type Span: 24 m with 8 panel	**04**

Width of walk way: 4 m
Truss height = 3 m
Flooring: RCC slab 110 mm thick.
Live Load: 5 kN/m^2
Floor Finish: 0.75 kN/m^2
Assume Suitable data if required

(c) Design top chord members for above problem of foot over bridge (or Q.3(b)). Assume self weight of truss = 0.7 kN/m. **07**

Q.4 **(a)** Distinguish between elastic modulus and plastic modulus. **03**

(b) Explain Lateral load due to Wind and Seismic as per I.S. Standard. **04**

(c) Calculate plastic moment of resistance for a fixed beam of span 10m loaded by a collapse U.D.L. of 30 kN/m over left 5m span and a collapse point load of 60 kN at 2.5 m from right support. **07**

OR

Q.4 **(a)** Define Shape Factor and Collapse load. Also write plastic section modulus of rectangular beam. **03**

(b) Calculate shape factor and plastic moment capacity of an ISMB 400 about y-y axis. **04**

(c) Design a suitable section for a two span continuous beam, each having a span of 6.0 m and supporting a dead load of 20 kN/m and live load of 25 kN/m by plastic design approach. **07**

Q.5 **(a)** Enlist and explain in brief about various loads acting on gantry girder. **03**

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

(c) Design a gantry girder considering following data: Crane capacity = 180 kN, self-weight of crane girder = 180 kN, self-weight of trolley = 30 kN distance between crane hook and the gantry girder = 1 m, wheel base = 3 m, c/c distance between gantry rails = 15 m, span of gantry girder = 6 m, self-weight of rail section = 280 N/m, diameter of crane wheels = 125 mm and self-weight of gantry = 1320 N/m. Checks for buckling and deflections are not required. Connections design is not required. Assume EOT type crane. **07**

OR

Q.5 **(a)** Draw neat sketch showing overhead crane system with gantry girder and other important components. **03**

(b) What is a foot over bridge? Write its application. **04**

(c) Provide a suitable section for following data for Gantry Girder . No need to carry out the checks. A simply supported gantry girder to carry two electric ally overhead crane travelling with following details. **07**

1.Crane capacity = 200 kN
2.Self weight of crane girder =200 kN
3.Wheel spacing =3.5 m
4.Weight of crab = 40 kN
5.Span of crane between rails = 15 m
6.Span of gantry girder = 7.5 m
7. Self weight of rail section= 300 N/m
8.Minimum hook approach =1.2 m
9.self weight of gantry = 1.6 kN/m
10.weight of rail = 300 N/m
11. Take yield stress of steel =250MPa.
Assume no lateral restraint along the span.

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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**

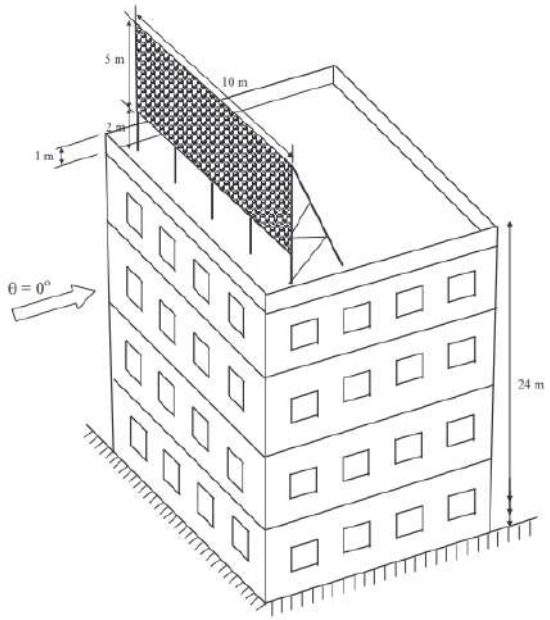

Fig 1

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**

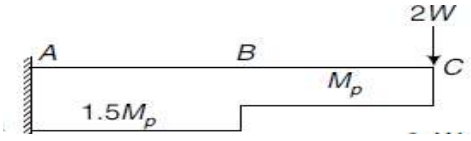

Fig 2

(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**

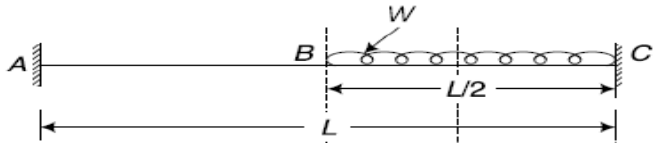

Fig 3

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**

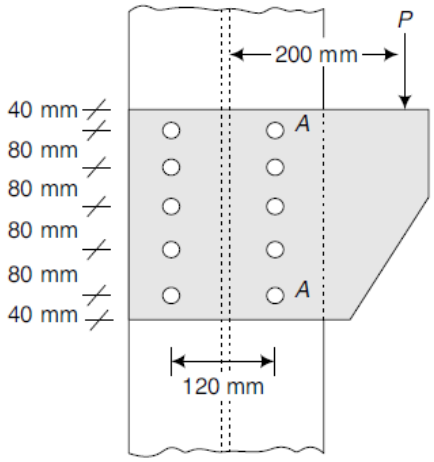

Fig 4

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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