Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3170618 Date:08-12-2023

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) and IS: 875 (Part I to V) is permitted.**

Q.1	**(a)**	Enlist various types of loads to act on a steel structure and discuss effect of wind load on steel structures.	**03**
	(b)	Enlist different types of connections and Draw neat sketch of bolted web and seat angle connection between to beams of different depths.	**04**
	(c)	Design an unstiffened welded seat angle connection between a beam ISMB 300 and column ISHB 250 for a beam reaction of 100 kN. Assume field weld and Fe 410 grade of steel.	**07**
Q.2	**(a)**	Differentiate between plate girder and Beam.	**03**
	(b)	What is tension field action? Explain with neat sketch: Tension field method for finding nominal shear strength of a web.	**04**
	(c)	The following data refers to a welded plate girder of span 21 m to carry u.d.l. of 25 kN/m (excluding self-weight) all over its span and two concentrated loads of 180 kN each at 5 m from each end. Assume Self weight of girder = 10 kN/m. Avoid use of bearing and intermediate stiffeners. Use Fe 415 steel. find out 1. Shear Force and Bending Moment 2. Size of web plate. 3. Size of Flange. 4. Check for moment capacity of flange. 5. Shear resistance of web.	**07**
		OR	
	(c)	Design a section for bolted plate girder for an effective span of 24 m. The girder is laterally restrained throughout and carrying factored U.D.L. of 60 kN/m (including self-weight) over the entire span with two factored point loads 400 kN at 8 m from each support. Connections and stiffener's design are not required.	**07**
Q.3	**(a)**	Write advantages of plate girder over trusses.	**03**
	(b)	Enlist various elements of plate girder and Draw neat sketch of transversely and longitudinally stiffened plate girder.	**04**
	(c)	Design a gantry girder considering following data: Crane capacity = 220 kN, self-weight of crane girder = 200 kN, self-weight of trolley = 30 kN distance between crane hook and the gantry girder = 1.2 m, wheel base = 3.2 m, c/c distance between gantry rails = 16 m, span of gantry girder = 8 m, self-weight of gantry girder = 1.6 kN/m, self-weight of rail section = 400 N/m. Checks for buckling and deflections are not required. Connections design is not required.	**07**
		OR	

Q.3 **(a)** Enlist various loads acting on gantry girder and Write codal criteria for additional impact allowances for crane girders. **03**

(b) Enlist various types of trusses used for truss girders. **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 electrically overhead crane travelling with following details. **07**

1.Crane capacity = 200 kN
2.Self weight of crane girder =180 kN
3.Wheel spacing =3.2 m
4.Weight of crab = 50 kN
5.Span of crane between rails = 16 m
6.Span of gantry girder = 8 m
7. min. spacing between cranes = 2m
8.Self weight of rail section= 500 N/m
9.Minimum hook approach =1.2 m
10. Take yield stress of steel =250MPa.
11. , self-weight of gantry girder = 1.5 kN/m

Q.4 **(a)** What is the meaning of foot over bridge? Write where it is useful. **03**

(b) Design a cross beam for a warren type steel foot bridge with the following data: **04**

Span: 18 m
Panel length : 3m
Width of walk way: 3.5 m
Truss height = 3 m
Flooring: RCC slab 125 mm thick.
Live Load: 5 kN/m^2
Floor Finish: 1 kN/m^2
Assume self-weight of girder = 625 N/m, Also assume Suitable data if required.

(c) Design top chord members for above problem of foot over bridge (**Q.4(b)**). Assume self-weight of truss = 780 N/m. **07**

OR

Q.4 **(a)** Differentiate between deck and through type truss bridge. **03**

(b) Design a cross beam for a steel foot bridge with the following data: **04**

Type of truss: N-type
Span: 18 m with 6 panel
Width of walk way: 3.5 m
Truss height = 3 m
Flooring: RCC slab 125 mm thick.
Live Load: 5 kN/m^2
Floor Finish: 1 kN/m^2
Assume self-weight of girder = 625 N/m, Also assume Suitable data if required.

(c) Design bottom chord members for above problem of foot over bridge (**or Q.4(b)**). Assume self-weight of truss = 780 N/m. **07**

Q.5 **(a)** Distinguish between working stress method and plastic design method. **03**

(b) What is plastic hinge? At which points plastic hinge is likely to form? **04**

(c) A continuous steel beam consists of three equal spans 6m each carries an u.d.l. of 75 kN/m under working conditions. Using plastic method, design the beam which shall consist of I-section without any flange plate. **07**

OR

Q.5	**(a)**	State the assumptions made in plastic design.	**03**
	(b)	Write advantages and disadvantages of plastic design method.	**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**

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