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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