Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3170618 Date:10-01-2023

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, IS 1893, IS:875, and Steel table is permitted.**
6. **Consider** Fy **= 250 N/mm^2 and Fu = 410 N/mm^2 if not mention.**

			MARKS
Q.1	**(a)**	Explain the light moment connection.	**03**
	(b)	Explain Lateral load due to Wind and Seismic as per I.S. Standard.	**04**
	(c)	A beam ISLB 300 is connected to a flange of column ISHB 300 to transmit an end reaction of 150 kN due to factored loads. Design web angle connection using M 20 bolts of 4.6 grade and steel Fe 415 (ISHB 300 – 63 kg).	**07**
Q.2	**(a)**	How would you generalize the plate girder? Explain the advantages and disadvantages of it.	**03**
	(b)	Explain pre -buckling and post-buckling behavior of the web plate.	**04**
	(c)	A simply supported welded plate girder of span 35 m that is subjected to a service load of 60 kN/m UDL and two fixed point loads of 350 kN each spaced at 9 m from each support. Design the plate girder and draw the cross section using the Fy 250 steel plates. Perform all necessary checks for cross-section as per IS code provisions. Design web slice for plate girder design at 10 m from the support using fillet weld.	**07**
		OR	
	(c)	Design a welded plate girder with a clear span of 16 m simply supported at the ends subjected to the following, 1. Dead load including self-weight= 34 kN/m 2. Imposed Load = 20 kN/m 3. Two Moving Loads = 250 kN each spaced 2 m apart Assume that the top compression flange of the plate girder is restrained laterally and prevented from rotating. Design as an unstiffened plate girder with thick webs.	**07**
Q.3	**(a)**	What is a footbridge? Explain the use of it.	**03**
	(b)	What is the popular geometry of the foot bridge?	**04**
	(c)	Design a steel foot-over bridge for the following. a) Span Of bridge = 18 m b) spacing of girder = 2.25 m c/c c) Flooring = RCC slab 115 mm Thick. d) Types of girder N-type truss. e) clear walking width between main girders 4.0 kN/m^2 Assume the Fy 415 and other data required	**07**
		OR	
Q.3	**(a)**	Enlist the advantages and disadvantages of steel structures.	**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 foot over bridge is of span 24 m and a pedestrian load of 4 kN/m^2. The clear distance between two trusses is 4.0 m and the truss height is 2.0m. Take the dead weight of the truss is 1.10 kN/m. Assume a suitable configuration of truss and design & detail a cross beam and a top chord near the center. **07**

Q.4 **(a)** Explain the Stress-Strain curve for mild steel with terminology. **03**

(b) Find the shape factor for the given section in figure 1. Also, find the fully plastic moment for the given section when Fy = 252 N/mm^2. **04**

(c) A two-span continuous beam ABC has span length AB = 8m and BC = 6m and carries a UDL of 30 kN/m completely covering the span AB and BC. Hence A and C are simple Supports shown in Figure 2. If the load factor is 1.8 and the shape factor is 1.15 for the 'I' Section, find the section modulus needed. Assume yield stress for the material as 250 N/mm^2. Also, design the continuous beam and suggest a section. **07**

OR

Q.4 **(a)** Explain the plastic bending of a beam with terminology **03**

(b) Explain the hinge length and assumptions made in plastic analysis in detail **04**

(c) Determine the collapse load for a propped cantilever with an eccentric point load. **07**

Q.5 **(a)** What is the difference between a gantry girder and a plate girder **03**

(b) Draw sketches for any two forms of Gantry girder. **04**

(c) Design a hand-operated traveling crane simply supported by a gantry girder for the given data: **07**

1. The span of the gantry girder = 5m.
2. The span of the crane girder = 15m
3. Crane capacity= 200 KN
4. Self-weight of crane girder excluding trolley = 200 KN
5. Self-weight of trolley = 30 KN
6. Minimum hook approach = 1m
7. Distance between wheels = 3.5m c/c
8. Self-weight of rails = 0.3 KN/m

OR

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

(b) Describe the design procedure steps for the Gantry girder. **04**

(c) Provide a suitable section for the following data for Gantry Girder. No need to carry out the checks. A simply supported gantry girder to carry two electrically overhead cranes traveling with the 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.

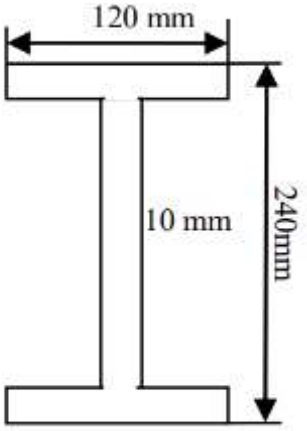

Figure 1

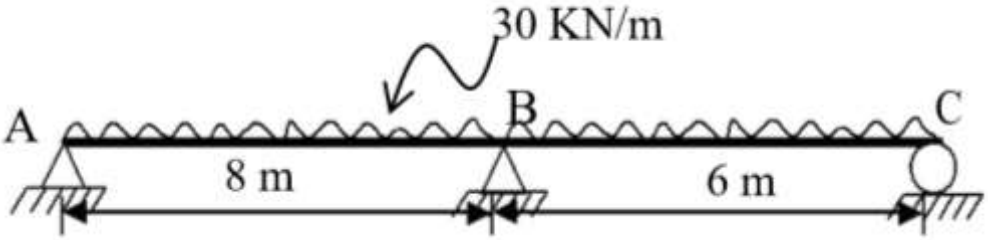

Figure 2

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