GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3170618   **Date:30-11-2024**
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:875 and Steel table is permitted.**

Q.1	**(a)**	List various types of loads to be considered in the design of steel structure with relevant IS code.	**03**
	(b)	Express the relation between basic wind speed and design wind speed. Briefly discuss various factors to be considered to obtain design wind speed as per IS: 875 -2015 (Part-3).	**04**
	(c)	Determine collapse load for beam loaded as shown in Fig.1.	**07**
Q.2	**(a)**	Derive formula for shape factor of circular section, with usual notations.	**03**
	(b)	Derive the collapse load for propped cantilever beam of length L, subjected to point load W kN at distance of L/3 from simple support.	**04**
	(c)	Design a seat connection for a factored beam end reaction of 120 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	
	(c)	Determine plastic moment capacity for given frame as shown in Fig-2	**07**
Q.3	**(a)**	Explain the Plastic Hinge concept. Obtain the length and profile of plastic hinge for simply supported beam subjected to a uniformly distributed load.	**07**
	(b)	Design a unstiffened seat connection for a factored beam end reaction of 210 kN. The beam section is ISMB 300 connected to the flange of column section ISHB 200 using bolted connections. Use steel grade Fe 410 and bolts of grade 4.6.	**07**
		OR	
Q.3	**(a)**	Enlist advantages and disadvantages of steel structures.	**03**
	(b)	Draw neat sketch of fully stiffened welded plate girder with all the elements.	**04**
	(c)	Design suitable section for unstiffened plate girder having span 20 m to carry superimposed load of 40 kN/m including self weight and two point loads 130 kN at 4 m from each the support. Check for stress and deflection criteria.	**07**
Q.4	**(a)**	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 180 kN at 5 m from each support.	**07**
	(b)	Design a vertical stiffener under concentrated load for Q.4 (a)	**07**
		OR	
Q.4	**(a)**	A gantry girder of 6.2m span is to be designed for crane capacity of 230 kN. The effective span of crane girder is 18 m. Weight of crane girder excluding crab is 200 kN and weight of crab is 60 kN. Take clearance as 1.1 m and wheel base as 3.0 m. Choose suitable section and check the bending stresses and deflection.	**14**

Q.5 **(a)** Enlist various components of foot over bridge   **03**

(b) Explain simple post critical method to calculate nominal shear strength of girder.   **04**

(c) Analysis a steel foot bridge for the following data: **07**
Type of truss: Pratt , Span: 30 m , Width of walk way: 2.5 m, Truss height = 3.0 m,
Flooring: RCC slab 120 mm with finishing 20 mm thick, Live Load: 4 kN/m^2 ,Assume
Suitable data if required .

OR

Q.5 **(a)** Design a cross beam of a steel foot over bridge for the following data and check for   **07**
the moment and shear capacity of cross girder:
(i) Type of truss: N-type (ii) Span: 24 m with 6 equal panels (iii) Width of walk way:
4 m (iv) Truss height = 4 m (v) Flooring: RCC slab 115 mm thick (vi) Live Load:
5.0 kN/m^2 (vii) Floor Finish: 0.75 kN/m^2 (viii) Self weight of cross beam = 0.5 kN/m.

(b) Design most heavily loaded top chord member of a through type steel foot over   **07**
bridge truss for the data given in Q.5 (a) above. Assume Rakers are provided at each
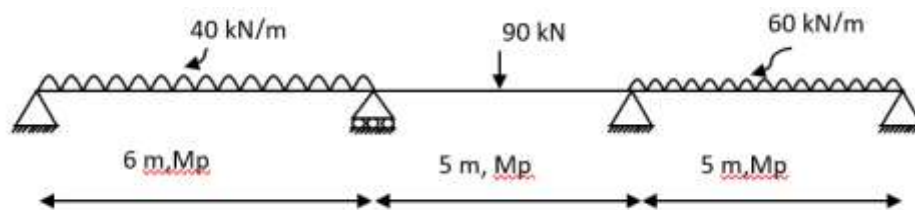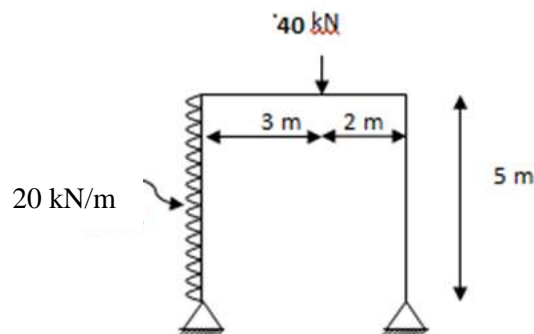panel point. Take self weight of truss = 0.75 kN/m.

Fig.1

Fig.2

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