Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (NEW) EXAMINATION – WINTER 2017

Subject Code: 2180610 Date: 07/11/2017

Subject Name: Design of Steel Structures

Time:02:30 PM TO 05:30 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of IS: 800, IS: 875 and Steel Tables is permitted, provided that they do not contain anything other than the printed matter inside.**
5. **Consider f_y = 250 N/mm^2 and *fu* = 410 N/mm^2 if not mention.**

Q.1	**(a)**	What are risk co-efficient, terrain factor and topography factor ?	**03**
	(b)	Write design consideration for heavy moment resisting bolted connection.	**04**
	(c)	Compute the collapse load for the portal frame shown in **Fig.1** and design the members if factored Wu = 72 kN and f_y of steel is 250 MPa.	**07**
Q.2	**(a)**	A workshop of effective span 15 m is to be provided with a pitched roof. The supporting trusses are provided at a spacing of 3.5 m. The purlines are spaced at 1.5 m centres. If the roof is inclined at 30° to the horizontal, design the purlin. Assume the dead load of the roofing to be 160 N/m^2 and that the wind pressure is 1200 N/m^2 normal to the roof. Consider dead load of purlin = 120 N/m.	**07**
	(b)	An ISMB 300@ 433.6 N/m beam has to be connected to the flange of an ISHB 200@ 392.4 N/m column with 20 mm dia bolt. Design unstiffened seated connection for a factored beam reaction of 120 kN. Consider seat angle 150 x 75 x 12 mm and clearance between the beam end and column = 3 mm.	**07**
		OR	
	(b)	A column ISHB 200@ 392.4 N/m has to support a beam ISHB 300@ 433.6 N/m. The beam transmits a factored end reaction of 100 kN. Design an unstiffened welded seat connection. Consider seat angle 100 x 75 x 10 mm and clearance between the column flange and beam = 5 mm.	**07**
Q.3		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 plate girder without intermediate transverse stiffeners. Also Design the cross section, the end load bearing stiffener and connection.	**14**
		OR	
Q.3	**(a)**	Explain stability against web buckling for plate girder.	**07**
	(b)	Enlist advantages and disadvantages of steel structures.	**07**

Q.4 Design a hand operated travelling crane simply supported by gantry girder for the given data : **14**

Span of gantry girder = 5m, Span of crane girder = 15 m, Crane capacity = 200 kN, Self weight of crane girder excluding trolley = 200 kN, Self weight of trolley = 30 kN, Minimum hook approach = 1 m, Distance between wheels = 3.5 m c/c, Self weight of rails = 0.3 kN/m. Checks for buckling and deflections are not required.

OR

Q.4 Design members AB, AC and joint A of a truss, for the following data. Consider member AC is horizontal and member AB is at an inclination of 30° with member AC. Also sketch connection details with cross-section of members. **14**

Member	Length	Compressive Force	Tensile force
AB	2.5 m	90 kN	60 kN
AC	2.8 m	75 kN	95 kN

Q.5 **(a)** Design a foot bridge for the particulars: (a) cross beams (b) most heavily loaded bottom chord member (c) Vertical member in which maximum compression occur. Type of girder = Lattice types, Span of Girders = 16 m c/c, Cross girders spacing = 2 m c/c, Clear width between main girders = 2.5 m, Pedestrian traffic = 4000 N/m^2, Assume Self weight of flooring = 480 N/m^2, Self weight of cross beam =300 N, Weight of one truss = 400 N/m, **14**

E = 1 x 10^4 N /mm^2.

OR

Q.5 **(a)** Define Shape Factor, Collapse load and Plastic Hinge. **03**

(b) Derive the collapse load for fixed beam of length L, subjected to concentrated load W at centre. **04**

(c) Determine plastic moment capacity for continuous beam as shown in **Fig.2**. Take load factor = 1.5 **07**

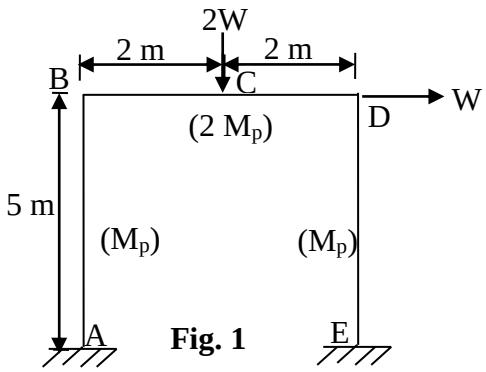

Fig. 1

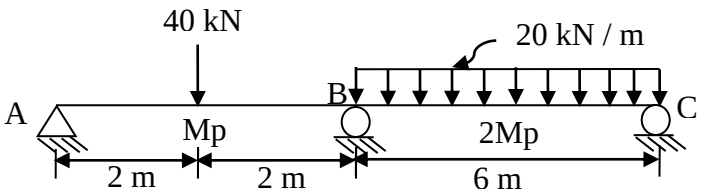

Fig. 2

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