Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII (New) EXAMINATION – WINTER 2019

Subject Code: 2174003 **Date: 28/11/2019**

Subject Name: Design of Steel and Masonary Structure

Time: 10:30 AM TO 01:30 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Draw neat and clean sketches with pencil only.**
3. **Use of IS 800-2007, IS 875-1987, IS 1905 and Steel Table is allowed.**
4. **Make suitable assumptions wherever necessary.**
5. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	What are advantages and disadvantages of steel as a structural material? Draw idealized stress- strain curve for mid steel.	**07**
	(b)	Determine the ultimate load carrying capacity in tension of lap joint shown in figure 1. If the bolt threads are outside the shear plane. Use M16 bolts of product grade C and property class 4.6. The yield and ultimate strengths of the flats are 250 MPa and 410 MPa, respectively.	**07**
Q.2	**(a)**	Determine the design tensile strength of a plate (200 × 8 mm) connected to 10 mm thick gusset plate using 20 mm bolts as shown in figure 2, if the yield and the ultimate stress of the steel used are 250 MPa and 410 MPa, respectively.	**07**
	(b)	An ISLC 300 @ 324.7 N/m of Fe 410 grade of steel is to carry factored tensile force of 900 kN. The channel section is to be welded at the site to a gusset plate 12 mm thick. Design a fillet weld, if the overlap is limited to 350 mm.	**07**
		OR	
	(b)	Design sag rods for consecutive purlins near the supported end of a roof truss system as shown in figure 3. The purlins are supported at one-third points by sag rods. Also design the ridge rod between ridge purlins. Assume c/c spacing of truss = 6 m, spacing of purlin = 1.4 m, self-weight of roofing = 200 N/m^2, intensity of wind pressure = 1500 N/m^2, slope of the roof truss = 25^0, and no access is provided to the roof.	**07**
Q.3	**(a)**	Design a beam-column (ISHB 400 @ 82.2 Kg/m) carrying compression of 400 kN at an eccentricity of 125 mm along the minor axis as shown in figure 4. Assume that the ends of the column are hinged with an unsupported length of 5 m. The grade of the steel is Fe410. (Use f_{cd} = 120 MPa.)	**07**
	(b)	Design a batten system for a column composed of 2 ISMC 350 @ 42.1 Kg/m placed back to back at clear spacing of 200 mm. Axial designed load on column is 1250 kN. Effective length of column is 5.0 m.	**07**
		OR	
Q.3	**(a)**	For a column section built up of shape shown in figure 5. Determine the axial load capacity in compression of column having both ends restrained in direction and position.	**07**

(b) Design a slab base foundation for a column ISHB 500 to carry a factored axial load of 1200 kN. Take safe bearing capacity of soil as 180 kN/m^2. Assume Fe410 grade of steel and M25 grade of concrete. **07**

Q.4 **(a)** Design angle purlin for the following data by simplified method: **07**
Spacing of trusses = 5 m
Spacing of purlins = 2 m
Weight of A.C. Sheets including laps and fixtures = 0.205 kN/m^2
Live load = 0.6 kN/m^2
Wind load = 1 kN/m^2, suction
Inclination of main rafter of truss = 21^0.

(b) Design a welded plate girder for 24 m span to support a uniformly distributed load of 80 kN/m over full span along with two moving loads 100 kN each spaced at 6 m apart. The girder is laterally supported throughout. Use steel grade of Fe410 both for Flange as well as web. (Note: Design of weld connection for flange plate and web plate is not required). **07**

OR

Q.4 **(a)** Design a simply supported I section to support the slab of a hall 9 m × 24 m with beams spaced at 3 m c/c. The thickness of the slab is 100 mm. Consider a floor finish load of 0.5 kN/m^2 and a live load of 3 kN/m^2. The grade of steel is Fe410. Assume that an adequate lateral support is provided to the compression flange. **07**

(b) Design a simply supported gantry girder to be used in an Industrial building for the following data: **07**
Crane Capacity = 100 kN
Weight of crab = 35 kN
Weight of crane (excluding crab) = 160 kN
Minimum clearance between crane hook and gantry girder = 1 m
Wheel base = 3 m
Distance between centre to centre of gantries = 20 m
Distance between centre to centre of gantry columns = 6 m
Crane type = M.O.T.
(Note: No checks are required)

Q.5 **(a)** Explain different possible failures in masonry structures along with its causes and probable remedies. Draw neat sketch (if required) **03**

(b) What are the common defects of workmanship in masonry work? **04**

(c) Design an interior cross wall having 3.5 m clear height of a two-storeyed building. The wall is unstiffened and it supports a 3 m wide slab. Consider following data: Live load on roof = 1.75 kN/m^2 ; Live load on floor = 2 kN/m^2 ; Thickness of RCC Slab = 150 mm; Weight of floor finish = 1.0 kN/m^2 **07**

OR

(c) Design an interior wall of a single storeyed workshop of height 4 m supporting a RCC roof. The bottom of the wall rests over a foundation block. Assume roof load 30 kN/m. Refer figure 6. **07**

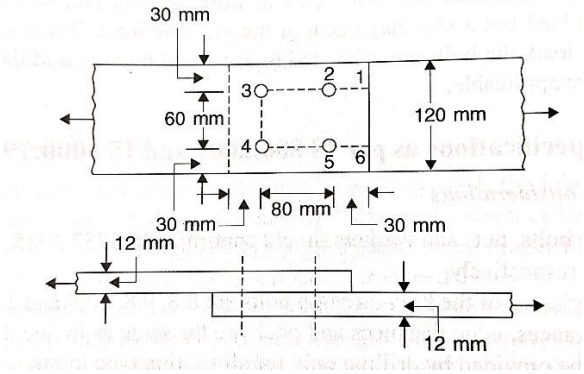

Figure 1

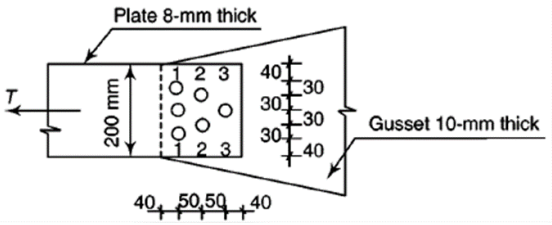

Figure 2

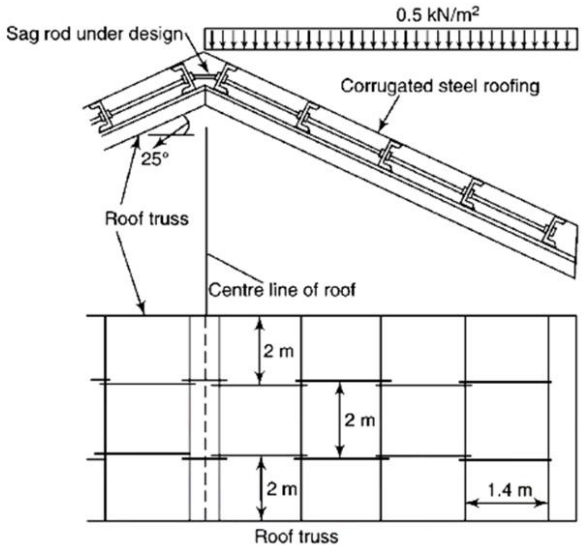

Figure 3

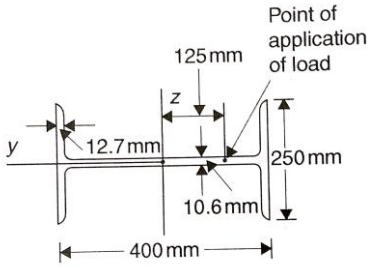

Figure 4

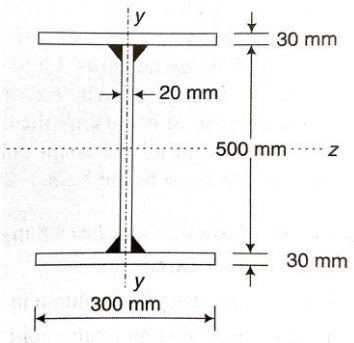

Figure 5

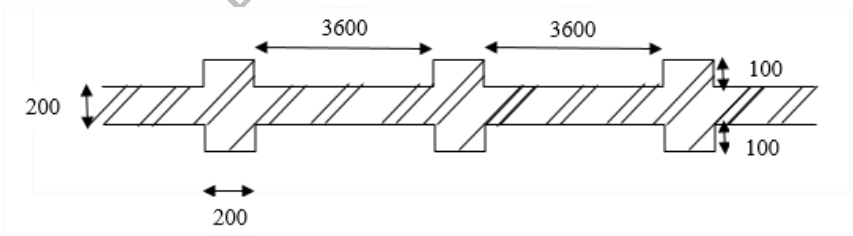

Figure 6

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