Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3150612 Date: 27/06/2023

Subject Name: Design of Structures

Time: 02:30 PM TO 05:00 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 : 456-2000, IS : 800-2007, IS 875 and Steel Table is permitted**

			MARKS
Q.1	**(a)**	Differentiate the limit state method and working stress method of design for Steel structures.	**03**
	(b)	Define (1) Characteristic load (2) Characteristic strength (3) Clear cover (4) Effective cover	**04**
	(c)	Calculate the moment of resistance of a beam section 230 mm X 460 mm effective depth reinforced with 2 Nos 16 mm diameter bars as compression reinforcement at an effective cover of 40 mm and 4 Nos 20 mm diameter bars as tension reinforcement Use grade M20 and Fe 500.	**07**
Q.2	**(a)**	What does 4 and 6 imply for bolts of grade 4.6?	**03**
	(b)	Define Under-reinforced section, Balanced section and Over-reinforced section.	**04**
	(c)	Calculate the strength of a 20 mm diameter bolt of grade 4.6 for the Lap joint. The main plates to be jointed are 12 mm thick.	**07**
		OR	
	(c)	A short column of size 300 mm X 450 mm is subjected to factored load of 2000 kN. If the unsupported length of column is 4.2 m, Calculate (a) the design moments due to minimum eccentricity. If the above column is subjected to (b) M_{ux} = 100 kN-m or (c) M_{uy} = 30 kN-m, Find design loads and moments.	**07**
Q.3	**(a)**	Differentiate the lap and butt joint with neat sketches.	**03**
	(b)	Draw neat sketch of gusseted based foundation.	**04**
	(c)	Select a suitable angle section to resist a factored tensile force of 200 kN assuming single row of 16 mm bolts. Take yield stress f_y= 250 N/mm^2 and ultimate stress of 410 N/mm^2.	**07**
		OR	
Q.3	**(a)**	Define (i) Gauge (ii) Pitch (iii) slenderness ratio	**03**
	(b)	Plot neat sketch of stress-strain curve of concrete and steel with stress block parameters adopted by IS: 456-2000 and IS 800-2007.	**04**
	(c)	Design an interior slab panel of effective dimensions 4.2 m × 6.25 m subjected to a factored load of 15 kN/m^2 inclusive of self-weight and floor finish load. The slab is provided with main reinforcement bar diameter as 10 mm, and has overall thickness of 150mm. Clear cover is 20 mm, grade of concrete is M20, grade of steel Fe415.	**07**
Q.4	**(a)**	State advantages and disadvantages of welded connections.	**03**

	(b)	Determine the development for 16 mm diameter bar, Fe 415 grade steel in compression and M 25 grade of concrete.	**04**
	(c)	Calculate the value of the least radius of gyration for a compound column consisting of ISHB 250 @ 536.6 N/m with one cover plate 300 mm × 20 mm on each flange.	**07**

OR

Q.4	**(a)**	Draw neat sketch of battening system.	**03**
	(b)	Why are the end returns provided in fillet welds?	**04**
	(c)	Explain the design procedure of slab base and gusseted base foundation.	**07**
Q.5	**(a)**	Differentiate between one-way slab and two-way slab.	**03**
	(b)	Write the design steps for single lacing system for column.	**04**
	(c)	Design a simply supported one way slab for an effective span of 3.0 m to carry total factored load of 9 kN/m^2. Use M: 20 grade of concrete and Fe: 250 grade of steel.	**07**

OR

Q.5	**(a)**	Why are four different buckling curves prescribed to evaluate column strength?	**03**
	(b)	Enlist the various failure modes of axially loaded tensile member along with sketch (line diagram only).	**04**
	(c)	Explain the design procedure for laterally supported and unsupported steel beam.	**07**

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