

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2021****Subject Code:3150612****Date:27/12/2021****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) and Steel table is permitted.
6. Assume M20 grade concrete and Fe415 steel for RCC element, if not provided.

		MARKS	
Q.1	(a) Differentiate the limit state method and working stress method of design for RCC structures.	03	
	(b) Define (1) Characteristic load (2) Characteristic strength (3) Clear cover (4) Effective cover	04	
	(c) Calculate the moment of resistance for a singly reinforced beam of 150 X 350 mm overall size and effective cover of 40 mm. The beam is reinforced with 3-16 mm diameter bars. Use M: 20 grade of concrete and Fe: 415 grade of steel.	07	
Q.2	(a) Enlist advantages and disadvantages of structural steel.	03	
	(b) Explain the lap and butt joint with neat sketches.	04	
	(c) Calculate the area of reinforcement in tension and compression zone of rectangular R.C. beam of limited size 250 mm wide and 400 mm deep effective. The effective cover for compression and tension reinforcement is 40 mm. The beam has to resist factored bending moment 180 kN.m. Use M: 20 grade of concrete and Fe: 415 grade of steel.	07	
	OR		
Q.3	(c) A singly reinforced slab 120 mm thick is supported by T-beams spaced 3.2 m centre to centre. The effective depth and width of web are 560 mm and 450 mm respectively. 8 nos. of Tor steel of 20 mm diameter are provided in 2 layers. The effective cover to the bars in lower layer is 50 mm. The effective span of simply supported beam is 3.60 m. Determine the depth of neutral axis and moment of resistance of T-beam. Use M: 20 grade of concrete and Fe: 415 grade of steel.	07	
	(a) Explain the single lacing system and double lacing system with neat sketch.	03	
	(b) Determine the development for 16 mm diameter bar, Fe: 415 grade steel in compression and M: 25 grade of concrete.	04	
Q.3	(c) Design a short R.C. square column for an axial compressive factored load of 1500 kN. Consider minimum percentage of steel as longitudinal reinforcement. Also, design lateral ties. Use M: 20 grade of concrete and Fe: 415 grade of steel.	07	
		OR	
	(a) Differentiate between one-way slab and two-way slab.	03	
	(b) A cantilever beam of 2 m span is projected from a column of 400 mm width. The cantilever beam is provided with 4 bars of 20 mm diameter of Fe: 415 grade steel. Effective cover is 50 mm. Determine the anchorage length and sketch the anchorage details. Use M: 20 grade of concrete.	04	

- (c) A R.C. Beam 250 X 500 mm effective is reinforced with 4-20mm diameter bar with Fe: 415. The beam carries factored shear force of 200 kN. Calculate the spacing of 8 mm dia-2 legged-Fe: 250 stirrups. Use M: 20 grade of concrete. **07**
- Q.4** (a) Define (1) Pitch distance (2) Edge distance (3) End distance **03**
 (b) Two plates of 12 mm and 20 mm thickness have width of 100 mm. These plates are connected by lap joint to resist design tensile load of 70 kN. Find bolt value if 16 mm bolts of grade 4.6 is used for connection. **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/m². Use M: 20 grade of concrete and Fe: 250 grade of steel. **07**
- OR**
- Q.4** (a) Explain slenderness ratio, lug angle and shear leg effect. **03**
 (b) Enumerate the design steps for isolated rectangular column footing. **04**
 (c) Design a tension member to carry a factored load of 230 kN. Use single unequal angle with 4 mm fillet weld for the connection to gusset plate. Length of member is 3.0 m. Take $f_y = 250\text{MPa}$ and $f_u = 410\text{MPa}$. **07**
- Q.5** (a) Draw a neat sketch with all details of gusseted base footing. **03**
 (b) Explain term (1) Lateral – torsional buckling and (2) Web crippling **04**
 (c) Design a double angle discontinuous strut to carry a factored load of 200 kN. The length of the strut is 3.0 m between intersections. The two angles are connected back to back on the opposite sides of gusset plate and tack bolted. **07**
- OR**
- Q.5** (a) Draw a neat sketch with all details of slab base footing. **03**
 (b) Enumerate the design steps for single lacing system for column. **04**
 (c) Determine the design axial load on the column section ISMB 350 having height 3.0 m, hinged at both ends. Take $f_y = 250\text{MPa}$. **07**
