Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150612 Date:09/06/2022

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, IS: 800 and steel table is permitted.**
6. **Assume M20 grade concrete and Fe415 steel for RCC element and fy of 250 MPa and fu of 410 MPa for the structural steel if not given.**

Q.1	**(a)**	Explain the concept of limit state design methodology.	**03**
	(b)	Explain limit state of collapse & limit state of serviceability in flexure.	**04**
	(c)	Find the Moment of Resistance of a singly reinforced concrete beam of 200mm width and 450mm effective depth, reinforced with 4 bars of 12mm dia of Fe415 and M20 concrete.	**07**
Q.2	**(a)**	Determine development length for 20 mm diameter, Fe 415 grade steel bar in compression. Take M-20 grade of concrete.	**03**
	(b)	Write design steps for isolated rectangular column footing.	**04**
	(c)	Design reinforcement for a rectangular R.C.C. beam, 200 mm wide, simply supported over an effective span of 4 m loaded with service load of 40 KN/m including self-weight. Draw sketches of cross section of beam.	**07**
		OR	
	(c)	Design for tensile and compressive reinforcement for a R.C.C. beam 250 mm wide and 550 mm deep with concrete grade M20 & steel Fe 415 at effective cover of 40 mm on both sides to resist factored moment of 310 KN.m.	**07**
Q.3	**(a)**	What is the function of providing distribution steel in slab?	**03**
	(b)	Deign lap joint to connect two plates 100x16 mm and 100x12mm to transfer 100 kN axial factored load. Use single row of 4.6 grade bolts. Plates are of steel grade 410.	**04**
	(c)	Design isolated footing for an axially loaded column 350 X 350 mm in cross Section and carrying 1600 KN working load. Take SBC of soil as 250 kN/m2.check for one ways shear.	**07**
		OR	
Q.3	**(a)**	Explain the difference between one way and two way slab?	**03**
	(b)	Two plates 150 X 10 mm of grade 410 are connected by 20 mm diameter bolts using butt joint. Design the bolted connections to transmit the pull equal to the strength of the plate. Grade of bolt is 4.6.	**04**
	(c)	Design simply supported roof slab for a room 9 m x 4 m clear in size. The slab is carrying an imposed load of 2.5KN/m2. Use M-20 concrete & Fe 415 steel. Check the slab for control of deflection & cracking. Show reinforcement details.	**07**

Q.4	**(a)**	What are the reasons for providing combined footing?	**03**
	(b)	Write design steps of lacing column.	**04**
	(c)	Design a tension member to carry a factored load of 240 KN. Use single unequal angle with 4mm fillet weld for the connection to gusset plate. Length of the member is 3.0m. Take f_y = 250 MPa & f_u = 410 MPa.	**07**

OR

Q.4	**(a)**	Explain the possible failure modes of an axially loaded Column.	**03**
	(b)	A Double angle strut made of 2 ISA 80 X 80 X6 mm placed back to back on either side of gusset plate. The length of the member is 3 m. Determine compression capacity of the member. Assume Fe410 steel with fy = 250 MPa.	**04**
	(c)	Design a steel column to carry factored axial load of 1400 KN, the length of the column is 3.5 m and hinged at both ends. Assume fy = 250 MPa.	**07**

Q.5	**(a)**	Write short notes on block shear failure in plates and angles.	**03**
	(b)	Explain "battening" with neat sketch.	**04**
	(c)	Design a slab base foundation for a suitable column section to carry a factored load of 1200 KN. Assume Fe 410 steel and M 25 concrete. Take safe bearing capacity of soil 200 KN/m^2.	**07**

OR

Q.5	**(a)**	Explain shear lag effect and lug angle?	**03**
	(b)	Draw a neat sketch of gusseted steel footing.	**04**
	(c)	Design a simply Supported two way slab of 4 m X 5m clear span supported on 230 mm thick wall on all four sides. Live load 4 KN/m^2 and floor finish 1 KN/m^2.Use M-20 concrete and Fe-250 steel. Corners are not held Down. Check for cracking and deflection of slab.	**07**

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