GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2020

Subject Code:2160607   **Date:01/02/2021**
Subject Name:Elementary Structural Design
Time:02:00 PM TO 04:00 PM   **Total Marks: 47**

Instructions:
1. **Attempt any THREE questions from Q.1 to Q.6 .**
2. **Q.7 is compulsory.**
3. **Make suitable assumptions wherever necessary.**
4. **Use of IS:456, IS:800 and steel table is permitted.**
5. **Assume M20 grade concrete and Fe415 steel for RCC element and f_y of 250 MPa and f_u of 410 MPa for the structural steel if not given.**

Q.1	**(a)**	Explain Under reinforced, Over reinforced and Balance section.	**03**
	(b)	Write advantages and disadvantages of steel and R.C.C. structures.	**04**
	(c)	Design a short square R.C. column for an axial compressive factored load of 1500kN. The grade of concrete is M20 and steel Fe415. Use minimum percentage of longitudinal reinforcement. Also design lateral ties and sketch	**07**
Q.2	**(a)**	Define (i) Limit State (ii) Characteristic strength (iii) Partial Safety Factor	**03**
	(b)	Write equation for maximum death of neutral axis and limiting moment of resistance for different grade of steel.	**04**
	(c)	Find tension and compression steel reinforcement area required in R. C. beam 300 mm x 600 mm to resist factored bending moment of 325 kN.m. Take 50 mm effective cover on both faces. Take grade of concrete is M20 and steel Fe 415.	**07**
Q.3	**(a)**	Give functions of following (i) Stirrups in a beam (ii) Ties in a column (iii) Secondary reinforcement in a slab.	**03**
	(b)	Calculate mid span moments of interior panel two way slab continuous slab with span l_x = 3.7 m and l_y = 4.7 m. Slab is subjected to total factored load (Including self-weight) of 12.20 kN/m^2. Take grade of concrete M20 and grade of steel Fe 415.	**04**
	(c)	Design a simply supported one-way slab for clear room dimension 3 m x 8 m. Slab is supported on masonry walls of 300 mm thickness. Live load acting on slab is 3.5 kN/m^2 and floor finish is equal to 1.0 kN/m^2. Use M20 grade of concrete and Fe 415 grade of steel.	**07**
Q.4	**(a)**	Write design steps for isolated rectangular column footing.	**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 Fe415 grade. Effective cover is 50 mm, determine the anchorage length and sketch the anchorage details. Grade of concrete is M20.	**04**
	(c)	A R. C. column of size 400 mm x 400 mm size carries an axial compressive load 1200 kN. Safe bearing capacity of soil 200 kN/m^2. Design an isolated	**07**

sloped footing for column. Check footing for two way shear only. Use M20 grade of concrete and Fe 415 grade of steel.

Q.5 **(a)** Explain "various modes of failure" of bolted joint with neat sketch. **03**

(b) A tie plate of 75 mm x 8 mm is connected to gusset plate to transmit a factored load of 120 kN. Determine the size and length of fillet weld, assuming site welds, Fe 410 steel and E 41 electrode. **04**

(c) Design a single angle to carry a design tensile load of 350 kN. Assume that the length of the member is 2.8 m. Assume grade Fe 410 steel with f_y = 250 MPa. **07**

Q.6 **(a)** Write down advantages and disadvantages of welding. **03**

(b) Two plate of 6 mm thickness are connected by a single bolted lap joint with 20 mm diameter bolt at 60 mm pitch. Calculate shear capacity of bolt. Take f_u of plate as 410 MPa and assume 4.6 grade bolts. **04**

(c) Calculate the compressive strength of a single angle strut ISA 100 x 75 x 10 mm with center to center length of 1.5 m. Angle is loaded through one leg and ends are fixed. Consider 1 bolt at each end. Take f_y = 250 MPa. **07**

Q.7 Draw a neat sketch of gusseted steel footing. **05**

OR

Q.7 Discuss IS code provisions for design of beam-column. **05**

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