

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VI (NEW) EXAMINATION – WINTER 2024

Subject Code:2160607

Date:05-12-2024

Subject Name:Elementary Structural Design

Time:02:30 PM TO 05:30 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. IS 456, IS 800, Steel table & SP 16 Are allowed

		Marks
Q.1	(a) State and explain in brief types of limit state as per IS 456. Explain assumptions made in limit state of Flexure.	03
	(b) Differentiate between Singly and doubly Reinforced concrete beam.	04
	(c) Find MOR for singly reinforced rectangular beam of dimension 230 X 450 mm, having 3-16 MM Dia bar in tension. Use M25 grade of concrete and Fe 500 grade of steel.	07
Q.2	(a) Draw Sectional and elevation of reinforcement sketch for Two way slab as per IS Code requirements.	03
	(b) Differentiate between under reinforced and over reinforced section. Explain its codal provisions in the design of RCC member.	04
	(c) Design doubly reinforced beam section 300x600 mm to carry factored bending moment 325 kNm. Consider M25 concrete and fe500 steel. Furnish reinforcement details.	07
	OR	
	(c) Design and detail a one-way simply supported slab of 3.9 m clear span supported on 230 mm thick walls. Consider 3.15 kN/m ² live load and 1.25 kN/m ² floor finish. Use M20 Grade of concrete and Fe 500 grade of steel.	07
Q.3	(a) Explain the importance of shear reinforcement in RCC Members. Explain step by step procedure to design RCC Beam for shear only.	03
	(b) Design isolated footing for an axially loaded column 550 x 500 mm in c/s and carrying 1300 kN working load. Take SBC of soil as 165 kN/m ² . Use M20 grade of concrete and Fe 500 grade of steel.	04
	(c) A short column of 300mm x 600mm size carries a factored load axial load of 1250kN. The column is short Design the column for axial and transverse reinforcement. Also sketch reinforcement details. Consider M25 concrete and fe500 steel.	07
	OR	
Q.3	(a) What is Flanged beam Explain types of flanged beam with neat sketches. Explain step by step procedure to design a flanged beam section as per IS Code requirements.	03
	(b) Design and detail RCC square column section to carry ultimate axial load 1200 kN. The effective length of column is 3.25m. Consider M25 concrete and fe500 steel.	04

- (c) Design a square footing of uniform thickness for an axially loaded column of 600 mm x 600 mm size. The safe bearing capacity of soil is 165 kN/m². Load on column is 1100 kN. Draw reinforcement sketch for the design. Consider M25 concrete and Fe500 steel. **07**
- Q.4** (a) Write the characteristics of Plastic, Compact and Slender sections **03**
- (b) Design suitable fillet weld to connect a tie plate 80mm x 10mm to a 10 mm thick gusset plate. The plate is subjected to load equal full strength of member. Assume shop welding & Fe-410. **04**
- (c) Design a double angle section to carry a tension of 285 kN working load. The end connection is to be made using M16 bolts of property class 4.6. Assume that the angles are provided on both sides of gusset. Also design the bolt connection. **07**
- OR**
- Q.4** (a) How can the effects of shear lag be considered in the design calculation? **03**
- (b) Two plates of 16 mm and 20 mm thickness have width of 150 mm. These plates are connected by lap joint to resist design tensile load of 120 kN. Find bolt value if 20 mm bolts of grade 4.6 is used for connection. **04**
- (c) Select a suitable angle section to carry a factored tensile force of 325 kN assuming a single row of M20 bolts and assuming design strength $f_y = 250$ N/mm² **07**
- Q.5** (a) Describe failure modes of steel beam. **03**
- (b) A built up column with 2 ISMC 250, back to back at spacing of 150mm, is carrying an axial load of 720 kN. Length of the column is 9.2 m. It is held in position at both ends but not restrained in direction. Design a suitable double lacing system. **04**
- (c) Determine working imposed uniformly distributed load acting on a laterally unrestrained simply supported beam of section ISMB 350 @ 52.4 kg/m. Span of the beam is 3.85 m. **07**
- OR**
- Q.5** (a) Write design steps of lacing column. **03**
- (b) Design a single angle discontinuous strut to carry a factored axial compressive load of 130 kN. The length of strut is 2.85 m between intersections. It is connected to 12mm thick gusset plate by 16 mm diameter 4.6 grade bolts. Use steel of grade Fe 410 **04**
- (c) Design a simply supported steel beam of span 4.95 m carrying working dead load of 13.5 kN/m and working live load of 18.5 kN/m. The compression flange of the beam is laterally restrained throughout. Assume steel grade Fe 410. **07**
