Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2023

Subject Code:3160612 Date:12-07-2023

Subject Name:Design of Reinforced Concrete structures

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Simple and non-programmable scientific calculators are allowed.

4. **IS: 456 (2000), IS-1893-1(2016), IS-13920(2016), IS-3370 (Part 1 to 4), SP-16, SP-34, IS-875 (Part 1 to 5) is permitted.**
5. **Use M20 grade of concrete and Fe415 grade of steel, until otherwise stated.**

			MARKS
Q.1	**(a)**	Enlist and explain various types of the retaining walls based on their usage.	**03**
	(b)	Enlist the minimum reinforcement criteria for the structures retaining liquid in context to IS 3370.	**04**
	(c)	The Counterfort retaining wall has to retain the earth with a horizontal top 6.0 m above ground level. Density of earth is 18kN/m^3. Angle of internal friction ϕ is 30 degree. SBC of soil is180 kN/m^2. Coefficient of friction μ is 0.6. Determine dimensions of the retaining wall and check the stability of wall. Draw neat sketch.	**07**
Q.2	**(a)**	Prepare structural layout and nominate all the members like slabs, beams, columns of G+3 building (whole structure) of having 5 bays of 5 m in X -direction and 4 bays of 4 m in Y direction.	**03**
	(b)	For Q.2 (a) Calculate the load on any continuous beam of typical floor. Consider slab thickness is 120 mm. Internal and external wall thickness is 230 mm. Floor height is 3.0 m.	**04**
	(c)	For Q.2 (b) deign the continuous beam and give the reinforcement detail of longitudinal section.	**07**
		OR	
	(c)	Design the ground floor column for the G+3 building given in Q.2 (a)	**07**
Q.3	**(a)**	The cantilever retaining wall has to retain the earth with a horizontal top 5.0 m above ground level. Density of earth is 18kN/m^3. Angle of internal friction ϕ is 30 degree. SBC of soil is 180kN/m. Coefficient of friction μ is 0.5. Determine dimensions of the retaining wall. Use M30 and Fe 415.	**03**
	(b)	For problem 3(a) above, check the stability of wall.	**04**
	(c)	For problem 3(a) above, design Heel Slab and draw sketch of reinforcement details. Use M25 and Fe 415.	**07**
		OR	
Q.3	**(a)**	Draw the Intze tank and explain various structural elements of Intze tank.	**03**

	(b)	The circular water tank of 450 kl capacity is required to construct below ground level. Considering flexible base, determine dimensions of the tank. The free board is 0.2 m. The unit weight of soil is 17kN/m^3 and angle of internal friction is 30^0. Use M30 and Fe 415.	**04**
	(c)	For Q. 3(b) above, design components of circular water tank and draw detailed plan and section of water tank showing all the dimensions and reinforcements.	**07**
Q.4	**(a)**	Enlist advantages and disadvantages of flat slab.	**03**
	(b)	Explain the codal provision of Direct Design Method for Flat slab.	**04**
	(c)	Determine the main reinforcement for the interior panel of flat slab without drop and column head with following data: (i) Slab = 20 m x 30 m (ii) Panel size = 4m x 6m (iii) Live load = 4kN/m^2 (iv) Floor finishes = 1kN/m^2 (v) Size of column = 500 mm x 500 mm (vi) Floor to floor height = 4.0 m. Use M20 and Fe 415. Draw neat sketch of reinforcement detailing.	**07**
		OR	
Q.4	**(a)**	Explain Construction joints can be used in water tanks with sketches.	**03**
	(b)	For rectangular underground water tank for a capacity of 70,000 litres, calculate Bending moments and direct compression on long wall and short wall. Consider tank is empty and surrounding soil is saturated. The saturated unit weight of soil is 18kN/m^3 and angle of internal friction is 30^o. Use M30 and Fe 415.	**04**
	(c)	For Q.4 (b) above, Design Long wall and Short Wall with all necessary checks and give details of reinforcement with sketches.	**07**
Q.5	**(a)**	Explain with sketch (i) Short column effect (ii) Strong column weak beam.	**03**
	(b)	Explain effect of Irregularities on performance of RC buildings during earthquakes.	**04**
	(c)	Draw and detail the typical qualitative reinforcement detailing of two span reinforced concrete continuous rectangular beam of dimension 230 mm X 550 mm as per IS 13920-2016.	**07**
		OR	
Q.5	**(a)**	Explain ductile detailing of column as per IS: 13920-2016.	**03**
	(b)	Give the guidelines for efficient earthquake resistant design of structures.	**04**
	(c)	Calculate base shear for the four storey special moment resisting RC frame hospital building located at Ahmedabad, having 4 nos. of bay in X-direction and 4 nos. of bay in Y-direction. Width of bay is 4 m. Height of each story is 3.5 m. Dead load on floors & roof including all (Slabs, Beams, Column, infill wall etc.) is 10kN/m^2 and Live load is 4kN/m^2. Consider Medium soil. Use seismic coefficient method as per IS: 1893-2016. Also mention relevant clause as per IS: 1893-2016.	**07**