# GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code: 3160612   **Date:04-06-2025**
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.
4. Simple and non-programmable scientific calculators are allowed.
5. IS: 456 (2000), IS-1893-1(2016), IS-13920(2016), IS-3370(2021 latest Code Part 1 to 4), SP-16, SP-34, IS-875 (Part 1 to 5) is permitted.
6. Use M20 grade of concrete and Fe415 grade of steel, until otherwise stated
7. Simple and non-programmable scientific calculators are allowed

			MARKS
Q.1	**(a)**	**Define** Following terms: (1) Epicenter (2) Focus (3) Critical Damping.	**03**
	(b)	**Prepare** structural layout and nominate all the members like slabs, beams, columns of G+3 building (whole structure) of having 4 bays of 4 m in X –direction and 3 bays of 3 m in Y-direction.	**04**
	(c)	A multistoried unbraced building as shown in **Fig. 1** having 20m X 30m plan dimension and overall height of 30m is to be designed in Bharuch in developed outskirt area with scattered buildings of its height. Determine the designed wind pressure acting on the internal frame of building and draw the pressure diagram. Assume bay width 5m each, Ground storey height 5m, Roof parapet 1m high and remaining storey height 4m each.	**07**
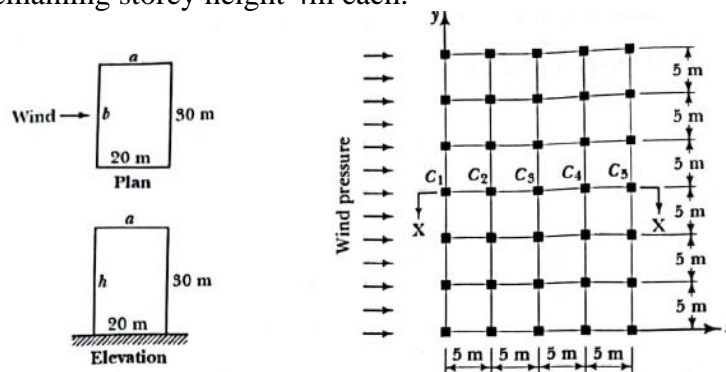
Fig. 1

Q.2	**(a)**	Determine the fundamental natural period of four storied MRF building 13.5m X 13.5m in plan and height of 16.25m, if (i) It is considered without masonry infill; (ii) It is considered with masonry infill.	**03**
	(b)	How you will provide drainage to retaining wall? State the stability requirements for the retaining wall.	**04**
	(c)	The plan and elevation of a three-storey RCC Community Hall is shown in **Fig. 2**. The building is located in seismic zone V. The type of soil encountered is medium stiff and it is proposed to design the	**07**

building with a special moment resisting frame. The intensity of DL is 10 kN/m^2 and the floors are to cater to an IL of 3 kN/m^2. Determine the design seismic loads on the structure by static analysis.
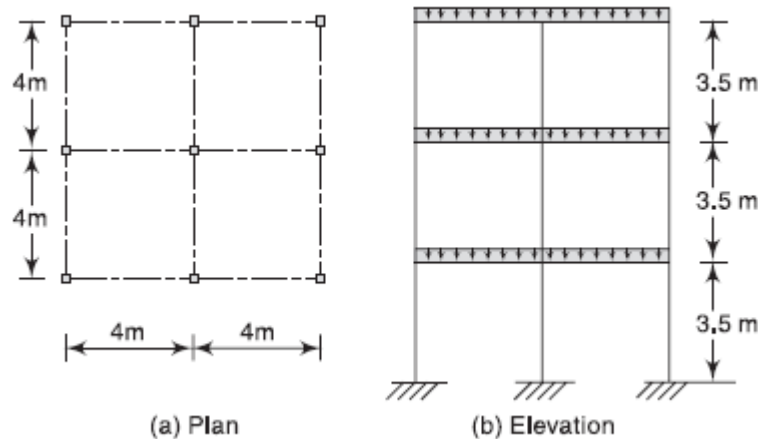

(a) Plan   (b) Elevation

Fig. 2

OR

(c) **Explain** different types of mass and vertical irregularities in the buildings.   **07**

Q.3 **(a)** **Discuss** the expected damages by Earthquake in structures having (i) Soft storey (ii) Floating columns   **03**

(b) **Explain** ductile detailing criteria for spacing of links over the entire length of the beam.   **04**

(c) **Enlist** advantages and disadvantages of flat slab. **Explain** the codal provision of Direct Design Method for Flat slab.   **07**

OR

Q.3 **(a)** An RCC column of size 350 mm X 350mm reinforced with 8 no. 16mm diameter bars carries a characteristic load of 800 kN. The allowable bearing pressure on soil is 200kN/m^2. Calculate the trial size of footing and net upward pressure. The materials are grade M20 concrete and Fe 415 HYSD for both, the column and the footing.   **03**

(b) For the above **Q.3(a)** evaluate the steel requirement and and development length.   **04**

(c) For the above parameters obtained in **Q. 3(a-b),** check the isolated square footing for shear and design the appropriate dimension of base. The reinforcement detailing in PLAN and section need to be present with neat sketches.   **07**

Q.4 **(a)** Which are the assumptions made to analyze the flat slab by Equivalent Frame Method.   **03**

(b) Classify different jointing material used in the water tank. Explain any one in detail.   **04**

(c) A counterfort retaining wall with height 6m, footing depth 1 m, with 450mm thick base having width 4.5m is constructed to retain the earth of 6m. The top surface is horizontal behind the wall. The counterforts are provided at a 3m c/c. The soil behind the wall is a well drained medium dense soil (unit weight = 16.2 kN/m^3, angle of internal friction, $\phi=30^0$; Safe bearing capacity of soil 150 kN/m^2). The coefficient of friction between the base and soil is 0.6. **Estimate** the horizontal and vertical loads and moments. Wall is designed with grade M20 concrete and Fe 415 steel.   **07**

OR

Q.4 **(a)** A retaining wall is constructed to retain the earth 4m high. The top surface is horizontal behind the wall. The soil behind the wall is well drained medium dense sand with following properties: Unit Weight   **03**

$= 17 \text{ kN/m}^3$, angle of internal friction, $\phi=30^0$. The material under wall base is same as above with safe bearing capacity of 150 kN/m^2. The coefficient of friction between the base and soil is 0.55. Use M20 grade and HYSD reinforcement of grade Fe 415. Determine the coefficient of earth pressure, base width.

(b) Determine the thickness of stem and base slab for the retaining wall mentioned in **Q 4(a).**   **04**

(c) For the above problem stated in **Q. 4(b),** Determine the soil pressure distribution and check wall stability.   **07**

Q.5 **(a)** **Discuss** briefly various types of retaining walls with neat sketches and situations where a particular type is used.   **03**

(b) **Write** an brief note on (a) Structural Plan density (b) Plan aspect ratio of buildings.   **04**

(c) **What** are the flat slab and conventional slab-beam diaphragms? Explain with suitable examples.   **07**

OR

Q.5 **(a)** **Draw** the Intze tank and explain various structural elements of Intze tank.   **03**

(b) **Enlist** the minimum reinforcement criteria for the structures retaining liquid in context to IS 3370 (2021).   **04**

(c) A wall in a long reservoir is 90 m long, 4 m high and 350mm thick. **Calculate** the steel area to control thermal cracking and the joint spacing for (i) Continuous casting with no contraction joint and (ii) Semi-continuous for partial restraint as per design code for a design crack width of 0.2mm. Use M35 grade concrete and Fe 500D steel grade for construction.   **07**

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