Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 3160612 Date:22-05-2024

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.**

			MARKS
Q.1	**(a)**	Explain Philosophy of Earthquake resistant design. List four virtue of good earthquake resistant design.	**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 5 m in X –direction and 4 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 Vadodara 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**

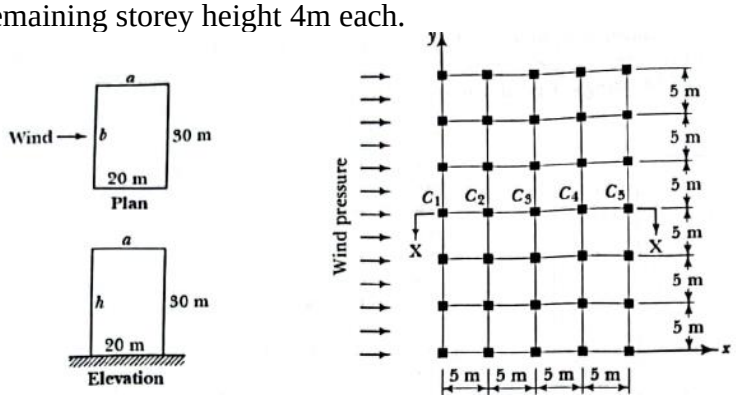

Fig. 1

Q.2	**(a)**	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 = 17 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.	**03**
	(b)	Determine the thickness of stem and base slab for the retaining wall mentioned in **Q 2(a).**	**04**
	(c)	For the above problem stated in **Q. 2(b),** Determine the soil pressure distribution and check wall stability.	**07**

OR

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

Q.3 **(a)** Draw the Intze tank and explain various structural elements of Intze tank. **03**

(b) Explain ductile detailing criteria for spacing of links over the entire length of the beam. **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.3 **(a)** Enlist advantages and disadvantages of flat slab. **03**

(b) Explain the codal provision of Direct Design Method for Flat slab. **04**

(c) Explain the limit state method as applied to water retaining structures. **07**

Q.4 **(a)** Explain Construction joints can be used in water tanks with sketches. **03**

(b) An isolated rectangular sloped footing for the columns of size 230mm X 650mm, reinforced with 6 bars of 20mm diameter and carrying an axial load of 1200kN. The bearing capacity of soil is 300 KN/m^2. Take offset from face of the column equal to 50mm. Determine the dimensions of footing. **04**

(c) For an isolated footing as mentioned above in **Q. 4(b),** Determine the depth of footing in two orthogonal directions. **07**

OR

Q.4 **(a)** Give the guidelines for efficient earthquake resistant design of structures. **03**

(b) 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. **04**

(c) How you will provide drainage to retaining wall? State the stability requirements for the retaining wall. **07**

Q.5 **(a)** Write a short note on Mechanism of load transfer in multistoried (G+3 Story) buildings. **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)** Which are the assumptions made to analyze the flat slab by Equivalent Frame Method. **03**

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

(c) A slab of water retaining structure is 300 mm thick. Assuming that construction has movement joints placed at 13m c/c, and construction is being carried out in summer. Determine the maximum spacing of cracks and distribution of steel (or reinforcement for moisture and temperature) for the slab. The material is M30 grade concrete and grade of steel is Fe500. **07**

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