

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER– VI (NEW) EXAMINATION – WINTER 2021****Subject Code:3160612****Date:02/12/2021****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 (Part 1 to 4), SP-16, SP-34, IS-875 (Part 1 to 5) are permitted.
6. Use M20 grade of concrete and Fe415 grade of steel, if not given.

- Q.1**
- (a) Draw retaining wall showing various forces acting on it. **03**
  - (b) Classify different jointing material used in the water tank. Explain any one in detail. **04**
  - (c) A G+6 residential building of 22 m height is having a plan dimension 24 m x 24 m, having bay width 4 m in both directions. The floor height is 3 m. Parapet height is 1 m. The building is located at Vadodara. The upwind slope is less than 3°. Estimate the Wind loads acting on internal frame at nodal points. Assume the depth of foundation is 2 m, depth of beam is 500 mm and ground beam is located at 500 mm below ground level. **07**
- Q.2**
- (a) Explain ductile detailing criteria for longitudinal reinforcement of the beam. **03**
  - (b) Prepare structural layout for the G+3 residential building RC frame having 4 bays of 3 m each in x-direction and 3 bays of 4 m each in y-direction. Floor height is 3m. Designate slabs, beams and columns. Suggest preliminary dimensions of the slab, beam and columns. **04**
  - (c) For the Q.2(b), estimate load on intermediate continuous beam laying in y-direction. Assume wall thickness = 300mm. **07**
- OR**
- (c) For the Q.2(b), estimate axial load on the interior column of ground floor. Assume wall thickness = 300mm. **07**
- Q.3**
- (a) A cantilever retaining wall has to retain level backfill. Fix basic dimensions of the cantilever retaining wall using following data: Height of stem = 4 m above ground level, Angle of repose of soil = 30°, Unit weight of soil = 18kN/m<sup>3</sup>, SBC of soil = 190kN/m<sup>2</sup> **03**
  - (b) For Q-3(a), check the cantilever retaining wall against subsidence. **04**
  - (c) For Q-3(a), design the base slab of the cantilever retaining wall **07**
- OR**
- Q.3**
- (a) Which are the limitations of direct design method for flat slab? **03**
  - (b) Explain four virtues of Earthquake Resistant Design. **04**
  - (c) A counterfort retaining wall has to retain level backfill. Fix the basic dimensions of the various elements of counterfort retaining wall and design stem of the counterfort retaining wall using following data: Height of stem = 5.5m above ground level, Angle of repose of soil = 30°, Unit weight of soil = 18kN/m<sup>3</sup>, SBC of soil = 190kN/m<sup>2</sup> **07**

- Q.4** (a) Draw Intze tank and show various structural elements of the Intze tank. **03**  
 (b) A circular underground water tank is hinged at base and free at top. Capacity of the water tank is 50000 litre. Calculate design constants and fix basic dimensions of the water tank. Use M30 grade of concrete and Fe415 steel. Take saturate unit weight of soil  $18\text{kN/m}^3$  and  $\Phi=30^\circ$ . **04**  
 (c) For Q-4(b), design the cylindrical wall of the water tank for (i) the tank is full of water and no soil outside, (ii) the tank is empty and surrounding soil is saturated. Use the design tables given in IS 3370 (Part IV). **07**

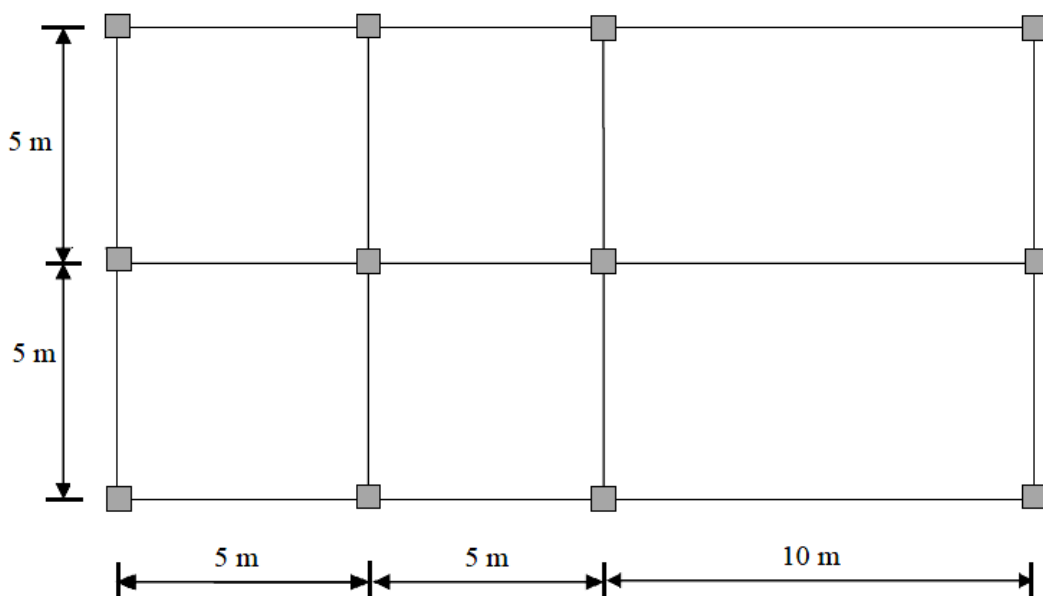
**OR**

- Q.4** (a) Fix the basic dimensions of Intze type container of an elevated water tank to store 6 lacs liter of water. Height of staging = 12 m up to bottom of tank. Use M30 grade concrete and Fe 415 grade steel. **03**  
 (b) For OR Q-4(a), design and detail top spherical dome. **04**  
 (c) For OR Q-4(a), design and detail top ring beam. **07**

- Q.5** (a) Determine centre of stiffness for the one storey building plan shown in fig.1. All columns are of size 300mm x 300mm. **03**  
 (b) Explain concept of capacity design of structures. **04**  
 (c) Design an interior panel of flat slab of size 4m x 4m without providing drop and column head. Columns are of size 400mm x 400mm. The storey height above and below slab is 3m. Live load on panel is  $3\text{kN/m}^2$ . Floor finish load is  $1\text{kN/m}^2$ . **07**

**OR**

- Q.5** (a) Explain in brief 'Equivalent Frame Method'. **03**  
 (b) Which are the assumptions made to analyse the flat slab by Equivalent Frame Method. **04**  
 (c) A four storey building has plan dimensions 22.5m x 22.5m. Floor height is 3m. The building is located in seismic zone III on a site with medium soil. The structure type is ordinary moment resisting frame. Seismic weight of first floor, second floor and third floor;  $W_1 = W_2 = W_3 = 3619\text{kN}$ . Seismic weight of roof slab,  $W_4 = 2793.5\text{kN}$ . Calculate design base shear and storey shear using seismic coefficient method. **07**



**Fig.1**

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**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2022****Subject Code:3160612****Date:08/06/2022****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, IS 3370, IS 875, SP 16, IS 1893, IS 1343, IS 13920 are permitted.
6. Use M20 grade of concrete and Fe415 grade of steel, if not given any where

- Q.1** (a) Explain Philosophy of Earthquake resistant design. Give four virtue of good earthquake resistant design. **03**
- (b) Mention the ductile detailing criteria for flexural members as per IS 13920. **04**
- (c) A G+7 multistoried unbraced frame building of 30 m height is having a plan dimension 20m X 30m, having bay width 5 m in both direction. Take Ground floor height as 5 m and all other floor height is 4 m. Take parapet height 1m. The location of building is in “Vadodara” city of Gujarat state with the terrain category III. The upwind slope is less than 3°, Take plinth is at 1m above G.L having no plinth beams but consider beams at 1m below G.L and footings are provided at 2 m below G.L. Assume overall depth of all beams = 500 mm and slab thickness 150 mm. Consider Design life of building as 100 years. Compute wind loads acting on an internal frame at node points and plot wind pressure diagram as per provisions of IS: 875(Part-III). **07**
- Q.2** (a) State the guide lines for preparation of structural layout for building **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) Enlist different types of slab form in of above layout Q.2 (b) and Design any one slab panel with reinforced details. **07**
- OR**
- (c) Estimate the load on the Continues beam of span 5 m of above example Q.2 (b) and design it. **07**
- Q.3** (a) The cantilever retaining wall has to retain the earth with a horizontal top 4 m above ground level. Density of earth is 17 kN/m<sup>3</sup>. Angle of internal friction  $\phi$  is 30°. SBC of soil is 150 kN/m<sup>2</sup>. Coefficient of friction  $\mu$  is 0.55. Determine dimensions of the retaining wall. Use M20 grade of concrete and Fe 415 grade of steel. **03**
- (b) For problem 3 (a) above, check the stability of wall. **04**
- (c) For problem 3 (a) above, design Stem and draw diagram showing reinforcement details. **07**
- OR**
- Q.3** (a) The counter fort retaining wall has to retain the earth with a horizontal top 6 m above ground level. Density of earth is 16.2 kN/m<sup>3</sup>. Angle of internal friction  $\phi$  is 30°. SBC of soil is 150 kN/m<sup>2</sup>. Coefficient of friction  $\mu$  is 0.6. Determine dimensions of the retaining wall. Use M20 grade of concrete and Fe 415 grade of steel. **03**
- (b) For problem 3 (a) above, check the stability of wall. **04**
- (c) For problem 3 (a) above, design stem and draw diagram showing reinforcement details. **07**
- Q.4** (a) Explain the Various types of joints can use in water tanks. with necessary sketches **03**
- (b) Fix the basic dimension of rectangular underground tank of capacity 68,000 liters and find the design constants. Use M30 concrete and Fe415 grade steel. Take saturate unit weight of soil 18 kN/m<sup>3</sup> and  $\Phi = 30^\circ$ . **04**

(c) Design long wall of water tank and furnish reinforcement Detailing for above Q.4(b) **07**

**OR**

- Q.4** (a) Fix the basic dimensions of Intze type container of an elevated water tank to store 8 laces liter of water. Height of staging =15m up to bottom of tank, wind load = 1.5 KN/m<sup>2</sup> throughout the height. Use M30 grade concrete and Fe 415 grade steel. **03**
- (b) For Q-4 (a) above, Design and detail top dome. **04**
- (c) For Q-4 (a) above, Design top ring beam and cylindrical wall. **07**

- Q.5** (a) Describe advantages and disadvantages of Flat slab. **03**
- (b) Explain the codal provision of Direct Design Method for flat slab. **04**
- (c) Design an interior panel of flat slab having equal panels of 5m × 5m. The internal columns are 500 mm in diameter and column head is 1000 mm in diameter. The storey height above and below slab is 4m. Design the flat slab with drop and column head. Live load 4 kN/m<sup>2</sup>. M-20 concrete and Fe-415 steel. **07**

**OR**

- Q.5** (a) Explain ductile detailing of column as per IS: 13920 with sketch. **03**
- (b) Explain the 'Strong column-Weak beam' design concept. **04**
- (c) Calculate base shear for the five storey RC frame building (Office Building) has size 30 m X 30 m located in Bhuj, using seismic coefficient method for following data: Type of soil = Hard, the weight of the floors and height of the floors are 2000 kN, 2500 kN, 2500 kN, 2500 kN and 2100 kN respectively, and 4.5 m, 3.5 m, 3.5 m, 3.5 m, 3.5 m respectively from, slab no.1 from bottom. Also determine the seismic forces and shears at each floor level. **07**

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