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 3º. 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 = 30º, Unit weight of soil = 18kN/m³, SBC of soil = 190kN/m²	**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 = 30º, Unit weight of soil = 18kN/m³, SBC of soil = 190kN/m²	**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 18kN/m^3 and $\Phi=30°$.	**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 3kN/m^2. Floor finish load is 1kN/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; $W_1 = W_2 = W_3 = 3619$kN. Seismic weight of roof slab, $W_4 = 2793.5$kN. Calculate design base shear and storey shear using seismic coefficient method.	**07**

Fig.1
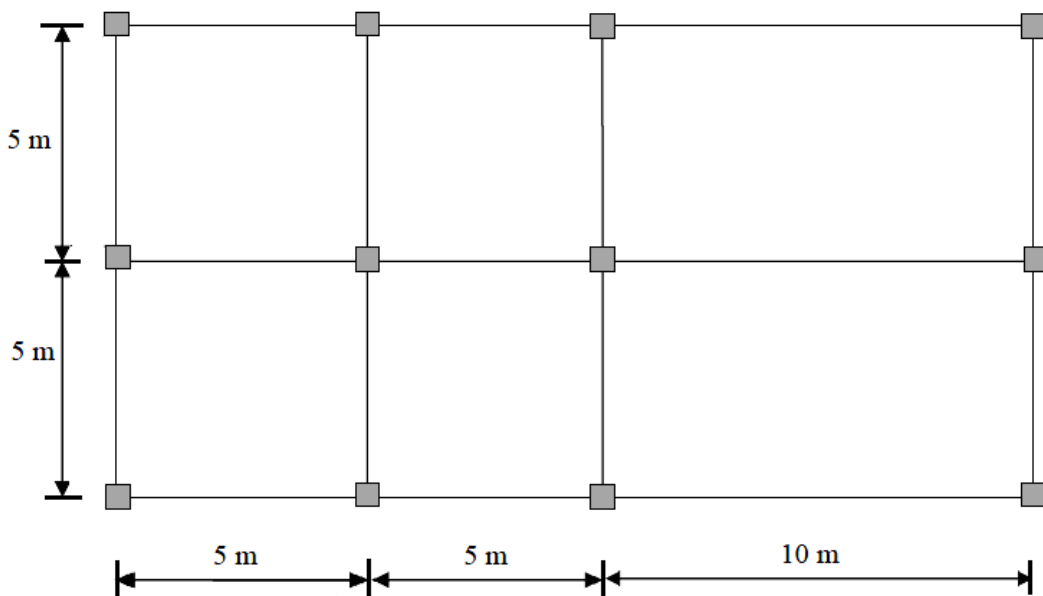
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