

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 2170607

Date: 03/06/2026

Subject Name: Design of Reinforced Concrete Structures

Time: 02:30 PM TO 05:30 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), SP (16), IS: 1893, IS: 875, IS 3370, IS1343, IS: 13920 are permitted.

- Q.1**
- (a) State the four virtues of Earthquake Resistant Design and explain any one in brief. 03
 - (b) For a flat slab system, define (i) column strip and (ii) middle strip. State any two limitations of Direct Design Method. 04
 - (c) A G+3 RC framed building is to be designed: (i) List gravity loads to be considered as per IS practice and (ii) write any four load combinations used for RC frame design. Also explain load path with a neat schematic. 07
- Q.2**
- (a) List types of retaining walls and write one application of each. 03
 - (b) Explain stability checks for retaining wall: sliding and overturning. 04
 - (c) A cantilever retaining wall retains level backfill of height $H = 4.5$ m. Soil: $\gamma = 18$ kN/m³, angle of internal friction $\phi = 30^\circ$. Take concrete M25 and steel Fe500. (i) Calculate active earth pressure and overturning moment about base. (ii) Using stem thickness at base = 450 mm (effective depth $d = 400$ mm), design the vertical reinforcement at the base of stem per metre length. (Neglect water table). 07
- OR
- (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 = 6.0 m above ground level, Angle of repose of soil = 30° , Unit weight of soil = 18 kN/m³, SBC of soil = 180 kN/m². 07
- Q.3**
- (a) Explain ductile detailing provisions as per IS:13920 for beam. 03
 - (b) Prepare structural layout for the G+3 residential building RC frame having 4 bays of 4 m both in x-direction and y-direction. Floor height is 3m. Designate slabs, beams and columns. Suggest preliminary dimensions of the slab, beam and columns. 04
 - (c) Design any one slab panel using data of Q.3(b). 07
- OR
- Q.3**
- (a) List guidelines for preparation of structural layout of a G+3 RC framed building. 03
 - (b) Explain ductile detailing provisions as per IS:13920 for column. 04
 - (c) A G+6 residential building of 22 m height is having a plan dimension 24 m $\times$ 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 Surat. The upwind slope is less than 3° . Estimate the Wind loads acting on internal frame at nodal points. Assume the depth of foundation is 3 m. 07

- Q.4**
- (a) Explain structural behavior of circular underground water tank. **03**
 - (b) Explain permissible stresses and codal provisions for water tank design. **04**
 - (c) Design hoop (circumferential) reinforcement near the base for a circular underground water tank of capacity $V = 200 \text{ m}^3$ with water depth $h = 3.5 \text{ m}$. Consider tank full condition. Use M30 and Fe500. **07**

OR

- Q.4**
- (a) Fix the basic dimensions of Intze type container of an elevated water tank to store 5 lacs liter of water. Height of staging = 10 m up to bottom of tank. Use M30 and Fe500. **03**
 - (b) Design and detail top spherical dome using data of OR Q.4(a). **04**
 - (c) A rectangular underground water tank has internal dimensions $5 \text{ m} \times 4 \text{ m}$ with water depth 3 m. Design the long wall. Consider tank full condition. Use M30 and Fe500. **07**

- Q.5**
- (a) Explain Torsionally coupled & uncoupled system. **03**
 - (b) Explain equivalent frame method. **04**
 - (c) Design an interior panel of flat slab of size $5 \text{ m} \times 5 \text{ m}$. Columns are of size $500 \text{ mm} \times 500 \text{ mm}$. The storey height above and below slab is 3 m. Floor finish load is 0.75 kN/m^2 . Live load on panel is 3.0 kN/m^2 . **07**

OR

- Q.5**
- (a) Explain 'Strong column - Weak beam' design concept. **03**
 - (b) List various irregularities in structures. Explain any one in brief. **04**
 - (c) A three storey building has plan dimensions $10 \text{ m} \times 10 \text{ m}$. Storey height is 3 m. The building is located in seismic zone IV on a site with medium soil. The building is provided with special moment resisting frame. Intensity of dead load on typical floor is 9.0 kN/m^2 , intensity of dead load on roof slab is 6.0 kN/m^2 and intensity of imposed load is 3.0 kN/m^2 . Calculate design base shear and distribute the shear along the height using seismic coefficient method. **07**
