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Question Paper Code : 31215

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Seventh Semester

Civil Engineering

CE 2401/CE 71/CE 1351/10111 CE 701 – DESIGN OF REINFORCED CONCRETE
AND BRICK MASONRY STRUCTURES

(Regulation 2008/2010)

Time : Three hours

Maximum : 100 marks

(Assume any other data if necessary and indicate them clearly)

(IS 456, IS 1905, IS 3370 (Part II and Part IV), IRC:21 and SP 16 design charts and tables are permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A cantilever retaining wall supports an inclined backfill. Sketch the distribution of active earth pressure on the stem.
2. Name the two important stability aspects of a retaining wall.
3. Sketch the variation of hoop stress between the crown and base of a hemispherical top cover dome carrying uniformly distributed load per unit surface area.
4. Mention various critical load combinations that are to be considered in the analysis of walls of an underground rectangular water tank, when there is a possibility of ground water table to rise above the base slab.
5. Distinguish between one-way shear and punching shear in flat slabs.
6. What are the load cases for which a box-culvert should be designed to remain safe?
7. Sketch the yield line pattern in a rectangular slab fixed on all edges and subjected to a uniformly distributed load.
8. State the principle used in the virtual work method of yield line analysis.
9. Obtain the stress reduction factor for an eccentrically loaded masonry member with slenderness ratio of 12 and eccentricity to thickness ratio of 1/12.
10. Why is it intended to limit the slenderness of the load bearing masonry walls?

PART B — (5 × 16 = 80 marks)

11. (a) Design the main bars of 16 mm diameter and the distribution bars of 8 mm diameter required at the bottom section of the stem of a cantilever retaining wall to retain a horizontal backfill level with its top for the following data.

Height of the stem = 4.5 m.

Thickness of stem at top and bottom : 200 mm and 450 mm respectively.

Density of soil is 18 kN/m³ and angle of repose is 30°.

Materials used in the construction are M25 grade of concrete and Fe 415 steel reinforcement.

Or

- (b) Design the main bars of 12 mm diameter and distributors of 8 mm diameter required at the bottom section of the stem of a counter fort retaining wall to suit the following data.

Nature of backfill : Horizontal

Height of stem = 6.5 m

Thickness of stem at top and bottom : 250 mm and 450 mm respectively.

Density of soil is 18 kN/m³ and angle of repose is 30°.

Centre to centre spacing of counter forts = 3 m.

Materials used are M25 grade of concrete and Fe 415 steel reinforcement.

12. (a) Design the top dome, top ring beam and cylindrical side wall of an elevated circular water tank supported over eight columns for the following data.

Internal diameter = 12 m

Height of tank = 8 m

Central rise of dome = 2 m

The base of the tank above ground Level is 10 m

Materials used in the construction are M20 grade of concrete and Fe 415 steel reinforcement.

Or

- (b) Explain the steps involved in the wind load analysis of a rectangular elevated water tank supported on four identical columns with their lower ends fixed and braced at two intermediate levels.

13. (a) Design one of the flights of stairs of a school building spanning between landing beams to suit the following data.

Type of staircase: waist slab type.

Number of steps in flight = 12.

Tread = 300 mm and rise = 160 mm.

Width of landing beams = 400 mm.

Materials used are M20 concrete and Fe 415 steel reinforcement bars.

Or

- (b) Design a reinforced concrete wall of 3 m height, 100 mm thick and 4 m long between the cross walls. The factored load to be carried by the wall is 600 kN/m. Materials used are M 20 grade of concrete and Fe 415 steel reinforcement bars.

14. (a) Using virtual work method, obtain the expression for ultimate moment per unit length of the yield line in the case of an isotropically reinforced square slab fixed on all edges and subjected to a uniformly distributed load.

Or

- (b) Design a rectangular slab of 6m × 4m simply supported at the edges carrying a service live load of 4kN/m². Assume the co-efficient of orthotropy as 0.7. Materials used are M20 grade of concrete and Fe 415 steel bars.

15. (a) In the wall of a room, 5m long, 300 mm thick and 3.5 m high, there are three openings 0.9 m wide and 1.5 m high. The portion of brickwork between the windows is 200 mm wide each. If the load/m length of the wall at the lintel level is 40 KN/m, determine what minimum mortar strength must be used in the wall. Strength of bricks may be taken as 9 MPa.

Or

- (b) Determine the allowable axial load on a column 300 mm × 600 mm constructed in first class brickwork in 1:6 cement mortar using modular bricks 200 mm × 100 mm × 100mm. The height of the column between the footing and top slab is 5.1 m. The strength of the brick units may be taken as 10 MPa.