Reg. No. :

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Seventh Semester

Civil Engineering

14UCE702 -ADVANCED STRUCTURAL DESIGN

(Regulation 2014)

(Note: Use of IS 456:2000, SP 16:1980, IS 3370(Part –II):2009, IS 3370(Part –IV):1967, IS 800:2007, SP 6-1:1964 and IRC 21:2000 are permitted in the End Semester Examinations)

Duration: Three hours   Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

(Answer all Questions)

1. High strength bolts are designed on the basis of   CO1- R

    (a) Friction   (b) Tension   (c) Compression   (d) Shear

2. The maximum area of tension reinforcement in beams shall not exceed

    (a) 0.15 %   (b) 1.5 %   (c) 4 %   (d) 1 %

3. The bending moment at center span of water tank slab is

    (a) $pL^2/16$ (b) $pB^2/16$ (c) $pB^2/12$ (d) $pB^2/8$

4. Cantilever retaining walls can safely be used for a height not more than ------------

    (a) 3m   (b) 4m   (c) 5m   (d) 6m

5. If W is the load on a circular slab of radius R, the maximum circumferential moment at the centre of the slab is

    (a) $3WR^2/16$ (b) $2WR^2/16$ (c) $3WR^3/16$ (d) $2WR^3/16$

6. Bottom bars under the columns are extended into the interior of the footing slab to a distance greater than

    (a) 42 diameters from the centre of the column

    (b) 42 diameters from the inner edge of the column

    (c) 42 diameters from the outer edge of the column

    (d) 24 diameter from the centre of the column

7. The method of design of steel framework for greatest rigidity and economy in weight, is known as

   (a) simply design   (b) semi-rigid design

   (c) fully rigid design   (d) none of the above

8. A fillet weld may be termed as --------------

   (a) mitre weld   (b) concave weld   (c) convex weld   (d) all the above

9. The distance between, rivet line and the nearest edge of a joint not exposed to weather, is taken (where t is thickness in mm of the thinner outside plate).

   (a) 10 t   (b) 8 t   (c) 6 t   (d) 12 t

10. Which of the following is not a compression member?

    (a) Strut   (b) Tie   (c) Rafter   (d) Boom

PART – B (5 x 2= 10Marks)

11. What are the factors that govern will govern the structural design?

12. Mention the reinforcement details that should be provided in a water tanks.

13. What are the forces acting on the dome?

14. State the necessity of providing shear key in retaining wall.

15. Name the components of a roof truss.

PART – C (5 x 16= 80Marks)

16. (a) Design the Lap joint for the plates of sizes 100×16 mm and 100×10 mm thick connected so as to transmit a factored load of 100 kN using single row of 16 mm diameter bolts of grad 4.6 and plate of 410 grade   (16)

    Or

    (b) Design a cantilever wall to retain earth 3m high above ground level. Use the following data: (16)

    The density of earth $= 18$ kN/m^3
    Angle of internal friction $= 30^0$
    The safe bearing capacity of soil $= 180$ kN/m^2
    The coefficient of friction between soil and concrete $= 0.4$
    Use M20 and Fe415 grades.

17. (a) Design a circular tank with a flexible base for capacity of 5 Lakh litres. The depth of water is to be 4m. Free board=200mm. Use M20 concrete and grade I steel. Permissible direct tensile stress in concrete =1.2 N/mm^2.Permissible stress in steel in direct tension=100N/mm^2.Sketch the details of reinforcements in tank walls. (16)

Or

(b) A reinforced concrete water tank resting on ground is 6m x 2m with a maximum depth 2.5m.Using M20 concrete and grade I steel design the tank walls. (16)

18. (a) Design a solid slab bridge superstructure having a clear span of 9.0 m and carriageway of 7.5 m with 1.5 m wide footway on either side for a National Highway. Loading: Single lane of IRC Class 70-R (both wheeled and tracked) or two lanes of IRC Class A whichever produces maximum effect. (16)

Or

(b) Explain the design principle of reinforced concrete solid slab bridge and in which condition this bridge is used? (16)

19. (a) Design the vertical stem of a counter - fort retaining wall if the heights of the wall above the ground level are 5.60 m. The safe bearing capacity of the soil is 175 kN/m^2. The unit weight of soil is 18 kN/m^3. The angle of repose of the soil is 30 degree. The co – efficient of friction between the soil and concrete is 0.50. Assume the spacing of the counter – fort as 3m. Adopt M30 concrete and Fe 415 steel. (16)

Or

(b) Design a cantilever retaining wall to retain earth embankment 4.5 m above the ground level. The density of earth is 18 kN/m^3 and its angle of repose of is 30°. The embankment is horizontal at its top. The safe bearing capacity may be taken as 200 kN/m^2 and the co efficient of friction between soils and concrete is 0.5. Use M$_{20}$ grade concrete and Fe 415 grade steel reinforcement. (16)

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20. (a) Determine the basic wind intensity for an industrial building (16)
situated in Chennai using the following data:

Life of the structure = 50 years
Terrain category = 2
Size of the building = 20 m x 40 m
Height of the eave board = 10 m
Topography = slpoe < 3º
 Slope = 1 in 4.

Or

(b) Design the purlin for the following specification: (16)

Span of truss = 12 m c/c
Pitch = 1/5 of span
Spacing of truss = 5 m c/c
Spacing of purlin = 1.5 m c/c
Load from roofing materials etc., = 200 N/mm^2.
Wind load = 1200 N/m^2. Use angle section.

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