| Reg. No. | | | | | | | | | | | | | | | |
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| Question Paper Code | 13845 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Seventh Semester

**Civil Engineering**

**20CEPC702 - ADVANCED REINFORCED CONCRETE STRUCTURES**

Regulations - 2020

(Use of IS 456-2000, IS-3370 Code book is permitted)

Duration: 3 Hours | Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 1. | _____of these is the primary function of a retaining wall.<br>(a) To increase the height of a hill (b) To hold back soil and prevent erosion<br>(c) To provide a decorative landscape feature (d) To create a wall for a building | 1 | K1 | CO1 |
| 2. | _____component prevents water from accumulating behind a retaining wall, which can cause pressure buildup.<br>(a) Batter (b) Filter fabric (c) Drainage stone (d) Footing | 1 | K1 | CO1 |
| 3. | _____ of the following is not a classification of water tanks<br>(a) Tanks resting on ground (b) Elevated tanks supported on staging<br>(c) Underground tanks (d) Intze tanks | 1 | K1 | CO2 |
| 4. | According to the shape which of the following is not a type of water tank?<br>(a) Circular (b) Conical (c) Rectangular (d) Spherical | 1 | K1 | CO2 |
| 5. | As compared to the thickness of the rest of the slab, the drop panel is generally what percentage thicker?<br>(a) 10% (b) 20% (c) 25-50% (d) 25-40% thin | 1 | K1 | CO3 |
| 6. | The vertical portion between each tread on the stair is called the:<br>(a) Going (b) Nosing (c) Winder (d) Riser | 1 | K1 | CO3 |
| 7. | Type of suspension bridge from the following is<br>(a) sling bridge (b) ramp bridge (c) semi circular arch (d) segmental bridge | 1 | K1 | CO4 |
| 8. | Which is the temporary pier made in the river is<br>(a) Kerb (b) scuppers (c) afflux (d) cribs | 1 | K1 | CO4 |
| 9. | _____ is the basis for determining the correct yield line pattern for a slab?<br>(a) The pattern that requires the minimum load for collapse<br>(b) The pattern that requires the maximum load for collapse<br>(c) The pattern that is aesthetically pleasing<br>(d) The pattern that corresponds to the initial cracks formed under load | 1 | K1 | CO5 |
| 10. | _____ is the primary function of a shear wall.<br>(a) To resist vertical loads<br>(b) To resist lateral forces like wind and seismic loads and transmit them to the foundation<br>(c) To provide insulation<br>(d) To support the roof | 1 | K1 | CO6 |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 11. | Label the lateral earth pressure diagram of clay depends for active and passive condition. | 2 | K1 | CO1 |
| 12. | List the assumptions in coulomb's theory. | 2 | K1 | CO1 |
| 13. | Interpret the forces acting on the dome. | 2 | K2 | CO2 |
| 14. | Explain for what conditions the underground water tanks are designed and checked. | 2 | K2 | CO2 |
| 15. | Define flat slab. | 2 | K1 | CO3 |
| 16. | Recall rise and thread in a stair case. | 2 | K1 | CO3 |

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| 17. | List the components of a bridge. | *2* | *K1* | *CO4* |
| 18. | Demonstrate the various forces act on a box culvert. | *2* | *K2* | *CO4* |
| 19. | List the assumptions made in yield line analysis of slabs. | *2* | *K1* | *CO5* |
| 20. | Construct the typical yield line pattern for different slabs. | *2* | *K2* | *CO5* |
| 21. | Tell the primary function of shear wall. | *2* | *K1* | *CO6* |
| 22. | Interpret as per IS 13920, what is the minimum thickness requirement for a shear wall. | *2* | *K1* | *CO6* |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

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|---|---|---|---|---|---|---|
| 23. | a) | A gravity retaining wall retains 10 m of a backfill, unit weight of soil =18 kN/$m^3$, angle of shearing resistance =30° with a horizontal surface. Assume the wall interface to be vertical, determine (i) the magnitude and point of application of the total active pressure (ii) if the water table is at a height of 5m, and how far do the magnitude and the point of the application of active pressure changed. Take submerged unit weight = 10kN/$m^3$. | *11* | *K3* | *CO1* |
| | | **OR** | | | |
| | b) | Design a cantilever retaining wall to retain earth embankment 4 m height above ground level. The unit weight of earth 18 kN/$m^2$. The embankment is horizontal at its top. The safe Bearing capacity of soil is 200 KN /$m^2$ of the coefficient of friction between the soil and concrete is 0.5. Adopt M 20 grade concrete and Fe 415 steel. Take Factor of safety against overturning and sliding as 1.4. Check stability. | *11* | *K3* | *CO1* |
| 24. | a) | A rectangular R.C. water tank with an open top is store 80000 litres of water. The inside dimensions of tank may be taken as 6mx4m.the tank rests on walls on all the four sides. Design the side the side walls of the tank using M20 concrete and grade I steel. | *11* | *K3* | *CO2* |
| | | **OR** | | | |
| | b) | Design the side walls of a square of R.C.C. tank of capacity 70000 liters of water. Depth of water in the tank =2.8m. Free board=0.2m. Adopt M20 concrete and grade I steel. Tensile stresses in steel limited to 100N/$mm^2$ at water face and 125N/$mm^2$ away from face. Sketch the details of reinforcements in the walls of the tank. | *11* | *K3* | *CO2* |
| 25. | a) | Design the interior panel of a flat slab with drops for an office floor to suit the following data:<br>Size of office floor = 25mx25m<br>Size of panels = 5mx5m<br>Loading class = 4kN/m 2<br>Materials: M20 grade concrete<br>Fe415 steel | *11* | *K3* | *CO3* |
| | | **OR** | | | |
| | b) | Design a dog legged stair case for a room of 4m wide the height between floor is 3.6m.Use M 20 & Fe415 steel. | *11* | *K3* | *CO3* |
| 26. | a) | Explain the step-by-step procedure for the design of mat foundation and how will you check for stability for against base pressure. | *11* | *K3* | *CO4* |
| | | **OR** | | | |
| | b) | In detail with neat sketches explain design principles of road bridges. | *11* | *K3* | *CO4* |
| 27. | a) | Design a simply supported square slab of 4.5m side length to support a service live load of 4kN/$m^2$. Adopt M20 grade concrete and Fe415 steel. Assume load factor according to IS: 456-2000. | *11* | *K3* | *CO5* |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| | b) | Design a rectangular slab 5m by 4m in size and simply supported at the edges to support a service load (live) of 4kN/$m^2$. Assume co efficient of orthotropy as 0.7. Adopt M20 concrete and Fe415 steel bars. | *11* | *K3* | *CO5* |
| 28. | a) | Explain the step-by-step procedure for the design of a rectangular shear wall subjected to gravity and seismic loads as per relevant IS codes (IS 456 and IS 13920). | *11* | *K3* | *CO6* |

**OR**

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| | b) | In detail with neat sketches explain what are the key architectural and structural considerations for the effective placement of shear walls in a multi-storey building? | *11* | *K3* | *CO6* |