

Faculty of Engineering

End Semester Examination May 2025

CE3CO35 Advance RCC Design

Programme	:	B.Tech.	Branch/Specialisation	:	CE
Duration	:	3 hours	Maximum Marks	:	60

Note: All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary.
 Notations and symbols have their usual meaning.

Section 1 (Answer all question(s))				Marks CO BL
Q1. What is the primary characteristic of a portal frame structure?				1 1 1
<input type="radio"/> It consists of only vertical columns without beams <input type="radio"/> It is always made of steel	<input checked="" type="radio"/> It resists lateral loads primarily through bending in the rigid joints <input type="radio"/> It cannot support vertical loads			
Q2. In a portal frame, what type of support condition is commonly used at the base for maximum stability?				1 1 1
<input type="radio"/> Pinned support <input checked="" type="radio"/> Fixed support	<input type="radio"/> Roller support <input type="radio"/> Hinged support			
Q3. What is the main function of a retaining wall?				1 1 1
<input type="radio"/> To support the roof of a building <input type="radio"/> To support bridges	<input checked="" type="radio"/> To hold back soil and prevent erosion <input type="radio"/> To distribute vertical loads of a structure			
Q4. Which type of retaining wall relies on its own weight for stability?				1 2 2
<input type="radio"/> Cantilever retaining wall <input type="radio"/> Anchored retaining wall	<input checked="" type="radio"/> Gravity retaining wall <input type="radio"/> Counterfort retaining wall			
Q5. Which structural element of an overhead water tank primarily resists bending moments due to water load?				1 2 2
<input type="radio"/> Base slab <input type="radio"/> Sidewalls	<input checked="" type="radio"/> Circular ring beam <input type="radio"/> Roof slab			
Q6. Which type of water tank is commonly used for storing water at ground level?				1 2 1
<input type="radio"/> Overhead water tank <input type="radio"/> Elevated water tank	<input checked="" type="radio"/> Underground water tank <input type="radio"/> Spherical water tank			
Q7. Deep bins are generally known as_____.				1 1 1
<input type="radio"/> Water tanks <input checked="" type="radio"/> Silos	<input type="radio"/> Bunkers <input type="radio"/> Retaining Walls			
Q8. Airy's theory for design of bins is primarily used for calculating_____.				1 1 1
<input type="radio"/> Storage capacity of bins <input type="radio"/> Opening of bins	<input checked="" type="radio"/> Pressures on side walls of bins <input type="radio"/> Difference between bunker and silo			
Q9. In prestressed concrete, what is the purpose of applying compressive force before loading?				1 1 1
<input type="radio"/> To reduce self-weight <input type="radio"/> To increase concrete permeability	<input checked="" type="radio"/> To counteract tensile stresses under service loads <input type="radio"/> To reduce concrete strength			

Q10. In a T-beam, which part primarily resists compression?

1 1 1

- Surface area of the beam
- Flange of the beam
- Stirrups
- Bottom reinforcement

Section 2 (Answer all question(s))

Marks CO BL

Q11. Explain the applications of the portal frame method for the analysis of structures.

2 2 2

Rubric	Marks
For each correct application, provide 1 mark.	2

Q12. What are the types of shear walls?

2 2 2

Rubric	Marks
Types of shear wall listing and explanation	2

Q13. (a) A two-story rectangular portal frame structure is subjected to lateral loading. The frame has a span of 8 m and a story height of 4 m per floor, with fixed column bases. The structure is subjected to a horizontal earthquake load of 50 kN at the roof level and 30 kN at the first-floor level. The beams carry a vertical dead load of 12 kN/m and a live load of 6 kN/m. The material used is structural steel with a yield strength of 250 MPa. Assume that the columns have equal stiffness and the beams are infinitely rigid compared to the columns. Analyze the frame using the Portal Frame Method to determine the internal forces in the columns and beams, compute the reactions at the base, axial forces in the columns, and shear forces in the beams. (Assume Suitable data if required.)

6 3 3

Rubric	Marks
Calculation of internal forces.	2
Reaction calculations	2
Forces calculation.	2

(OR)

(b) Design a single-span steel portal frame with a span of 10 m and an eave height of 5 m. The column bases are fixed. The frame is subjected to a dead load of 10 kN/m, a live load of 5 kN/m, and a horizontal wind load of 12 kN at the top. The material used is structural steel with a yield strength of 250 MPa. Determine suitable beam and column sections as per IS 800:2007.

Rubric	Marks
Correct Load calculations	2
Correct Section selection	2
Correct check for sections	2

Section 3 (Answer all question(s))

Marks CO BL

Q14. Explain retaining wall and its types.

2 2 2

Rubric	Marks
Explanation	1
Types	1

Q15. (a) Design a cantilever retaining wall to retain an earth embankment with a horizontal top 4.0 m above ground level. The density of soil is 19 kN/m³, and the angle of internal friction is 32°. The safe bearing capacity (SBC) of the soil is 220 kN/m², and the coefficient of friction between soil and concrete is 0.55. The retaining wall should be designed using M25 grade concrete and Fe-500 steel. Ensure the design satisfies stability checks for sliding, overturning, and bearing pressure.

Rubric	Marks
Forces calculation	2
Sliding checks	2
overturning check	2
Bearing pressure check	2

(OR)

- (b)** Explain in detail the step by step procedure of the design of counterfort retaining wall and its stability checks.

Rubric	Marks
Design of stem	2
Design of Heel	2
Design of Toe	2
Stability Checks (Min 3 Check)	2

Section 4 (Answer all question(s))

Q16. Explain water tank and its types.

Marks CO BL
3 2 2

Rubric	Marks
Water tank definition	2
Types	1

- Q17. (a)** Design a circular underground water tank with a flexible base to store 200,000 liters (200 m^3) of water. The water depth is limited to 4 meters. Assume M20 concrete, Fe-415 steel, and a water density of 1000 kg/m^3 . Determine the internal diameter, wall thickness (considering hoop tension), base slab thickness, and required steel reinforcement.

Rubric	Marks
Diameter and thickness calculation 2 marks each	4
slab thickness and reinforcement calculation 1.5 marks each	3

(OR)

- (b)** Design a rectangular water tank resting on ground with an open top for a capacity of 100000 litres. The inside dimension of the tank may be taken as $6\text{m} \times 4\text{m}$. Design the side Walls of the tank using M20 grade concrete and Fe250 grade I mild steel. (Assume suitable data if required)

Rubric	Marks
permissible stress calculation	1
calculation of Dimension of tank	1
Calculation of Moments in side walls	1
Design of long wall and short walls	1
Reinforcement for cantilever moment	1
Base slab calculation	1
Detailed Diagram	1

Section 5 (Answer all question(s))

Marks CO BL
4 2 2

- Q18.** Explain silo and its uses.

Rubric	Marks
Silo definition	2
Uses of silos	2

- Q19. (a)** A cylindrical silo has a diameter of 6 meters and a height of 12 meters. It is used to store grain with a density of 800 kg/m^3 . Calculate: (1) The total storage volume of the silo in cubic meters. (2) The total weight of the grain when the silo is completely filled. (3) The pressure at the bottom of the silo due to the stored grain (considering acceleration due to gravity as 9.81 m/s^2)

6 3 3

Rubric	Marks
For correct calculation of the total storage volume of the silo in cubic meters.	2
For correct calculation of the total weight of the grain when the silo is completely filled.	2
For correct calculation of the pressure at the bottom of the silo due to the stored grain	2

(OR)

- (b)** Explain in detail the difference between the silo and bunker covering all its points.

Rubric	Marks
For each correct point provide 1 mark (maximum 6 points)	6

Section 6 (Answer any 2 question(s))**Marks CO BL****Q20.** Explain T Beams and its advantages. Also explain its steps of design procedure.

5 4 4

Rubric	Marks
T beam definition and advantages	2
Design steps	3

Q21. Write a detailed note on application of working and limit state design.

5 4 4

Rubric	Marks
Application of working stress design	2.5
Application of limit state design	2.5

Q22. Explain in detail the all types of losses of prestress concrete.

5 3 4

Rubric	Marks
For each correct loss provide 1 mark (Maximum 5 marks)	5
