

Enrollment No.....



Faculty of Engineering
End Sem (Odd) Examination Dec-2019
CE3ES02 Advanced Design of RCC Structures

Programme: B.Tech.

Branch/Specialisation: CE

Duration: 3 Hrs.**Maximum Marks: 60**

- Note: 1. All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.
2. Use of I.S:456-2000, I.S.:3370 and I.S:13920 is allowed. Assume missing data suitably.

- Q.1 i. Shear walls are particularly important in - 1
 (a) Large, or high-rise buildings
 (b) Buildings in areas of high wind
 (c) Seismic activity
 (d) All of these
- ii. Pick the incorrect assumption in analysing the portal frame 1
 subjected to wind forces –
 (a) Horizontal force acts as udl on the frame
 (b) Point of contraflexure developed at the mid point of beams and columns
 (c) Interior columns resist double the shear force taken by each of the exterior columns
 (d) Horizontal forces induce bending moment in all the members of the frame
- iii. In a cantilever retaining wall without heel slab 1
 (a) Thickness of stem is kept same throughout
 (b) Base slab is made 10cm thicker than the stem
 (c) Width of the base slab is kept 0.7 times the total height of wall
 (d) All of these
- iv. Total pressure on vertical face of a retaining wall of height h acts 1
 parallel to the free surface and from the base at a distance of
 (a) $h/4$ (b) $h/3$ (c) $h/2$ (d) $2h/3$
- v. Coefficient recommended in IS:3370 to determine design forces are 1
 expressed as a function of
 (a) H^2/Dt (b) Dt/H^2 (c) H/D (d) D/t

P.T.O.

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- vi. Distribution and Temperature reinforcement in vertical direction in side walls of Intze Tank are taken as ____ of gross section **1**
 (a) 0.3% (b) 0.5% (c) 0.8% (d) 1.0%
- vii. If ϕ is the angle of repose then angle of rupture is equal to **1**
 (a) $45 + \phi$ (b) $45 + \phi/2$ (c) $90 + \phi$ (d) $90 + \phi/2$
- viii. Which of the following theories cannot be used for design of silos? **1**
 (a) Janssen's Theory (b) Rankine's Theory
 (c) Airy's Theory (d) All of these
- ix. For applicability of Courbon's Method, the ratio of span to width should be **1**
 (a) Less than 2
 (b) Greater than 2 but less than 4
 (c) Greater than 4 but less than 6
 (d) More than 6
- x. Losses of prestress may be due to - **1**
 (a) Creep in Steel (b) Creep in Concrete
 (c) Shrinkage in Concrete (d) All of these
- Q.2 i. Name and sketch different types of bracings. **3**
 ii. A Portal Frame with ends hinged is to be analysed for the following **7**
 data:
 Spacing of frames = 4.2m Height of columns = 4.5m Distance between column centres = 10m LL on roof = 1.5kN/m^2 . Find design moments. The frame is of 3 bay and 3 storeys.
- OR iii. Derive the expression for moment of resistance of a rectangular shear wall. **7**
- Q.3 i. Discuss component of counterfort type retaining wall. **3**
 ii. Design the stem of T-shaped cantilever type retaining wall to retain earth embankment 4.8m high above ground level. Take base width = 4m Toe projection = 1.2m, Thickness of base slab = 540mm. Unit weight of earth retain = 18kN/m^3 and $\phi = 30^\circ$. SBC = 180kN/m^2 and $\mu = 0.35$, Traffic load = 20kN/m^2 . Height of parapet = 1m, use M20 concrete and Fe415 steel. **7**
- OR iii. Design the upright slab of a counterfort retaining wall to retain earth 7.8m high above ground level. The backfill is horizontal and $\phi = 30^\circ$. The unit weight of backfill = 18kN/m^3 SBC = 200kN/m^2 . Use M20 concrete and Fe415 steel. **7**

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- Q.4 i. Explain the minimum reinforcement and their spacing for water tank. **3**
 ii. A rectangular RCC water tank with an open top is required to store 80kL of water. The inside dimensions of the tank may taken as 4m x 6m. Design the side walls of the tank. Materials are M20 grade concrete and Fe415 steel. **7**
- OR iii. Design a circular tank with flexible base for capacity 400 kL. The depth of water is to be 4.0m including free board of 200mm. Materials are M20 grade concrete and Fe415 steel. **7**
- Q.5 i. Discuss and compare briefly the Janssen's Theory and Airy's Theory. **3**
 ii. A silo with internal diameter 6.0m, height of cylindrical portion 15m and central opening with 0.5m is to be built to store wheat using M20 concrete and Fe415 steel. Design the cylindrical wall and apply checks. **7**
- OR iii. Design side walls of a rectangular bunker of capacity 300kN to store coal using M20 concrete and Fe415 steel. Take unit weight of coal = 8kN/m^3 , $\phi = 25^\circ$, $\mu = 0.45$. **7**
- Q.6 i. Discuss disadvantages of Prestressed concrete. **3**
 ii. A RCC single span T-Beam bridge is to consist of 5 beams 2.0m apart. The span of bridge is 10m clear width end bearings of 500mm. The LL on bridge is 20kN/m^2 including impact the carriage way over the bridge is to be 8.0m wide with a footpath of 1.5m on either side. Design the deck slab. Materials are M20 grade concrete and Fe415 steel. **7**
- OR iii. A prestressed concrete beam of 200x300mm is used over an effective span of 6m to support an imposed load of 4kN/m . At central section of beam, find eccentric prestressing force located 90mm from the bottom of the beam, which would nullify the bottom fibre stress due to loading. **7**

Marking Scheme
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Q.1	i.	Shear walls are particularly important in - (d) All of these	1
	ii.	Pick the incorrect assumption in analysing the portal frame subjected to wind forces – (a) Horizontal force acts as udl on the frame	1
	iii.	In a cantilever retaining wall without heel slab (d) All of these	1
	iv.	Total pressure on vertical face of a retaining wall of height h acts parallel to the free surface and from the base at a distance of (b) h/3	1
	v.	Coefficient recommended in IS:3370 to determine design forces are expressed as a function of (a) H^2/Dt	1
	vi.	Distribution and Temperature reinforcement in vertical direction in side walls of Intze Tank are taken as ____ of gross section (a) 0.3%	1
	vii.	If ϕ is the angle of repose then angle of rupture is equal to (d) $90 + \phi/2$	1
	viii.	Which of the following theories cannot be used for design of silos? (a) Janssen's Theory (b) Rankine's Theory (c) Airy's Theory (d) All of these	1
	ix.	For applicability of Courbon's Method, the ratio of span to width should be (b) Greater than 2 but less than 4	1
	x.	Losses of prestress may be due to - (d) All of these	1

Q.2	i.	Types of bracings	1.5 marks	3
		Sketch	1.5 marks	
	ii.	Find design moments		7
		General details	1 mark	
		Load Calculation	2 marks	
		Design moments		
		For Beam	2 marks	
		For column	2 marks	

OR	iii.	Expression for moment of resistance of a rectangular shear wall		7
		Strain diagram	1 mark	
		Stress diagram	1 mark	
		Tabulation/calculation	2 marks	
		Derivation	2 marks	
		Case I	0.5 mark	
		Case II	0.5 mark	

Q.3	i.	Component of counterfort type retaining wall		3
		1 mark for each	(1 mark *3)	
	ii.	Design the stem of T-shaped cantilever		7
		General arrangement details/drawing	1.5 mark	
		Proportioning	1 mark	
		Calculation of earth pressure	2 marks	
		Calculation of Bending moment	1.5 marks	
OR	iii.	Design the upright slab of a counterfort		7
		Design of stem (steel calculation)	1 mark	
		General arrangement details	1.5 mark	
		Drawing	1 mark	
		Calculation of earth pressure	2 marks	
		Calculation of Bending moment	1.5 marks	
		Design the upright slab (steel calculation)	1 mark	

Q.4	i.	Minimum reinforcement criterion	2 marks	3
		Their spacing for water tank	1 mark	
	ii.	Design the side walls of the tank.		7
		General arrangement details	1 mark	
		For long wall		
		Calculation of Bending moment	2 marks	
		Calculation of steel	1 mark	
OR	iii.	Design a circular tank with flexible base for capacity 400 kL.		7
		For short wall		
		Calculation of Bending moment	2 marks	
		Calculation of steel	1 mark	
		General arrangement	1 mark	
		Capacity calculation	1.5 marks	
		Hoop tension and steel calculation	2 marks	

		Vertical steel calculation	1.5 marks	
		Sketch	1 mark	
Q.5	i.	Janssen's Theory	1.5 marks	3
		Airy's Theory.	1.5 marks	
	ii.	Design the cylindrical wall and apply checks.		7
		Pressure calculation	3 marks	
		Design	2 marks	
		Checks	2 marks	
OR	iii.	Design side walls of a rectangular bunker		7
		Pressure calculation	3 marks	
		Design	3 marks	
		Sketch	1 mark	
Q.6	i.	Disadvantages of Prestressed concrete		3
		1 mark for each point	(1 mark *3)	
	ii.	Design the deck slab.		7
		General arrangement details /drawing	2 marks	
		Calculation of loads (DL/LL)	2 marks	
		Calculation of Bending moment	2 marks	
		Calculation steel in deck slab	1 mark	
OR	iii.	Find eccentric prestressing force		7
		General arrangement details / sketch	2 marks	
		Formula	1 mark	
		Calculation of e'' and equation framing	3 marks	
		Calculation of force	1 marks	
