JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

B.Tech-VIII Semester Civil Engineering

COURSE CODE (CREDITS):18B1WCE831 (3) MAX. MARKS: 25

COURSE NAME: ADVANCED REINFORCED CONCRETE DESIGN

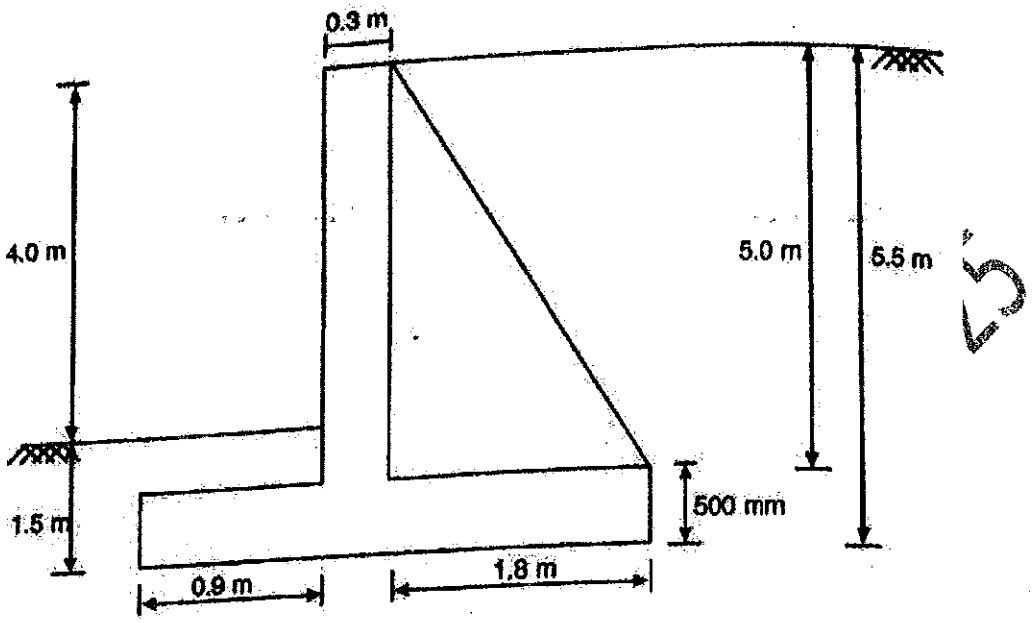
COURSE INSTRUCTORS: Dr. KAUSHAL KUMAR MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) IS 3370:2009 is allowed

Q.No	Question	CO	Marks
Q1	In respect to the design of Retaining walls, what is shear key? How is it designed?	3	**3**
Q2	Draw a neat sketch of various forces acting on underground water tank.	4	**2**
Q3	Calculate the forces in a cantilever retaining wall to retain horizontal earthen embankment of height 4 m above the ground level. The earthen backfill is having a density of 18 kN/m³ and angle of internal friction as 30°. The safe bearing capacity of the soil is 180 kN/m². The coefficient of friction between soil and concrete is assumed to be 0.45. Use M20 concrete and Fe 415 steel.	3	**10**
	OR		
	While designing a counter fort retaining wall to retain 4 m earth above ground level. The top of the earth is to be level. The density of earth is 15 kN/m². The angle of internal friction of soil is 30°. The safe bearing capacity of soil is 200 kN/m² and the coefficient of friction between soil and wall is 0.6. The preliminary profile and forces are given in page 2, Check the stability and design the stem.		
Q4	Design a circular tank with flexible base for a tank of 1,00,000 litre capacity. The depth of water in the tank is 5 m. Use M25 concrete and Fe 415 steel. Take unit weight of water as 9.8 kN/m². Permissible tensile stress in steel = 130 MPa & Permissible direct tensile stress in concrete = 1.3 MPa for M25 concrete.	4	**10**
	OR		
	Design a circular water tank with fixed base, resting on the ground, for a capacity of 500 kl. The depth of water in tank is 5 m and a free board of 200 mm is to be provided. Use M30 concrete and Fe 415 steel. Use IS code method.		

Data for Q3 (b):



■ **Forces Acting on the Retaining Wall**

Force (Type)	Force (kN)	Distance from toe edge m	Moment about toe edge (kNm)
1. Overturning force $P_h = \frac{1}{2}(K_a \gamma H)H$	$\frac{1}{2} \times \left(\frac{1}{3} \times 15 \times 5.5\right) 5.5 = 75.625$	$\frac{H}{3} = \frac{5.5}{3} = 1.833$	138.65
	$F_S = 75.625$ kN		$M_0 = 138.65$
2. Restoring forces			
(i) Weight of backfill (W_1)	$15 \times 5 \times 1.8 = 135$	$3.0 - \frac{1.8}{2} = 2.1$	283.5
(ii) Weight of stem (W_2)	$0.3 \times 5.0 \times 25 = 37.5$	$0.9 + \frac{0.3}{2} = 0.915$	34.31
(iii) Weight of base slab (W_3)	$0.5 \times 3 \times 25 = 37.5$	$\frac{3.0}{2} = 1.5$	56.25
	$\Sigma W = 210$ kN		$M_R = 374.06$ kNm

Data for Q 4, For IS code method

Tension in Circular Ring Wall, Fixed base, Free top and Subjected to Triangular Load

$\frac{H^2}{Dt}$	Coefficients at Point									
	0.0H	0.1H	0.2H	0.3H	0.4H	0.5H	0.6H	0.7H	0.8H	0.9H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0.4	+0.149	+0.134	+0.120	+0.101	+0.082	+0.066	+0.049	+0.029	+0.014	+0.004
0.8	+0.363	+0.239	+0.215	+0.109	+0.160	+0.130	+0.096	+0.063	+0.034	+0.010
1.2	+0.283	+0.271	+0.254	+0.234	+0.209	+0.180	+0.142	+0.099	+0.054	+0.016
1.6	+0.265	+0.268	+0.268	+0.266	+0.250	+0.226	+0.185	+0.134	+0.075	+0.023
2.0	+0.234	+0.251	+0.273	+0.285	+0.285	+0.274	+0.232	+0.172	+0.104	+0.0.0
3.0	+0.134	+0.203	+0.267	+0.322	+0.357	+0.362	+0.330	+0.262	+0.157	+0.052
4.0	+0.067	+0.164	+0.256	+0.339	+0.403	+0.429	+0.409	+0.334	+0.210	+0.073
5.0	+0.025	+0.137	+0.245	+0.346	+0.428	+0.477	+0.469	+0.398	+0.259	+0.092
6.0	+0.018	+0.119	+0.234	+0.344	+0.441	+0.504	+0.514	+0.447	+0.301	+0.112
8.0	-0.001	+0.104	+0.218	+0.335	+0.443	+0.534	+0.575	+0.530	+0.381	+0.151
10.0	-0.001	+0.098	+0.208	+0.323	+0.437	+0.542	+0.608	+0.589	+0.440	+0.179
12.0	-0.005	+0.097	+0.202	+0.312	+0.429	+0.543	+0.628	+0.633	+0.494	+0.211
14.0	-0.002	+0.098	+0.200	+0.306	+0.420	+0.539	+0.639	+0.666	+0.541	+0.241
16.0	0.000	+0.099	+0.199	+0.304	+0.412	+0.531	+0.641	+0.687	+0.582	+0.265

Moments in Circular Ring Wall, Fixed base, Free top and Subjected to Triangular Load

$\frac{H^2}{Dt}$	Coefficients at Point									
	0.1H	0.2H	0.3H	0.4H	0.5H	0.6H	0.7H	0.8H	0.9H	1.0H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0.4	+0.0005	+0.0014	+0.0021	+0.0007	-0.0042	-0.0150	-0.0302	-0.0529	-0.0816	-0.1205
0.8	+0.0011	+0.0037	+0.0063	+0.0080	+0.0070	+0.0023	-0.0068	-0.0024	-0.0465	-0.0795
1.2	+0.0012	+0.0042	+0.0077	+0.0103	+0.0112	+0.0090	+0.0022	-0.0108	-0.0311	-0.0602
1.6	+0.0011	+0.0041	+0.0075	+0.0107	+0.0121	+0.0111	+0.0058	-0.0051	-0.0232	-0.0505
2.0	+0.0010	+0.0035	+0.0068	+0.0099	+0.0120	+0.0115	+0.0075	-0.0021	-0.0185	-0.0436
3.0	+0.0006	+0.0024	+0.0047	+0.0071	+0.0090	+0.0097	+0.0077	+0.0012	-0.0119	-0.0333
4.0	+0.0003	+0.0015	+0.0028	+0.0047	+0.0066	+0.0077	+0.0069	+0.0023	-0.0080	-0.0268
5.0	+0.0002	+0.0008	+0.0016	+0.0029	+0.0046	+0.0059	+0.0059	+0.0028	-0.0058	-0.0222
6.0	+0.0001	+0.0003	+0.0008	+0.0019	+0.0032	+0.0046	+0.0051	+0.0029	-0.0041	-0.0187
8.0	0.0000	+0.0001	+0.0002	+0.0008	+0.0016	+0.0028	+0.0038	+0.0029	-0.0022	-0.0146
10.0	0.0000	0.0000	+0.0001	+0.0004	+0.0007	+0.0019	+0.0029	+0.0028	-0.0012	-0.0122
12.0	0.0000	+0.0001	+0.0001	+0.0002	+0.0003	+0.0013	+0.0023	+0.0026	-0.0005	-0.0104
14.0	0.0000	0.0000	0.0000	0.0000	+0.0001	+0.0008	+0.0019	+0.0023	-0.0001	-0.0090
16.0	0.0000	0.0000	-0.0001	-0.0002	-0.0001	+0.0004	+0.0013	+0.0019	+0.0001	-0.0079

Shear at the base of cylindrical section

$\frac{H^2}{DT}$	Triangular load fixed base	Triangular or rectangular load hinged base
0.4	+0.436	+0.245
0.8	+0.374	+0.234
1.2	+0.339	+0.220
1.6	+0.317	+0.204
2.0	+0.299	+0.189
3.0	+0.262	+0.158
4.0	+0.236	+0.137
5.0	+0.213	+0.121
6.0	+0.197	+0.110
8.0	+0.174	+0.096
10.0	+0.158	+0.087
12.0	+0.145	+0.079
14.0	+0.135	+0.073
16.0	+0.127	+0.068

Note: +ve sign indicates shear acting inward.