BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BTECH **SEMESTER : VI**
BRANCH: CIVIL **SESSION : SP/2025**

SUBJECT: CE435 ADVANCED CONCRETE STRUCTURES DESIGN

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Use of IS456 2000 is allowed in the examination hall.**

			CO	BL
	Q1(a), Q1(b), Q2(a), Q2(b) is based on the following Data: An RCC dog-legged staircase for a residential building as per IS 456:2000. The following data is given: Floor-to-floor height: 3.0 meters Riser: 150 mm, Tread: 300 mm Width of staircase: 1 meter Materials: M20 concrete, Fe500 steel Staircase supported on beams at both riser ends Live load: 3 kN/m^2, Finishing load: 0.5 kN/m^2			
Q.1(a)	Calculate the length of the waist slab for the staircase and determine the inclined span of one flight.	[2]	CO1	Apply
Q.1(b)	Calculate the design moment for the flight, assuming a thickness of 150 mm of waist slab and beam width 300 mm.	[3]	CO2	Analyze
Q.2(a)	Is 150 assumed thickness of waist slab adequate to design the waist slab reinforcement only on tension side. Justify your answer.	[2]	CO2	Evaluate
Q.2(b)	Design the reinforcement of staircase and with a neat sketch, show the reinforcement details.	[3]	CO3	Create
Q.3(a)	Explain the function of weep holes in the retaining wall structures.	[2]	CO1	
Q.3(b)	Explain in detail how stability check is performed in the retaining wall.	[3]	CO1	
	Q4(a), Q4(b), Q5(a), Q5(b) is based on the below Data: An RCC cantilever retaining wall to retain 3 meters of soil. The following data is given: Height of retained earth: 3 meters Thickness of stem at top: 200 mm Base slab dimensions: Toe 1 m, Heel 2 m, total width 3.45 m Stem thickness- at bottom: 0.45 m, at top: 0.3 m Backfill with γ = 18 kN/m^3, Angle of internal friction: 30° Material: M20 concrete, Fe500 steel SBC of soil: 200 kN/m^2 Coefficient of friction: 0.55 Live load on backfill: 5 kN/m^2 **PTO** Assume density of concrete: 25 kN/m^3			

Q.4(a)	What shall be the total height of the wall for which stability check shall be performed?	[2]	CO1	Apply
Q.4(b)	Determine all the forces acting on the retaining wall.	[3]	CO2	Analyze
Q.5(a)	Compute the Factor of safety against sliding. Is the Retaining wall safe against sliding?	[2]	CO2	Evaluate
Q.5(b)	What is the maximum pressure in the retaining wall. Is the foundation of retaining wall safe.	[3]	CO2	Analyze

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415
480
500
f_{ck}
20

TABLE 2 FLEXURE — REINFORCEMENT PERCENTAGE, p_t FOR SINGLY REINFORCED SECTIONS

f_{ck} = 20 N/mm²

M_u/bd^2, N/mm²	f_y, N/mm²					M_u/bd^2, N/mm²	f_y, N/mm²				
	240	250	415	480	500		240	250	415	480	500
0·30	0·146	0·140	0·085	0·073	0·070	2·22	1·253	1·203	0·725	0·627	0·602
0·35	0·171	0·164	0·099	0·086	0·082	2·24	1·267	1·216	0·733	0·633	0·608
0·40	0·196	0·188	0·114	0·098	0·094	2·26	1·281	1·230	0·741	0·640	0·615
0·45	0·222	0·213	0·128	0·111	0·106	2·28	1·295	1·243	0·749	0·647	0·621
0·50	0·247	0·237	0·143	0·123	0·119	2·30	1·309	1·256	0·757	0·654	0·628
0·55	0·272	0·262	0·158	0·136	0·131	2·32	1·323	1·270	0·765	0·661	0·635
0·60	0·298	0·286	0·172	0·149	0·143	2·34	1·337	1·283	0·773	0·668	0·642
0·65	0·324	0·311	0·187	0·162	0·156	2·36	1·351	1·297	0·781	0·675	0·648
0·70	0·350	0·336	0·203	0·175	0·168	2·38	1·365	1·311	0·790	0·683	0·655
0·75	0·376	0·361	0·218	0·188	0·181	2·40	1·380	1·324	0·798	0·690	0·662
0·80	0·403	0·387	0·233	0·201	0·193	2·42	1·394	1·338	0·806	0·697	0·669
0·85	0·430	0·412	0·248	0·215	0·206	2·44	1·408	1·352	0·814	0·704	0·676
0·90	0·456	0·438	0·264	0·228	0·219	2·46	1·423	1·366	0·823	0·711	0·683
0·95	0·483	0·464	0·280	0·242	0·232	2·48	1·438	1·380	0·831	0·719	0·690
1·00	0·511	0·490	0·295	0·255	0·245	2·50	1·452	1·394	0·840	0·726	0·697
1·05	0·538	0·517	0·311	0·269	0·258	2·52	1·467	1·408	0·848	0·734	0·704
1·10	0·566	0·543	0·327	0·283	0·272	2·54	1·482	1·423	0·857	0·741	0·711