U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

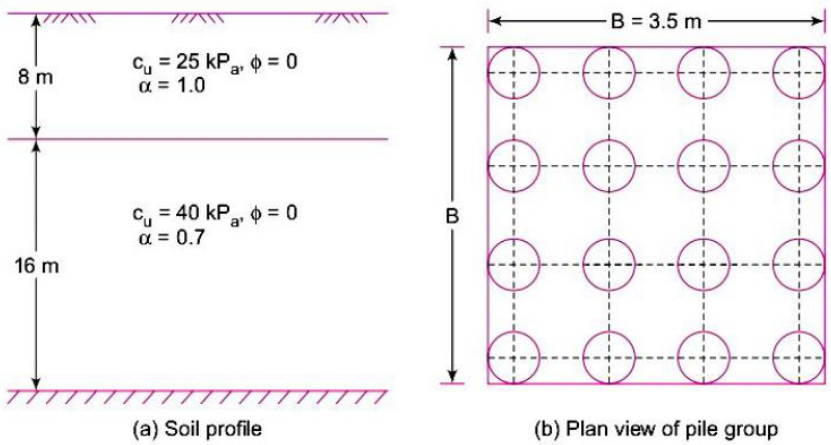
Programme: B.E. **Semester: VI**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV6PCBFS **Max Marks: 100**
Course: Bridge Engineering and Foundation Systems

Instructions:
1. Answer any FIVE full questions, choosing one full question from each unit.
2. Use of IS 2911,:456:2000, IRC6, IRC21, Piguard's curves are permitted.
3. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	PO	Marks
		UNIT – I			
1	a)	Define the following terms: (i) Afflux (ii) Effective Span (iii)Waterway (iv)Scour Depth	*CO* 1	*PO1*	**4**
	b)	Discuss the advantages and limitation of prestressed bridge	*CO* 1	*PO1*	**6**
	c)	A stream has the following details of cross section It is proposed to construct a bridge across the stream with the following data No of spans: 3 HFL: 52.8 m Velocity of water: 2.0 m/sec Velocity of approach = 1.6 m /sec Calculate: (i) Linear waterway, (ii) Afflux	*CO1*	*PO2*	**10**
		OR			
2	a)	Briefly explain with a neat sketch the components of a bridge	*CO1*	*PO2*	**10**
	b)	Briefly explain the salient features for selecting an ideal bridge site	*CO1*	*PO2*	**10**
		UNIT – II			
3	a)	Design a deck slab for the following particulars: Clear span = 5.5 m Width of Footpath = 1 m on either side Wearing coat = 100 mm thick Loading: IRC Class AA (tracked) Materials: M35 Concrete and Fe415 steel Co-efficient of dispersion k=2.7	*CO* 1	*PO3*	**20**

Distance	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
R. L	54.8	54	53.5	52.6	51.7	51.2	52	52.4	52.6	52.8	52.8	52.8	53.7	54.1	54.9

			OR			
	4	a)	Design an intermediate panel of deck slab of a RCC T-beam - slab type bridge for a National highway to suit the following data: Effective span of T-beam=16.0m Clear width of roadway = 7.5m; Krebs: 600mm wide x 300mm (depth) either side. Thickness of plain cement concrete wearing coat = 80mm. Three longitudinal girders at 2.5 m c/c Cross girders at 4 m c/c. Loading = IRC Class AA tracked vehicle Use M40 grade concrete and Fe 500 grade steel.	***CO*** 1	***PO3***	**20**
			UNIT - III			
	5	a)	A 'n' pile group has to be proportioned in a uniform pattern in soft clay with equal spacing in all directions. Assuming any value of cohesion, determine the optimum value of spacing of piles in the group. Take number of piles =25 and adhesion factor =0.7. Neglect the end bearing effect and assume that each pile is circular in section.	***CO*** 2	***PO2***	**10**
		b)	A 12m long concrete pile 40cm in diameter is driven into dense sand having average void ratio of 0.6. The GWT is at a depth of 4m below GL. Water content above GWT is 15%. If ϕ=35º, Nq=41.4, Nγ=42.4, δ=0.75ϕ, Dc=15B. Estimate the safe load.	***CO*** 2	***PO2***	**10**
			OR			
	6	a)	Briefly explain pile load test	***CO*** 2	***PO1***	**06**
		b)	A group of 16 piles was installed in a layered clay soil deposit as shown below. The diameter of each pile is 500cm. The length of the pile group is 18m. Estimate the safe load capacity of the group with a factor of safety of 2.5. The adhesion factor between the pile and soil in each soil layer are shown below.  (a) Soil profile (b) Plan view of pile group	***CO2***	***PO2***	**14**

			UNIT – IV			
	7	a)	Explain briefly the non-dimensional approach for vertical piles subjected to lateral loads based on Reese and Matlock theory.	***CO*** 2	***PO1***	**10**
		b)	A concrete pile 30cm square and 5m long is subjected to a horizontal load of 5000N and a moment of 4000N-m at the ground level. Taking =20 x 10^3kN/m^3, find the maximum bending moment and deflection if I. The head of the pile is considered to be free II. The head is considered fixed with no external moment. Refer table 1.	***CO*** 2	***PO2***	**10**
			OR			
	8	a)	A concrete pile 0.4 m x 0.4 m and 8 m long is subjected to a horizontal load of 12 kN and moment of 6 kN-m at the ground level. Taking k' = 2.1 x 10^4 kN/m^3 and E = 3 x 10^7 kN/m^2, find the maximum B.M and deflection considering the pile head is free. Use Reese and Matlock method. (Refer Table A for coefficients)	***CO*** 2	***PO2***	**10**
		b)	Determine the deflection at ground surface (Z=0) for the pile width d=0.4m, L=10m, H=50kN (applied at the ground surface), EI=37 x 10^3kN-m^2, η_h=5000kN/m^2/m. Water table is at the ground level. Refer table 1.	***CO*** 2	***PO2***	**10**
			UNIT – V			
	9	a)	Explain the Different shapes and characteristics of wells	***CO*** 2	***PO1***	**6**
		b)	Explain the forces acting on well foundation	***CO*** 2	***PO1***	**6**
		c)	Explain the process of sinking of wells	***CO*** 2	***PO1***	**8**
			OR			
	10	a)	List and explain with a neat figure the components of a well foundation?	***CO*** 1	***PO1***	**6**
		b)	With neat sketches explain the various methods of rectifying tilt in well foundations.	***CO*** 2	***PO1***	**8**
		c)	What is grip length as applied to well foundation? How is the grip length calculated?	***CO*** 2	***PO1***	**6**

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Table 1 (**For Q 6b**) Non dimensional coefficients for laterally loaded pile (Reese and Matlock)

Z	A_y	A_s	A_m	A_v	A_p
0.0	2.435	– 1.623	0.000	1.000	0.000
0.1	2.273	– 1.618	0.100	0.989	– 0.227
0.2	2.112	– 1.603	0.198	0.956	– 0.422
0.3	1.952	– 1.578	0.291	0.906	– 0.586
0.4	1.796	– 1.545	0.379	0.840	– 0.718
0.5	1.644	– 1.503	0.459	0.764	– 0.822
0.6	1.496	– 1.454	0.532	0.677	– 0.897
0.7	1.353	– 1.397	0.595	0.585	– 0.947
0.8	1.216	– 1.335	0.649	0.489	– 0.973
0.9	1.086	– 1.268	0.693	0.392	– 0.977
1.0	0.962	– 1.197	0.727	0.295	– 0.962
1.2	0.738	– 1.047	0.767	0.109	– 0.885
1.4	0.544	– 0.893	0.772	– 0.056	– 0.761
1.6	0.381	– 0.741	0.746	– 0.193	– 0.609
1.8	0.247	– 0.596	0.696	– 0.298	– 0.445
2.0	0.142	– 0.464	0.628	– 0.371	– 0.283
3.0	– 0.075	– 0.040	0.225	– 0.349	0.226
4.0	– 0.050	0.052	0.000	– 0.106	0.201
5.0	– 0.009	0.025	– 0.033	0.013	0.046

Z	B_y	B_s	B_m	B_v	B_p
0.0	1.623	– 1.750	1.000	0.000	0.000
0.1	1.453	– 1.650	1.000	– 0.007	– 0.145
0.2	1.293	– 1.550	0.999	– 0.028	– 0.259
0.3	1.143	– 1.450	0.994	– 0.058	– 0.343
0.4	1.003	– 1.351	0.987	– 0.095	– 0.401
0.5	0.873	– 1.253	0.976	– 0.137	– 0.436
0.6	0.752	– 1.156	0.960	– 0.181	– 0.451
0.7	0.642	– 1.061	0.939	– 0.226	– 0.449
0.8	0.540	– 0.968	0.914	– 0.270	– 0.432
0.9	0.448	– 0.878	0.885	– 0.312	– 0.403
1.0	0.364	– 0.792	0.852	– 0.350	– 0.364
1.2	0.223	– 0.629	0.775	– 0.414	– 0.268
1.4	0.112	– 0.482	0.688	– 0.456	– 0.157
1.6	0.029	– 0.354	0.594	– 0.477	– 0.047
1.8	–0.030	– 0.245	0.498	– 0.476	– 0.054
2.0	–0.070	– 0.155	0.404	– 0.456	– 0.140
3.0	–0.089	0.057	0.059	– 0.213	0.268
4.0	–0.028	0.049	–0.042	0.017	0.112
5.0	–0.000	0.011	–0.026	0.029	– 0.002

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