U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 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. Missing data, if any, may be suitably assumed.
3. Use of IS 2911, 456-2000, IRC 6, IRC 21 and Piguards curves allowed

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)		Briefly explain with a neat sketch the components of a bridge	*CO* 1	*PO1*	**5**
	b)		Briefly explain the different methods of determining the design discharge and economical span in design of bridges	*CO* 1	*PO1*	**7**
	c)		Briefly Explain: (i) linear waterway (ii) scour depth & aflux (iii) Railway loads on bridges (iv) IRC loads on bridges	*CO* 1	*PO1*	**8**
			OR			
2	a)		Briefly explain the salient features for selecting an ideal bridge site	*CO1*	*PO2*	**10**
	b)		Briefly explain how bridges are classified.	*CO1*	*PO2*	**10**
			UNIT – II			
3			Design a slab culvert for the following details**:** Width of bridge: 7.5m Thickness of parapet: 0.5m Thickness of wearing coat: 75mm No footpath is to be provided Conditions of exposure: 'moderate' Materials adopted: Concrete grade-M25 and and Fe500 grade steel Clear span: 6.3m Height of vent: 3m Consider IRC class AA wheeled loading only as per IRC6 - 2017 for live load in this case.	*CO* 1	*PO3*	**20**
			OR			

	4		Design the intermediate longitudinal girder of a T beam and slab bridge for the following data: Effective span of girders = 16 m Clear width of road way = 7.5m Width of Kerb on either side = 600mm Average thickness of wearing coat = 80 mm Number of longitudinal girders = 3 Spacing of longitudinal girders = 2.5 m Spacing of cross girders = 4m Loading = IRC Class AA tracked vehicle Adopt M30 concrete and Fe 415 grade steel. Shear check is not required. Also sketch the reinforcement details.	***CO*** 1	***PO3***	**20**
			UNIT - III			
	5	a)	Indicate the circumstances under which the pile foundations are used for building construction	***CO*** 2	***PO1***	**4**
		b	Briefly explain negative skin friction of piles and how to determine it.	***CO*** 2	***PO1***	**6**
		c)	A 350 mm x 350 mm reinforced concrete pile 20 m long is driven through loose material and then into dense gravel to a final set of 3 mm/blow, using a 30 kN single –acting hammer with a stroke of 1.5 m. Determine the ultimate driving resistance of the pile if it is fitted with a helmet, plastic dolly and 50 mm packing on the top of the pile. The weight of the helmet and dolly is 5 kN. The other details are: Weight of pile = 740kN; Weight of hammer = 30 kN; pile hammer efficiency η_h = 0.85; the coefficient of restitution e = 0.38; Sum of the elastic compression of the pile cap, pile material and soil is 19.6 mm	***CO*** 2	***PO2***	**10**
			OR			
	6	a)	Explain how the pile load capacity is determined by using static formula	***CO*** 2	***PO1***	**8**
		b)	Using static formulae estimate the pile length required to carry a load of 250 kN in a layered soil system. Take pile diameter as 300 mm Depth (m) | Unit weight of soil (kN/m^3) | Unit cohesion (kN/m^2) | Adhesion factor 0 to – 6 | 18.0 | 40 | 0.9 -6 to -20 | 19.0 | 60 | 0.7	***CO*** 2	***PO2***	**12**
			UNIT – IV			
	7	a)	List the situations under which the structure will be subject to lateral loads.	***CO*** 2	***PO1***	**4**
		b)	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**

		c)	Explain briefly the non-dimensional approach for vertical piles subjected to lateral loads based on Reese and Matlock theory.	***CO*** 2	***PO1***	**6**
			OR			
	8	a)	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 The head is considered fixed with no external moment. Refer table 1.	***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)	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**
			OR			
	10	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**

Table A: 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	0.62	-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