Roll No. | | | | | | | | | | |

B.E (Full Time) – DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2021

CIVIL ENGINEERING
Fifth Semester

CE5501 – FOUNDATION ENGINEERING

(Regulation 2019)

Time: 180 minutes | Answer ALL Questions | Max. Marks: 100

CO 1	Graduate will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation
CO 2	Graduate will demonstrate an ability to design shallow foundations, its component or process as per the needs and specifications.
CO 3	Graduate will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications.
CO 4	Graduate will demonstrate an ability to design deep foundations, its componentor process as per the needs and specifications.
CO 5	Graduate will demonstrate an ability to design retaining walls, its component orprocess as per the needs and specifications.

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)

Q. No	Questions	Marks	CO	BL
1	What is meant by the significant depth of soil exploration?	2	1	1
2	Sampler with inner diameter of 35 mm and wall thickness of 1 mm is used for soil sampling. Assess the quality of soil sample.	2	1	5
3	List various factors that affecting bearing capacity of foundation soil.	2	2	1
4	Distinguish angular distortions with tilt of the foundation.	2	2	4
5	What is the function of strap beam in strap footing?	2	3	1
6	Classify various types of raft foundation?	2	3	4
7	Distinguish the effect of method installation of driven piles in loose sand and soft clay.	2	4	2
8	Examine the following statement 'negative skin friction' in piles will cause the factor of safety to increase or decrease.	2	4	4
9	Compare active earth pressure with passive earth pressure.	2	5	2
10	Classify the various modes of failure of a retaining wall.	2	5	2

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11a. (i)	Explain about the selection of number of bore holes, depth of boring and spacing between the bore holes for various projects.	8	1	2
(ii)	The SPT 'N' value recorded at a depth of 7 m during the soil investigation was 45 in a deposit of fully submerged sand. The saturated unit weight of the soil was 20 kN/m^3. Estimate the corrected SPT 'N' value as per IS: 2131 – 1981.	5	1	5
	OR			
11b. (i)	Explain about various precautionary measures that need to be undertaken while measuring the SPT N-value?	8	1	2

(ii)	The cone penetration resistance measured in a clay soil based on CPT was 4500 kN/m^2 and the total overburden pressure at the depth was 100 kN/m^2. Estimate the undrained cohesive strength of the normally consolidated clay soil using CPT.	5	1	5
12a. (i)	Discuss in details of various modes of failure of the footing.	8	2	6
(ii)	Find out an ultimate bearing capacity of 1.5 m wide square footing is resting at a depth of 1 m from the ground surface on dry sandy soil deposit. Sand properties are angle of internal friction 38°, unit weight 17 kN/m^3, Nq = 48.8 and Nγ = 56.2. Use IS code method.	5	2	1
	OR			
12b. (i)	Choose the type of soil conditions on which the plate load tests are mostly conducted and discuss in details of it.	8	2	6
(ii)	Find out an immediate settlement for a 1.5 m wide square footing founded at a depth of 1.5 m in silty soil whose modulus of elasticity is 10000 kN/m^2. The footing is expected to transmit a unit pressure of 250 kN/m^2.	5	2	1
13a. (i)	The exterior column which carries a load of 2000 kN is connected to an interior column that carries a load of 1500 kN by a trapezoidal combined footing. Both an interior and exterior columns size is 450 $\times$ 450 mm and center to center distance between the columns is 5.4 m. Evaluate the suitable dimensions for a trapezoidal combined footing. The net allowable bearing pressure of soil is 190 kN/m^2.	10	3	5
(ii)	What are the various assumptions to be followed in the rigid method of design of a combined footings?	3	3	1
	OR			
13b. (i)	What are the various problems that are to be considered in design of a floating mat foundation?	9	3	1
(ii)	The raft foundation has a dimension of 20 m $\times$ 10 m is resting over saturated clay. The saturated clay soil is having a unit weight of 19 kN/m^3 and undrained cohesion value of 120 kN/m^2. The total dead and live load on the raft is 30,000 kN. Determine the factor of safety against bearing capacity failure of the raft.	4	3	5
14a. (i)	Explain an “equivalent raft? and with neat sketch show the location at which equivalent raft should be placed for estimating the settlement of a floating pile group in clay.	5	4	2
(ii)	A 3 $\times$ 3 pile groups is to be proportioned in a deposit of soft clay. Assuming the piles to be circular is having a diameter of 300 mm and a length of 10 m. Evaluate spacing between the piles in a group by assuming the pile group efficiency of 100 %. Neglect bearing and assume adhesion factor of 0.8.	8	4	5
	OR			
14b. (i)	The following data was obtained during the vertical pile load test on a 300 mm diameter pile. Plot the load – settlement curve and determine the allowable load as per IS code method.	7	4	5
(ii)	Explain the various limitations of dynamic formulae used to estimate allowable load carrying capacity of the pile.	6	4	2

Load (kN)	50	100	200	300	400	500	600
Settlement (mm)	3	4	10	17	27	41	61

15a.	Develop an expression for active and passive earth pressure on retaining wall at a depth 'z' below the surface of a dry cohesionless soil backfill with a horizontal surface using Rankine's earth pressure theory. Use appropriate soil idealization for both active and passive earth pressure state behind the retaining wall with neat sketches of Mohr's circle.	13	5	6
	OR			
15b. (i)	A 8 m high retaining wall with vertical back to supports a sandy soil having c′ = 0, γ = 16 kN/m^3 $\gamma_{sat.}$ = 21 kN/m^3 and ϕ' = 34°. Neglecting wall friction, estimate the total active thrust on the wall, if the water table raises upto a height of 4 m above the base of the wall.	5	5	6
(ii)	Discuss in details about the procedures are to be followed for verifying the stability of a cantilever retaining wall.	8	5	6

PART- C (1 x 15 = 15 Marks)

Q. No	Questions	Marks	CO	BL
16. (i)	A circular tank of a diameter 3 m is founded at a depth of 1 m below the ground surface on a 6 m thick normally consolidated clay soil. The water table is located at the base of the foundation. The saturated unit weight of the soil is 19.5 kN/m^3, and the *in-situ* void ratio e_o is 1.08. Laboratory tests on representative undisturbed samples of the clay gave a value of compression index 0.2. Determine the consolidation settlement of the foundation for a total contact pressure of 95 kPa. Use 2:1 method for computing Δp.	8	2	5
(ii)	A 5 m height of retaining wall with a vertical back has to retain a horizontal sandy soil backfill. The properties of soil are c = 0, ϕ = 30°, γ. = 17 kN/m^3. Draw lateral earth pressure distribution on the wall. Also, Determine the total lateral thrust exerted by the backfill on the wall and its point of application. Assume, the wall is unyielding and rigidly connected with the floor slab.	7	5	5
	********** Best of Luck **********			