**C**            **538A1**       Total Pages:**3**

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# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIFTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022**
**CIVIL ENGINEERING**

**(2020 SCHEME)**

**Course Code :**   **20CET305**

**Course Name:**   **Geotechnical Engineering – II**

**Max. Marks :**   **100**                       **Duration: 3 Hours**

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*No tables are permitted*

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## PART A
### *(Answer all questions. Each question carries 3 marks)*

1. List the assumptions of Coulomb's theory of earth pressure.
2. Enumerate the different types of foundations.
3. List the factors affecting bearing capacity.
4. Define ultimate bearing capacity, net ultimate bearing capacity and safe bearing capacity.
5. Explain allowable settlement.
6. Explain floating foundations.
7. List the classification of piles based on mode of transfer of loads.
8. Draw a neat sketch of a well foundation marking all its elements.
9. Explain depth of exploration.
10. List the corrections applied to observed SPT N value.

## PART B
### *(Answer one full question from each module, each question carries 14 marks)*

### MODULE I

11. a) Describe critical height for an unsupported vertical cut.   (6)
    b) A retaining wall 6 m high retains a backfill with following properties   (8)
    I layer : $H_1$ = 3 m ,$\varphi$=30°,$\gamma$ = 17 kN/m$^3$
    II layer : $H_2$ = 3 m ,$\varphi$=36°,$\gamma$ = 18 kN/m$^3$
    Determine the total active pressure per metre run and its point of application

### OR

12. a) Differentiate between active, passive and earth pressure at rest with examples   (6)
    b) A retaining wall with a smooth vertical back retains a purely   (8)

cohesive fill. Height of wall is 12m. Unit weight of fill is 20 $kN/m^3$. C = 1 $N/cm^2$. What is the total active thrust on the wall? At what depth is the intensity of pressure zero and where does the resultant thrust act?

## MODULE II

13. a) State the assumptions of Terzaghi's bearing capacity theory (5)
    b) Calculate the ultimate bearing capacities per unit areas of (9)
       i. A strip footing 1m wide
       ii. A square footing 3m x 3m
       iii. A circular footing of 3m diameter
       Given unit weight of soil is $17.8kN/m^3$, depth of foundation 3m, cohesion 19.62 $kN/m^2$ &$\Phi$=20°. For $\Phi$=20°, Nc = 17.7 Nq = 7.4 Nγ = 5.0

## OR

14. a) A strip footing of 2m width is founded at a depth of 4m below the ground surface. Determine the net ultimate bearing capacity using Skempton's equation. (5)

    b) A load of 900kN is to be carried by a circular footing resting at a depth of 2m below ground level over a sandy clay having c = 6kPa, unit weight 20 $kN/m^3$ . Using Terzaghi's analysis, determine the required size of footing. Assume $N_c$ = 12 $N_q$ = 6 $N_γ$ = 3. Factor of safety = 3 (9)

## MODULE III

15. a) Determine the immediate settlement of a square rigid footing 2m x 2m founded on silt at 1.5m. The footing carries a load of 300kN. Take Poisson's ratio as 0.3, soil modulus as 10000kPa & influence factor as 0.8 (5)
    b) Explain Plate Load Test with neat sketch. List the limitations of plate load test. (9)

## OR

16. a) What is differential settlement? What are its causes? How can it be prevented? (6)
    b) Design a combined trapezoidal footing for two columns of sizes 0.5m x 0.5m and 0.3m x 0.3m carrying loads 3000kN and 2000kN respectively. Centre to centre column distance is 5m. Footings shall not project beyond the outer surface of columns. Allowable soil pressure is 250 $kN/m^2$. (8)

## MODULE IV

17. a) Explain any four methods (with neat sketches) for rectification of tilts in a well foundation. (8)

b) A square pile group of 9 piles passes through a recently filled up material of 4.5m depth. The diameter of the pile is 30cm and pile spacing is 90cm c/c. If the UCS of the cohesive material is 60 kN/m$^2$ & $\gamma$= 15 kN/m$^3$. Compute the negative skin friction of the pile group. $\alpha$ = 0.4    (6)

**OR**

18. a) Explain Pile load test. How allowable load is calculated from pile load test?    (8)

b) A group of 16 piles 10 m long and 300mm diameter is to be arranged in square pattern in clay soil with undrained cohesion 35 kN/m$^2$. Determine the c/c spacing of piles, if group efficiency is 100 %. Adhesion factor = 0.7 Neglect end bearing.    (6)

**MODULE V**

19. a) What are the IS guidelines for choosing depth and spacing of boreholes?    (6)

b) Explain Wash boring and Auger boring techniques of soil exploration.    (8)

**OR**

20. a) Field N value in a deposit of fully saturated fine silt was 45 at a depth of 7m. Saturated unit weight of soil is 19 kN/m$^3$. Calculate the corrected SPT value as per IS code    (6)

b) Explain geophysical exploration using seismic refraction method. What are its limitations?    (8)

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