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Question Paper Code : 20518

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Civil Engineering

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CE 3503 — FOUNDATION ENGINEERING

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the different objectives of site investigation.
2. Define depth of exploration.
3. Distinguish between uniform settlement and differential settlement.
4. Differentiate between primary consolidation and secondary consolidation.
5. Where can be the raft or mat foundation adopted?
6. What do you mean by buoyancy raft foundation?
7. Define negative skin friction.
8. Mention the reasons for conducting initial tests on piles.
9. State Active and Passive Earth pressure.
10. List the assumptions made in Rankine's theory.

PART B — (5 × 13 = 65 marks)

11. (a) For a 70-story building with a footprint of 30 m × 20 m, supported by a mat foundation situated at a depth of 12 m, how many boreholes would you recommend and at what depth? Indicate the locations for these boreholes on the building plan view.

Or

(b) Briefly explain with neat sketch Standard Penetration Test and the correction to be applied to find "N" value.

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12. (a) Demonstrate the elastic and plastic equilibrium zones as per Terzaghi's bearing capacity analysis. Additionally, establish a connection between the forces at play during the verge of failure.

Or

(b) Calculate the instantaneous settlement beneath a foundation measuring 16 m × 32 m, which applies a pressure of 150 kN/m in a sandy substrate. The sand's modulus of elasticity (E) is 65×10^3 kN/m². Assume $I_s = 1$ and a Poisson's ratio of 0.5.

13. (a) (i) Explain the design procedure of a combined footing. (7)

(ii) Describe about contact pressure for foundations on clay and sand. (6)

Or

(b) Critically discuss the choices of different shallow foundations with different site conditions. State the merits and demerits of each foundation type.

14. (a) Design a square pile group to carry 600 kN in clay with an unconfined compressive strength of 60 kN/m². The piles are 25 cm diameter and 6.2 m long. Adhesion may be taken as 0.6.

Or

(b) A 16 pile group has to be arranged in the form of a square in soft clay with uniform spacing. Neglecting end bearing, determine the optimum value of the spacing of the piles in terms of the pile assuming a shear mobilization factor of 0.6.

15. (a) A retaining wall has a vertical back and is 12 m high. The soil is sandy loam of unit weight 22 kN/m³. It shows a cohesion of 13 kN/m² and $\varphi = 20°$. Neglecting wall friction, determine the thrust on the wall. The upper surface of the fill is horizontal.

Or

(b) (i) Explain the different modes of failure of a retaining wall. (7)

(ii) Discuss the effect of line load on retaining wall. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Design a strap footing for the two columns of size 0.6 × 0.6 m carrying a load of 800 kN and 1200 kN. The allowable soil pressure is 120 kN/m². Take eccentricity of the footing of column carrying 800 kN as 1 m. The columns are spaced at 6 m c/c.

Or

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(b) A plate load test was conducted with a 40 cm square plate at a depth of 1.5 m below the ground level, in a cohesive soil having $\Phi = 0$. The failure was observed at a load of 30 kN. The water table was observed to be at a depth of 4.5 m below ground surface. Compute the ultimate bearing capacity for a strip footing, 1 m wide with its base located at the same level as the test plate, and in the same soil. Take the bulk unit weight of the soil as 17 kN/m^3 . Also, calculate the safe bearing capacity of factor at a safety of 3.

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