**B**                    **512A1**                    Total Pages: **4**

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# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SECOND SEMESTER M.TECH DEGREE EXAMINATION (R,S), MAY 2024**
*GEOMECHANICS AND STRUCTURES*
**(2021 Scheme)**

**Course Code:**     **21GS202**

**Course Name:**     **Foundation Analysis and Design**

**Max. Marks:**     **60**                              **Duration: 3 Hours**

| *Use of IS 2911 P1 1980 is permitted* |
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## PART A
### *(Answer all questions. Each question carries 3 marks)*

1.   What are the assumptions of Terzaghi's bearing capacity theory

2.   Explain different types of shallow foundations.

3.   Explain pile's load-transfer mechanism.

4.   Explain Negative skin friction.

5.   Explain Modulus of subgrade reaction method.

6.   How do you calculate lateral load capacity and moment capacity of a pile?

7.   What are the factors influencing contact pressure distribution beneath rigid footing?

8.   Explain soil structure interaction.

## PART B
### *(Answer one full question from each module, each question carries 6 marks)*

### MODULE I

9.  a)  A rectangular footing of size 10 ft x 20 ft, is founded at 6 ft below the ground surface in a homogenous cohesion-less soil having an angle of shearing resistance $35^0$. The water table is at a greater depth. Unit weight of soil is 114 lb/sq ft. Determine net allowable bearing pressure for FOS = 3, considering general bearing capacity theory.   (4)

    b)  Describe the importance of pressure bulb distribution in settlement analysis of shallow foundation.   (2)

**OR**

10. For a square footing resting on sand deposit, pressure at level of (6) foundation is 200 kN/m². Determine the settlement after 6 years of construction for the variation of elastic modulus with depth as shown in figure. Assume $\gamma$= 16 kN/m³. Assume q = 24 kN/m²
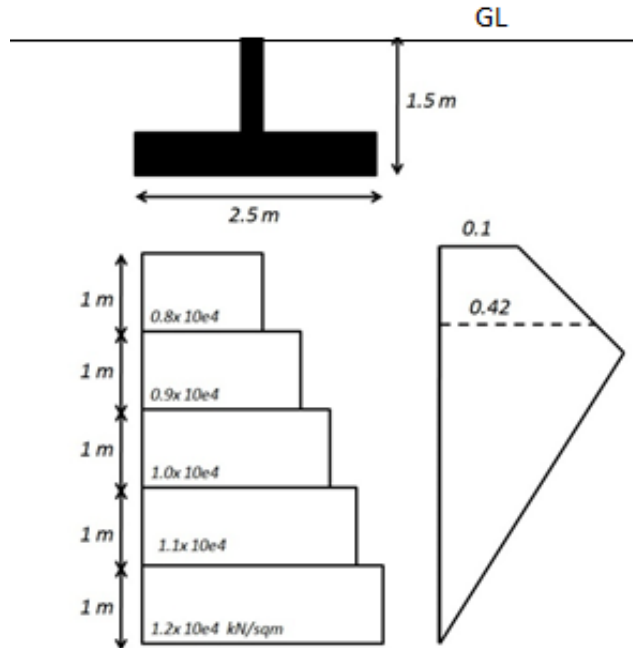


**MODULE II**

11. For the plan, design a mat foundation. Assume SBC = 200 kN/m². Draw (6) pressure distribution diagram and justify your answer. All Columns are 0.6x0.6 m
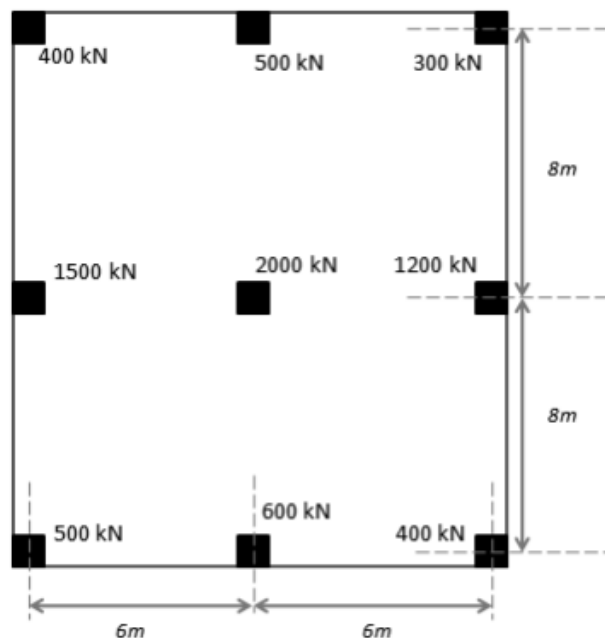
**OR**

12. a) Explain the design principles followed in designing shallow foundations.   (4)

     b) How do you arrive at bearing capacity from SPT- test.   (2)

### MODULE III

13. a) A concrete pile, 30 cm diameter is driven into a medium dense sand with $\Phi= 35^0$, $\gamma= 21$ kN/m³, tan $\delta= 0.70$ for a depth of 8m. Estimate safe load if water table rises to 2m below ground surface. Take $\gamma_w= 10$ kN/m³ and FOS as 2.5.   (4)

     b) Explain the concept of critical depth.   (2)

**OR**

14. Determine the safe load of a 60cm diameter pile for soil data given. Take FOS= 2.   (6)
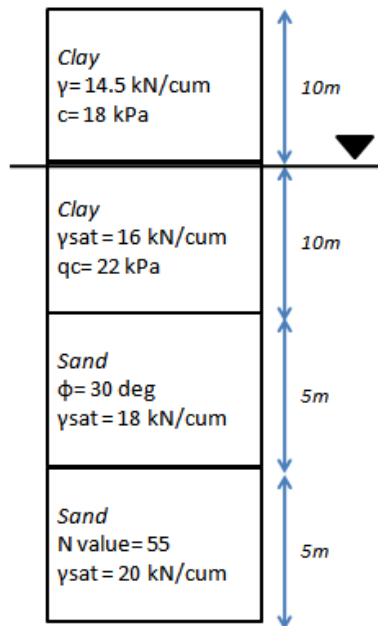


### MODULE IV

15. a) What are the different types of pile load tests? Explain ML Test.   (4)

     b) Calculate the group efficiency of piles using Converse Lebarre equation. Diameter of pile is 40cm. Centre to centre spacing between piles is 2.5D. 24 piles are arranged with 6 piles in a row.   (2)

**OR**

16. Find consolidation settlement of pile groups consisting of 6 piles with diameter 0.6m spaced at 1.2m centre to centre. Piles are arranged in 2 rows. Piles are 18m long. Top 15m consist of clay layer having compression index value of 0.3 and initial void ratio 1.2. Bottom layer is stiff clay with compression index 0.11 and initial void ratio of 0.8. Pile is transferring a load of 750 kN. 1/3rd of the load is transferred by bearing. (6)

### MODULE V

17. a) What is non dimensional analysis of laterally loaded piles? (3)
    b) Explain IS Code method of bearing capacity analysis of under reamed piles. (3)

### OR

18. Determine lateral loaded capacity of a 70cm diameter pile on preloaded clay for the soil profile given. Assume eccentricity e as 0.5 and pile as free headed pile. (6)
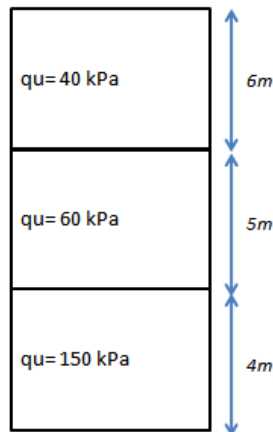


### MODULE VI

19. Explain concept of 'Beams on Elastic Foundation'. (6)

### OR

20. Explain factors influencing modulus of sub grade reaction. (6)

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