Register No.: …… Name: ……

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M. TECH DEGREE EXAMINATION (Supplementary), December 2021

GEOMECHANICS AND STRUCTURES

Course Code: **20CEGST102**

Course Name: **Design of Reinforced Concrete Foundations**

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

IS.456, IS.875 & SP16 can be used.
Assume missing data, if any

PART A

(Answer all questions. Each question carries 3 marks)

1. Differentiate between strip footing and isolated footing.
2. Why are strap beams provided in combined footings?
3. Explain the general considerations followed in the design of rigid rafts.
4. What are the limitations of Winkler model?
5. When under reamed piles are provided?
6. Explain the load transfer mechanisms in pile cap.
7. What can be done to prevent overturning in a tower foundation?
8. Explain the variation of stresses in a shell foundation under vertical load.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Design a footing for a 300 mm square column transferring a load of 1200 kN. One side of the footing is restricted to 1.5m from the centre of column. Safe bearing capacity of soil is 100 kN/m^2. Assume M25 grade concrete and Fe 500 Steel. (6)

OR

10. When are pedestals provided in foundations? Design a plain concrete pedestal for a 300mm x 300mm column carrying a service load of 900 kN, to rest on soil with bearing capacity 200 kN/m^2. (6)

MODULE II

11. Design a suitable combined footing for two columns 400mm x 400mm and 300mm x 300mm in size, 3.6m apart, carrying loads of 750 kN and 450 kN respectively. The footing cannot be extended beyond the outer of the column transferring 750 kN by more than 100mm. Soil pressure for design=120 kN/m^2. Assume concrete as M25 grade concrete and Fe 500 Steel. (6)

OR

12. Design a combined footing to transfer column loads of 1500 kN and 1750 kN. SBC of the soil is 100 kPa. Centre to Centre distance between the columns is 3.6 m. Column sizes are 400 mm x 400 mm. Use M20 grade concrete and Fe 415 Steel. (6)

MODULE III

13. Design an annular raft for a circular water tank with outer diameter 12 m, which is supported by 8 columns, rests on a ring beam of 10.0 m diameter. Total load from the tank is 20000 kN. Safe bearing capacity of soil is 250 kN/m^2. Design the ring beam and the raft. (6)

OR

14. Design a cantilever retaining wall to retain soil of 4.5 m high. Unit weight of back fill soil = 20 kN/m^3. $\phi = 33^0$. SBC of soil=200 kN/m^2. Coefficient of friction between soil and concrete is 0.5. Use M25 grade concrete and Fe 500 steel bars. Assume max ground water table is always below the retaining wall foundation. (6)

MODULE IV

15. Describe the analysis of foundation systems resting on elastic foundations using theory of subgrade reaction. (6)

OR

16. A mat slab supports 16 columns with column loads of 800 kN at corners, 1200 at exterior sides and 1600 kN at interior. Slab depth is 700 mm. Modulus of subgrade reaction of soil is 5 kg/cm^3. E for concrete = 22.4 kN/mm^2. Spacing of columns is 5.0 m and column sizes are $400mm \times 400mm$. Find the BM and SF along the one central line of the columns (interior) using the concept of plates resting on elastic foundations. (6)

MODULE V

17. Design a bored cast in situ pile to transfer a load of 1100 kN. Draw the reinforcement details. (6)

OR

18. A 50cm square column is supported on four piles of 40cm diameter each arranged symmetrically. The distance between piles is 1.0 m. The column carries a factored load of 1500kN and a moment of 75kNm. There is a moment of 100kNm due to wind acting in any one direction at a time. Design the pile cap using M25 grade concrete and Fe 500 steel. (6)

MODULE VI

19. Design a hypar shell footing for a column carrying 1600 kN to rest on soil with safe bearing capacity 80 kN/m^2. (6)

OR

20. Design a circular raft foundation for a cylindrical chimney of height 100 m and external diameter 6 m, located where the wind intensity is 1kN/m^2. Safe bearing pressure of soil is 140 kN/m^2. (6)

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