Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), DECEMBER 2023
GEOMECHANICS AND STRUCTURES
(2021 Scheme)

Course Code: **21GS102**

Course Name: **Theoretical Geomechanics**

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

PART A

(Answer all questions. Each question carries 3 marks)

1. What is a stress tensor? Explain the components of a stress tensor.
2. Determine the depth at which vertical stress reduces to 10% of the applied pressure on a circular footing.
3. Describe Burmister's two layer theory. How it can be used for computing the vertical stress under pavement?
4. What is a Kelvin model? Explain its components.
5. Describe isotropic stress line and failure locus in deviatoric plane with the help of a sketch.
6. Explain Von Mises failure criterion.
7. What do you mean by a constitutive model? Explain the basic criteria for model evaluation.
8. Explain the basic characteristics of jointed rock model.

PART B

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

MODULE I

9. At a point in a body the components of strain tensor are $\varepsilon_x = 0.01$, $\varepsilon_y = -0.005$, $\varepsilon_z = 0.005$, $\gamma_{xy}=0.03$, $\gamma_{yz} =0.01$, $\gamma_{xz}= -0.008$. Determine the principal strains and principal strain directions. (6)

OR

10. Obtain the characteristic equation of stress. Also write the invariants. (6)

MODULE II

11. The plan of three legged tower form an equilateral triangle of size 4 m. If the total weight of tower is 450 kN, equally carried by all legs. Compute the vertical stress at a depth of 4 m below the soil (i) at the centre of one of the legs and (ii) at the centre of the tower. (6)

OR

12. If it is required to find the vertical stress intensity beneath a building, irregular in plan, which method would you propose? Explain the method. (6)

MODULE III

13. A rectangular raft of size 30 x12 m founded at a depth of 2.5 m below the ground surface is subjected to a uniform pressure of 150 kPa. Assume the center of the area is the origin of coordinates (0, 0) and the corners have coordinates (6, 15). Calculate stresses at a depth of 20m below the foundation level by the methods of Westergaard at coordinates of (0, 0), (0, 15), (6, 0) (6, 15) and (10, 25). Neglect the effect of foundation depth on the stresses. (6)

OR

14. Explain with a neat sketch the stress distribution around vertical shafts. (6)

MODULE IV

15. With the aid of rheological model simulate and explain the consolidation of soil. (6)

OR

16. Give a brief conceptual explanation of Rheology. Explain the procedure for the determination of rheological properties. (6)

MODULE V

17. Explain yield criteria. (6)

OR

18. Describe Tresca failure criteria with a neat sketch of failure locus in principal stress space. Also mark the state of stress. (6)

MODULE VI

19. Explain hardening soil model. (6)

OR

20. Describe the basic parameters and advanced parameters of Mohr coulomb model. (6)

****