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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022
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. Explain the concept of three dimensional stress in soil.
2. Determine the depth at which vertical stress reduces to 10% of the applied pressure on a circular footing.
3. Compare Boussinesq's and Westergaard's analysis.
4. Explain different rheological models.
5. Write notes the following
   (i) Deviatoric plane
   (i) Hydrostatic axis
   (ii) Failure locus in deviatoric plane
6. Draw the failure locus of Tresca criterion. Also explain the state of stress.
7. What do you mean by a constitutive model? Explain the basic criteria for model evaluation.
8. Describe the basic characteristics of a hardening soil model.

PART B

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

MODULE I

9. The components of stress at a point are $\sigma_x = 1$, $\sigma_y = -2$, $\sigma_z = 1$, $\tau_{xy} = 2$, $\tau_{yz} = -2$, $\tau_{xz} = -4$kPa. Obtain the invariants of stress, the principal stresses and their direction cosines. (6)

OR

10. Derive the strain compatibility equation. (6)

MODULE II

11. An overhead water tank is supported at a depth of 3 m by four isolated square footing of sides 2 m each placed in a square pattern with a centre-to-centre spacing of 8 m. Compute the vertical stress at a level of 3m below ground (i) at the centre of the four footings and (ii) at the (6)

centre of one footing. Adopt Boussinesq's point load approximation. The load on each footing is 700 kN.

OR

12. Derive an expression for the vertical stress under a line load. (6)

MODULE III

13. A rectangular raft of size 30 x 12 m founded on the ground surface is subjected to a uniform pressure of 150 kN/m^2. Assume the center of the area as the origin of coordinates (0,0), and corners with coordinates (6, 15). Calculate the induced stress at a depth of 20 m by the Westergaard method at location (0, 0). (6)

OR

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

MODULE IV

15. Explain the stress strain behaviour of cohesive soil under loading (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. With a neat set of sketches, explain the Mohr-Coulomb Failure criterion based on Principal stress on a triaxial sample subjected to confining stress and deviatoric stress (6)

MODULE VI

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

OR

20. Explain an anisotropic elastic perfectly plastic model. (6)

****