Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (S), MAY 2022

CIVIL ENGINEERING (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. Differentiate between plane stress and plane strain problem with suitable examples.
2. A single concentrated load of 1000 kN acts at the ground surface. Construct an isobar of σ_z = 40kN/m^2 by making use of Boussinesq's equation.
3. Compare Boussinesq and Westergaard's solutions.
4. Explain different rheological models.
5. Describe isotropic stress line and 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 aspects of soil behaviour.
8. Explain jointed rock model.

PART B

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

MODULE I

9. The state of stress at a point for a given reference axis xyz are σ_x=50, σ_y= 30, σ_z=15, τ_{xy}=20, τ_{yz}=5, τ_{xz}=1Mpa. If coordinate system is rotated about z-axis in anticlockwise direction through an angle of 30°. Determine the new stress components with reference to x'y'z' system. Also prove that the stress invariants remain unchanged. (6)

OR

10. Obtain the characteristic equation to find the principal stresses. (6)

MODULE II

11. Two columns P and Q are 6m apart. The load on column P is 400kN and the load on column Q is 300kN. The loads can be considered as point loads. Calculate the vertical stresses in the soil 3m below the column foundations, vertically below P and Q. (6)

OR

12. A rectangular area 4m x 2m carries a uniform load of 80kN/m^2 at the ground surface. Find the vertical pressure at 5m below the centre and corner of the loaded area using the equivalent point load method. (6)

MODULE III

13. A ring foundation 10m external diameter and 9m internal diameter carries a uniformly distributed load of 10kN/m^2. Determine the vertical stress at a depth of 6m below the centre of the foundation by (a) Boussinesq's and (b) Westergaard's formula for μ=0. Comment on the vertical stress values obtained. (6)

OR

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

MODULE IV

15. Describe the procedure for determination of rheological constants. (6)

OR

16. Explain the computation of settlements. (6)

MODULE V

17. With a neat sketch, explain the Mohr-Coulomb failure criterion based on Principal stress on a triaxial sample subjected to confining stress and deviatoric stress. (6)

OR

18. Explain Tresca failure criterion. (6)

MODULE VI

19. Explain hardening soil model and list the parameters to define the model. Also explain the advanced parameters. (6)

OR

20. Explain any four constitutive models in soil mechanics. (6)

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