Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), FEBRUARY 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. Write the invariants of spherical stress tensor and deviatoric stress tensor.
2. Explain the significance of pressure bulb.
3. Compare the stress distribution in a ring foundation by Westergaard's and Boussinesq's analysis.
4. Explain a Bingham solid with the help of rheological model.
5. Draw the combined failure loci of Tresca, Von Mises and Mohr Coulomb failure criteria.
6. Describe failure locus and isotropic stress line.
7. How will you evaluate a constitutive model for soil mechanics?
8. Explain anisotropic elastic perfectly plastic models.

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=15, σ_y= -5, σ_z=10, τ_{xy}=3, τ_{yz}=0, 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. Derive the strain compatibility equation. (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 stress in the soil 3m below the column foundations, vertically below P and Q. (6)

OR

12. A strip load of considerable length and 1.5m width transmits a pressure of (6)

150kN/m^2 to the underlying soil. Determine the vertical stress at 0.75m depth below the footing if the point lies:
(i) directly below the centre of the footing and
(ii) directly below the edge of the footing.

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. (6)

OR

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

MODULE IV

15. Explain the procedure for determination of rheological properties. (6)

OR

16. Write note on settlement computation. (6)

MODULE V

17. Elaborate on the influence of intermediate principal stress on failure. (6)

OR

18. Explain the Tresca failure criterion. (6)

MODULE VI

19. Explain the Hardening soil model and specify how this model is better than Mohr Coulomb model. (6)

OR

20. Explain the modified Cam Clay model and list the parameters used to define the model. (6)

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