

M. Sc. (APPLIED GEOLOGY) EXAMINATION, 2022

(2nd Year, 2nd Semester)

ENGINEERING GEOLOGY

PAPER – DSE/TH/02A

Time : Two hours

Full Marks : 40

(Use a separate Answer script for each Part)

PART I (20 Marks)

Answer *any four* questions. 5×4=20

1. a) Derive Airy's stress function (U) and express the stress components (σ_{xx} , σ_{yy} and σ_{xy}) in a 2D Cartesian space in terms of U .
b) Explain the term: analytic. 3+2=5
2. a) Show that the Airy's stress function satisfies a biharmonic equation. State the physical meaning of \bar{z} , where $z = x + iy$. 4+1=5
3. Prove that $\sigma_{\theta\theta} - \sigma_{rr} + 2\sigma_{r\theta} = (\sigma_{yy} - \sigma_{xx} + \sigma_{xy})e^{2i\theta}$,

Where the terms on the left hand side are stress components expressed in polar coordinates and those on the right side represent the stress components in the corresponding Cartesian frame. 5

4. A tunnel is supported by a cylindrical wall with its internal radius a and outer radius b . The internal pressure

[Turn over

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within the tunnel is P_i , whereas the outside pressure is P_o . Find the differential stress at the inner and the outer walls of the cylinder. 5

5. a) There is a circular hole in a rock body, subjected to a far-field tension, T . Determine the stress field around the hole.
- b) Find out the location of maximum tensile stress at the hole-wall. 4+1=5
6. a) A distributed vertical load, W is applied on the ground surface in a mining area. Assuming the vertical plane as an elastic half-space, find the magnitude of shear stress at a point beneath the ground surface.
- b) Determine the shear stress on the ground surface. 4+1=5

PART II (20 Marks)

Answer *any four* questions from the following : 4×5=20

7. How does bulk unit weight of an in-situ soil sample differ from its dry unit weight? Establish the relation between bulk & dry unit weights with reference to the water content of fine grained moist soil? What is degree of saturation? 2+2+1
8. What is meant by 'Plasticity Index' of fine grained cohesive soil? How does volume of a supersaturated

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clayey soil vary with its decreasing water content? What is 'optimum moisture content'? 1+3+1

9. Establish the relation $V_s = \frac{V}{1+e}$, where V = volume of the soil; V_s = Volume of soil solid, and e = void ratio.
- A sample of soil has a porosity of 40%. The specific gravity of the solids is 2.65. Calculate (a) Void ratio, (b) Dry density, (c) Unit weight of the soil if soil is 60% saturated and (d) Unit weight of the soil when it is completely saturated. 2+3
10. What is the smallest unit of meso-scale LHZ mapping in local scale? Mention the geomorphological characters of it. Present a tabular chart to show Maximum LHEF Rating for different causative factors of landslide according to BIS Guidelines (IS 14496 (Part 2) : 1998].
11. Why does busting during post-monsoon season act as the triggering factor for landslide disaster in hill slopes covered with thin layer of residual soil? Explain some specific preventive measures may be deployed to restrict such triggering effect. 2+3