(W3) = 9005 gm

Volume of the calibrating can = 1000 cc.

Weight of sand in calibrating can after pouring from cylinder = 1500 gm 2+3

4. Mention the major factors related to flow turbulence and sediment properties responsible for river bank erosion at its lower regime. Why, in perennial river 'cantilever failure' is the most common mode of bank failure at the downstream side of manmade barrage? 2.5+2.5

5. What is relative-relief? Discuss the importance of 'slope facet' on estimation of TEHD ratings for LHZ mapping? "Commonly heavy precipitation during post monsoon act as a triggering factor of landslide disasters in hill slopes" — Explain. 2+1+2



# M. Sc. Applied Geology Examination, 2023

( 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.

1. a) Express the normal and shear stress components ($\sigma_{xx}$ , $\sigma_{yy}$ and $\sigma_{xy}$ ) in a 2D Cartesian space in terms of Airy's stress function $U$.

   b) With an example explain the concept of conformal mapping. 2+3=5

2. a) What is the primary meaning of a complex valued function?

   b) Using a diagram show the stress tensor in a polar coordinate frame.

   c) Form equations to show the transformation of a stress tensor in Cartesian space to polar coordinates. 1+2+2=5

3. a) How would you define a harmonic equation?

   b) A hollow cylinder is subjected to an internal pressure, $P_i$ and an external pressure $P_o$. The

cylinder has an internal and an external radius of $a$ and $b$, respectively. Derive an equation to show the radial stress in the cylinder.

Estimate the insitu bulk density of the soil. 1+4=5

4. An infinitely extended elastic medium contains a circular cavity of radius, $R$. The medium is given a far-field tensile stress, $T$. Determine the stress field around the cavity, and find the location of maximum tensile stress at the cavity wall. 5

5. a) In a mining area a uniformly distributed vertical normal stress $\sigma$ is applied in a region between two points: A and B at distance of $L$. Assuming the vertical plane as an elastic half-space, find the magnitude of normal and shear stresses at a point beneath the ground surface.

   b) Determine the shear stress on the ground surface. 4+1=5

6. a) Calculate the horizontal stress at a depth of $h$ in rocky terrain, assuming that the rock density as $\rho$ and Poisson's ratio 0.5.

   b) Find the stress field around a coherently attached rigid body in an incompressible elastic medium



subjected to a far-field tensile stress $p$. 2+3=5

**Part – II (20 Marks)**

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

1. How does saturated-unit-weight of a recent sediment sample differ from its submerged unit weight? Why estimation of submerged-unit-weight of natural sediment is an important issue in civil engineering practices? – discuss with examples. 2+3

2. What is meant by the term 'tenacity' of rock? How does it differ from 'hardness'? Prove that $e = \frac{G_S \times \gamma_w}{\gamma_d} - 1$, where, $e$ = void ratio, $\gamma_w$ = unit weight of water, $\gamma_d$ = dry unit weight of the soil, $G_S$ = specific gravity of the solid mass of the sediment. 2+3

3. Why the occurrence of 'Hardpan' is more common in transported soil than residual soil? During investigation of soil for developing a residential complex at Kota, Rajasthan, the following observations were taken for the in situ weight measurement by sand-replacement method:
   Weight of the excavated soil = 761.25 gm
   Weight of sand + Cylinder (W1) = 10500 gm
   Weight of sand + Cylinder after pouring in the excavated hole and cone (W2) = 9450 gm
   Weight of sand + Cylinder after pouring for cone only