B. Sc. (Geological Sciences) Examination, 2022

(1st Year, 2nd Semester)

Structural Geology

Paper – CORE/TH/04

Time : Two hours   Full Marks : 40

(Use a separate Answer script for each Part)

PART – I

Answer *any four* questions.

1. a) Using a sketch show the position of a point in a spherical coordinate system.

   b) "Velocity is a vector. Therefore, the velocity gradient is also a vector." Is this statement correct? Support the answer with arguments.

   c) With the help of diagrams explain the difference between rectilinear and non-rectilinear translational motions.   1+2+2=5

2. a) Would you expect a body to accelerate when it is subjected to surface forces? Justify your answer.

   b) Explain the mathematical expression used to define the stress vector on a plane.

   c) A compressible spherical body is taken to a great depth of a stagnant water body. Find the nature of stress that should act upon this body and infer how the body would change its shape.   1+2+2=5

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3. The stress at point in a Cartesian space (xy) is given by:

$$\begin{bmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{xy} & \sigma_{yy} \end{bmatrix}.$$

a) Determine the orientation of the plane of maximum shear stress in this space.

b) Find the orientations of the principal axes of stress.

$$3+2=5$$

4. a) State Hooke's law for elastic deformation of materials.

b) What is elastic limit?

c) Show the difference between Newtonian and Non-Newtonian fluids. $\qquad$ 2+1+2=5

5. a) With the help of a schematic graphical plot explain the steady state plastic creep of a material under stresses.

b) Using experimental stress-strain relations discuss the possible effects of pressure and temperature on the deformation behaviour of rocks. $\qquad$ 2+3=5

6. a) Explain the geometrical procedure used to determine the interlimb angle of a fold.

b) Identify the characteristic difference between a class 1B and a class 1C fold. $\qquad$ 3+2=5

PART – II

Answer *any five* questions. $\qquad$ 4×5

1. Prove that the homogeneous deformation can be representated by the following linear transformation. $x' = ax + by$; $y' = cx + dy$ where x, y and x', y' are the axes of the reference frames of the initial and deformed body respectively, and a, b, c and d are the constants.

2. Define coaxial and non-coaxial deformation with suitable examples and sketches.

3. Using mathematical derivation prove that direction of maximum shear (θ) always lies at an angle 45° with the principal axes of strain (α).

4. What is 'Failure envelop'? How does it help in understanding the condition of fracturing of brittle material? Explain with suitable sketch.

5. With the help of suitable diagram define Rake, Net slip, Dip-slip, Vertical throw, Horizontal throw, Stratigraphic throw and Heave of any faulted rock body.

6. Write six (6) major field evidences that help us to identity fault in a deformed terrain?

7. What is Pseudotachylite? How do you differentiate it from the breccia and gauge?