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8. How the repetition and omission of strata occur due to faulting? In a geological terrain, net slips of a fault are found different in different places. How would you explain the field observation?

Ex/SC/GEOL/UG/CORE/TH/04/2023

**B. SC. GEOLOGICAL SCIENCES EXAMINATION, 2023**

( 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 (Marks 20)**

Answer *any four* questions.

1. a) Define the term - kinematics.  
b) Using a sketch explain the motion required for deformation of body.  
c) The energy field in a Cartesian 2D space  $(x, y)$  is expressed as a function of spatial coordinates:  $E(x, y)$ . Find the force at a point in this space.  
1+2+2=5
2. a) “The Earth acts like a heat engine.” Explain this statement, commenting on the source of its energy.  
b) A spherical water drop falls in a vacuum medium under gravity. Would the spherical shape of the drop undergo distortion? Support the answer with a dynamic consideration. 2+3=5
3. The stress at point in a Cartesian space  $(xy)$  is given by:

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

[ Turn over

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- a) Find the stress vector on a plane oriented at an angle  $\phi$  to the x axis.
- b) Determine the orientations of the principal axes of stress. 3+2=5
4. a) Using a Mohr diagram for stress show that the maximum shear stress will be oriented at angle of  $45^\circ$  to the principal axis of stress.
- b) Prove that the shear stress:  $\tau_{xy}$  and  $\tau_{yx}$  acting on planes perpendicular to the coordinate axes, x and y, respectively, will be equal in magnitude. 2+3=5
5. a) With the help of a schematic sketch describe the procedure of rock deformation experiments.
- b) Explain the characteristic properties of shear thinning and shear thickening fluids. 3+2=5
6. a) Show the geometry of surfaces with positive and negative Gaussian curvatures.
- b) Describe the classification of folds based on fold axis and axial plane. 2+3=5

### PART – II

Attempt **any 5 (five)** questions. 4×5

1. In a homogeneous deformation the transformation equations are given as:

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$$x' = x + 0.6y$$
$$y' = 0.4x + 1.5y$$

- Calculate the length of semi-axes of strain ellipse and principal strains at a point.
2. Which types of primary structures are commonly used for determining stratigraphic correlation and paleo-current direction in geological analysis? Justify your answer with logical interpretation.
3. Define the following terms: a) Non-coaxial deformation, b) Vorticity, c) Horst- and Graben structure and d) Slickenside surface.
4. What are the differences between strike-slip and transform fault?
5. In a locality, a bed shows reverse offsetting against a normal fault. How would you explain the field observation? Define the term offset, slip and separation related to a fault.
6. In any crustal deformation, dip of a normal fault is generally found above  $45^\circ$  and it is less than  $45^\circ$  in case of reverse fault. How would you explain this phenomenon?
7. Prove that in a homogeneous deformation the direction of maximum shear strain bisects the principal axes of strain.

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