event. At what conditions barrel-shaped and fish-head boudins are formed? 3+2

6. How would you differentiate the Proto-, Ortho- and Ultra- mylonite in rock? Write at least one field feature from each type of mylonite which can be used as good shear sense indicator. 3+2

M. Sc. Applied Geology Examination, 2023

(1st Year, 1st Semester)

Structural Geology

Paper – CORE/TH/03

Time : Two hours   Full Marks : 40

(Use a separate Answer script for each Part)

PART – I (20 Marks)

Answer any **four** questions.

1. a) Define a point in the context of continuum mechanics.

   b) A physical quantity is expressed in terms of tensor notation as λ_{ijk}. Determine the number of components of this tensor.

   c) With help of an equation explain the term: tensorial homogeneity. 2+1+2=5

2. a) Show that the stress at a point is a symmetric tensor.

   b) The stress field in a region is represented by a tensor σ_{ij}. Derive the condition of equilibrium in the system, assuming that the gravity acts as a body force.

   c) Explain the mathematical concept of eigen values and vectors of a stress tensor. 1+2+2=5

3. a) "Displacement is a tensor of rank 1, the displacement gradient is also of the same rank." Is the statement correct? Answer with an explanation.

   b) Show that the strain at a point is a symmetric tensor, whereas the rotation is an asymmetric tensor.

   c) Form a 2D matrix for displacement in simple shear zones and find the strain tensor.　　2+2+1=5

4. a) Write a general equation in tensor form to express Hooke's law for elastic deformations.

   b) Derive an equation to find the relation of bulk modulus (K) with Lame's parameters: λ and μ.

   c) Express the stress versus strain rate relation for incompressible Newtonian fluids in a tensorial form to explain the coefficient of viscosity.　　1+2+2=5

5. a) Develop a mechanical model to show time dependent elasticity of rocks.

   b) Explain the elastic and viscous rheology of mantle as a function of the time scale of geological processes.　　3+2=5

6. a) With the help of sketches discuss the principal types of point defects in crystals.

   b) Using a diagram illustrate the diffusion controlled creep mechanisms.

   c) Can climb controlled creep take place at low temperatures? Answer with a reason.　　1+2+2=5

PART – II (20 Marks)

Answer any **four** questions.　　4×5

1. Write Coulomb- and Griffith- failure criteria and draw the failure envelops of each criterion. With the help of neat sketch represent graphically the normal and shear stress component on an inclined plane with respect to the Principal Stress axes in two dimensions.　　$2\frac{1}{2}+2\frac{1}{2}$

2. Write tensile failure criteria. Which conditions are needed to form tensile fracture in nature? What is plastic yielding? Write the criteria of plastic failure of a material.　　1+2+1+1

3. With the help of suitable sketches, explain the geological conditions of development of contractual-, extensional- and strike-slip duplex structure separately.　　5

4. Briefly describe three possible states of wedge deformation and their important features in contractional regime on the basis of critical taper angle of thrust wedge. In which geological situations the large-scale pull-apart basins are developed in nature?　　4+1

5. With the help of suitable sketches explain the formation of chocolate-tablet boudins associated with a folding