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Ex./IG/VI/24/2017

BACHELOR OF SCIENCE EXAMINATION, 2017

(2nd Year, 3rd Semester)

GEOLOGICAL SCIENCES

Paper : VI H

Structural Geology

Time : Two hours

Full Marks : 50

Use separate Answer scripts for each group.

GROUP - A (25 marks)

Answer any **five** questions.

1. (a) With the help of a diagram show qualitatively the possible particle paths for a body undergoing motion by a combination of rotation and rectilinear translation.
(b) Define the term–Continuum’ citing a physical phenomenon.
(c) Define a vector quantity in a 3D Cartesian space.
2+2+1

2. (a) Body force at a point within a body is expressed by a vector X , as a function of space coordinates (x_1, x_2, x_3) . Show the mathematical approach to determine the total body force acting upon the body.

(Turn Over)

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- (b) Enumerate the kinematic changes due to a body force and a surface force acting upon a deformable body.
- (c) What are the different ways the two types of forces originate in the solid earth. 2+2+1
3. (a) Define the stress at a point in a 2D Cartesian space.
- (b) Determine the orientation of the plane of maximum shear stress at that point.
- (c) With the help of Mohr circles show how the state of stress can vary with increasing depth in the earth. 1+3+1
4. (a) Prove that a circle transforms into an ellipse under a homogeneous strain field.
- (b) With the help of a transformation matrix derive the condition of irrotational deformation. 3+2
5. (a) Define the term rheology.
- (b) What is the fundamental difference between a Coulomb and a viscous substance ?
- (c) "The tensile strength of a Coulomb material is greater than its compressive strength"—is this statement correct ? Justify the answer with an appropriate theoretical analysis. 1+2+2

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16. Describe the following terms with proper figures : (a) Dip Slip, (b) Net Slip, (c) Strike Slip, (d) Vertical throw and (e) Stratigraphic throw. 5
17. In a given fault plane, the principal stress magnitudes σ_1 and σ_2 are recorded as 50 MPa and 31 MPa at zero pore pressure. The angle between normal to fault plane and σ_1 is 70° . Determine the normal stress and the shear stress are the truly please. The rock has preexisting fractures and angle of internal friction is 39° . The injection of water into the rock creates a pore pressure of 27MPa. Show the position of new Mohr circle. 5

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GROUP - B (25 marks)

Answer any **five** questions.

9. Why do shear fractures not form at 45° to σ_1 , where the resolved shear stress is to the maximum? 5
10. What are the different modes of fractures (describe with suitable figures)? 5
11. Write short note on (any two) : (a) Granular flow (b) Cataclasis (c) Fault damage zone (d) Wing crack (e) "Vorticity". 5
12. What is the difference between a fault propagation fold and fault bend fold? 5
13. Write short note on "rigid domino model". 5
14. What is meant by the term Griffith cracks, and how do they affect rock strength and fracture propagation? 5
15. What is the difference between shear fracture and fault? 5

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6. (a) With the help of a diagram define the principal curvatures of a surface.
(b) Show mathematically the inflection point and the hinge of a fold wave.
(c) Explain the field methods used for determining the fold axis of a large-scale fold. 2+1+2
7. (a) Write the constitutive rheological equation for an isotropic linear elastic substance.
(b) Use the same equation to derive the bulk modulus as a function of the elastic parameters.
(c) With a few examples explain the implications of Poisson's ratio in characterizing the physical properties of rocks. 1+2+2
8. (a) What is the fundamental basis of Ramsay's classification? Explain with a relevant diagram.
(b) Using sketches show the difference between pure flexural and flexural slip folding in layered rocks.
(c) Write short notes on the following two phenomena cleavage fanning and cleavage refraction.

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