M. Sc. (Applied Geology) Examination, 2022

(2nd Year, 2nd Semester)

Geomaterials

Paper – DSE/TH/02B

Time : Two hours Full Marks : 40

(Use a separate Answer script for each Part)

PART I (20 Marks)

Answer ***any four*** questions.

All questions carry equal marks.

1. "Color is independent of temperatur but temperature has a color" — Accept or reject the statement with reason.
2. Why does the "Engineering Stress-Strain curve" differ from the "true Stress-Strain curve" of a material?
3. What are the four C's in gemology? Why the gem minerals are made multifaceted?
4. If you put a piece of partially hydrated zeolite on your tongue what feeling would you expect? Justify your answer.
5. Why is the zeolite considered as "environment cleaner" and a good absorbent of H_2O?
6. "Cracks propagate faster in the ductile materials than in the brittle" accept or reject the statement using the laws of thermodynamics.

PART II (20 Marks)

Answer *any four* questions.

7. a) Express the stress versus strain relations for an anisotropic elastic crystal in terms of Voigt's notation.

   b) Expand the elastic constant tensor of a monoclinic silicate mineral. 3+2=5

8. a) Explain the physical significance of each constant in the elastic constant tensor for a cubic crystal.

   b) Develop an equation to show the internal energy of a solid as a function of its volume and strain under a stress σ_{ij}. 2+3=5

9. a) What is meant by the mechanical stability of crystalline solids?

   b) How would you evaluate such stability for a tetragonal crystal?

   c) Explain the parameters used to express the shear anisotropy of orthorhombic crystals. 1+2+2=5

10. a) Define the term: phonom, and provide its physical explanation.

    b) Express the Debye temperature of a crystalline solid as a function of the elastic wave velocity.

   c) Using the Debye model determine the lattice heat capacity. 1+2+2=5

11. a) State the Birch-Murnaghan equation of state, giving its physical implication.

    b) With the help of appropriate sketches explain the methods of determining the phase transition pressure from enthalpy versus pressure and energy versus volume plots. 2+3=5

12. a) Find the main structural difference between zircon and reidite.

    b) Can zircon be used as an insulator? Justify the answer.

    c) "Zircon is an outstanding refractory". Would you support this statement? Give reason in favour of your answer. 1+2+2=5