BACHELOR OF SCIENCE EXAMINATION, 2017

(1st Year, 1st Semester)

GEOLOGICAL SCIENCES

Paper : IIH

Principles of Optical Mineralogy and

Elements of Crystallography

Time : Two hours   Full Marks : 50

Use separate Answer scripts for each group.

GROUP - A (25 marks)

Answer any *five* questions.

1. With the help of mathematical equations explain the fundamental concept of Maxwell's theory of electro-magnetic field, and derive the speed of light in vacuum.   5

2. State Planck's law of black body radiation. Explain the term : quanta used in describing the physics of light. What do you understand by the statement wave particle duality in the theory of light ?   2+1+2

3. Define mathematically the phase of a light wave. Drive the relation between the wave number (k) and the angular frequency (ω) of a wave. Show the fundamental difference between wave equation and diffusion equation.   1+2+2

4. Light undergoes scattering when it travels through a mineral. Explain the phenomenon. What is called Raman shift?   3+2

5. Using Fermat's principle prove the law of light refraction. Do light waves always travel along the wave front normal? Explain your answer.   3+2

6. 'The refractive index of an anisotropic crystal is a scalar quantity' is this statement correct? Justify the answer. Explain the relation between crystal and optical symmetry of minerals.   3+2

7. With the help of a suitable diagram determine the vibration directions of a light passing through a bi-axial crystal. Show the difference in the isogyre patterns of uniaxial and bi-axial crystals. Explain the difference.   4+1

(b) State the point group that results if one mirror plane is removed from A-B Plane in the crystal class (4/m2/m2/m).

(c) Is (010) face always perpendicular to B-Axis of any crystal? Justify your answer.   3+1+1

14. (a) What do you understand by "Inversion"?

(b) State the "Crystal Forms" that result if a plane of symmetry is added perpendicular to the c-axis of a "Rhombohedron" and "Dome".

(c) Explain with suitable diagram the relation between "BAR6" and "3/m."   1+2+2

15. (a) Why 5-Fold Symmetry does not exist?

(b) What point group is developed through the interaction of two mirror planes at 30° to each other?

(c) What point group is developed through the interaction of two 2-fold axis of rotation at 45° to each other?

(d) What is the difference between two point groups "23" and "32"?   1.5+1+1.5+1

—— X ——

11. (a) The form (111) is the general form for Orthorhombic system. Why ? What is the general form of Cubic system ?

(b) What is pinacoid ? How many pedions should be required to completely enclose the space

(c) What is the difference betwee "Trapezohedron" and "scalenohedron" ? 2+1+2

12. (a) What point group is developed due to placement of "m" perpendicular to c-axis in the point group 222 ?

(b) Plot the stereographic projections of faces (100) and (010) with respect to triclinic system, if axes a- and b-lie on the equatorial plane.

(c) Which faces of a crystal provide the same result in Gnomonic Projection and Spherical Projection ? Explain with diagram. 1+2+2

13. (a) How many Principal axis and diagonal axis are present in crystal, which belongs to (23) class ? Draw a stereographic projection of the crystal class (BAR 32/m) placing or positioning the suitable symmetry elements at the perfect location for a crystal with 6 faces.

8. Describe the mathematical basis for reconstructing the Bentin's surfaces of an interference figure for a uniaxial and a bi axial crystal. 5

GROUP - B (25 marks)

Elements of Crystallography

9. Write short notes on (any *two*) : 2.5x2=5

(a) Trapezohedron

(b) Crystallographic axes

(c) Spherical Projection

10. (a) Face (PQR) cuts the a-axis with one-third unit length of a -axis, b-axis with twice of c-axis and cuts the c-axis with half unit length of a-axis. What will be the Miller indices as well as the Weiss Parameter of the face (PQR) ?

(b) Calculate zone symbol for the non-coplanar faces; (223) and (112).

(c) What is Symmetry. 2+2+1