v) Briefly discuss about the process by which we can examine the relative hardness of a mineral. Arrange the minerals as per Moh's Scale of Hardness in descending order? 3+2=5

vi) a) What point group is developed due to removal of **"i"** from the point group **BAR32/m**?

b) Plot the stereographic projection of face (010) with respect to monoclinic system on the equatorial plane.

c) Which face of a crystal provides the same result in Stereographic Projection and Spherical Projection? Explain with diagram. 2+1+2=5

vii) a) State the point group that results if a center of symmetry is added to a point occupied by (i) 3m; (ii) point group "p", where "p" is an odd number.

b) How will you distinguish the "vertical face" and "horizontal face" in stereographic projection?

c) Why 8-Fold Symmetry does not exist? Explain with diagram. 2+1+2=5

B. Sc. Geological Sciences Examination, 2023

(1st Year, 1st Semester)

Mineral Science

Paper – CORE/TH/02

Time : Two hours Full Marks : 40

(Use a separate Answer script for each Part)

PART – I (20 Marks)

Give justifications with relevant illustrations when attempting any question.

1. Answer any **one** question from the followings. 1×8=8

a) How is the ionic substitution between "Na and K" in the alkali feldspar structure distinguished from the "Na and Ca" substitution in the plagioclase structure? Explain it with the help of Goldschmidt's Rules. How do the limits of alkali feldspar solid solution vary with the temperature? State the names of two mineral groups each that show solid solutions and that do not show solid solutions.

b) Both the isotropic mineral section, and the anistropic mineral section that is perpendicular to its optic axis, remain extinct under microscope in cross polars during full rotation of the stage. How will you differentiate whether it is an isotropic or an anisotropic (uniaxial or biaxial) mineral?

2. Answer any **three** questions from the followings. 3×4=12

a) What is reconstructive polymorphism? Describe it with reference to the aluminosilicate (Al_2SiO_5) structures.

b) The pleochroic scheme of an orthopyroxene shows following absorption colours;

α – Pink

β – Yellow

γ – Green

Which colour or variation of colours will be shown by an optic axis perpendicular section of the orthopyroxene? Explain it with reason.

c) "The changes in interference colours before and after the insertion of an accessory plate in the microscope are opposite in NE and NW quadrants of a uniaxial optic axis figure." Justify the validity of the statement.

d) Describe the Nesosilicate and Tectosilicate structures in detail with examples.

e) What is the general stoichiometric formula of clinopyroxene? Mention their end member compositions. Does any section of clinopyroxene that is crystallized under monoclinic system, show straight extinction? Explain with illustrations.

PART – II (20 Marks)

1. Answer any **four (4)** questions: 5×4=20

i) a) Define "General Form" and "Zone Axis".

b) Calculate the face symbol of a face (PQR), if that face intersects the a-axis and c-axis with two third of b-axis.

c) Calculate the Zone Symbol for the non-parallel faces (123) and (221). 1.5+2+1.5=5

ii) a) What do you understand by "Elements of Symmetry"?

b) State the point group that results if a Plane of symmetry is added perpendicular to the z-axis of a Tetragonal Trapezohedron.

c) Is (001) face always perpendicular to Z-Axis of any crystal? Justify your answer. 1.5+2+1.5=5

iii) a) What point group is developed through the interaction of 2-two fold at 90° to each other?

b) How will you get the "Pole" of any crystal face?

c) What is the difference between two point groups **"4BAR2m"** and **"4BAR3m"**? 1+1.5+2.5=5

iv) What is lustre? Differentiate "Tenacity" and "Hardness" of a mineral. 5