**4.** *(a)* How many principal axis and diagonal axis are present in crystal that belongs to (23) class? Draw a stereographic projection of the crystal class (BAR32/m) placing or positioning the suitable symmetry elements at the perfect location for a crystal with 6 faces.

*(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 (001) face always perpendicular to C-Axis of any crystal? Justify your answer. 3+1+1=5

**5.** *(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 a suitable diagram the relation between 'BAR2' and 'm'. 1+2+2=5

**6.** *(a)* Why does 8-Fold Symmetry not exist?

*(b)* What point group is developed through the interaction of two mirror planes at 45° to each other?

*(c)* What point group is developed through the interaction of two 2-fold axis of rotation at 30° to each other?

*(d)* What is the difference between two point groups '23' and '32'? 1·5+1+1·5+1=5

★★★



**EX/SC/GEOL/UG/CORE/TH/02/2024(OLD)**

**BACHELOR OF SCIENCE EXAMINATION, 2024**

**(1st Year, 1st Semester)**

**GEOLOGICAL SCIENCE**

**PAPER : CORE/TH/02(OLD)**

**( Mineral Science )**

*Time* : *Two Hours* *Full Marks* : 40

*Use separate answer scripts for each part*

**PART—I**

**(Marks : 20)**

***Give justifications with relevant illustrations when attempting any question.***

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

*(a)* What are the Pauling's Rules? Express the coordination number and the radius ratio with examples. Calculate the lower limit of the radius ratio for octahedral coordination. Why the $[SiO_4]$ tetrahedrons do not prefer to share edges or faces in silicate structures? Justify with the help of Pauling's Rule.

*(b)* What is pleochroism? How will a mineral section, perpendicular to the optic axis, appear in crossed-polars? "A section perpendicular to the optic axis of a pleochroic mineral does not show any pleochroism" – accept or reject the statement with reasons.

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

*(a)* "Calcite crystal shows double images in hand specimen whereas the optically anisotropic quartz crystal does not produce the same." Explain the phenomenon.

*(b)* Describe the Double Chain Inosilicate structure in detail with examples.

*(c)* Draw a neat sketch of the X-Z section of a biaxial indicatrix to show all optic features. How are biaxial minerals classified further as (+) and (–) crystals?

*(d)* What is a solid solution? Give examples of two mineral groups that exhibit extensive solid solutions. An olivine composition is expressed as $Fo_{75}$ $Fa_{25}$ [Fo = Forsterite; Fa = Fyalite]. Write the formula of the mineral.

*(e)* What is the general formula of orthopyroxene? State their end-member compositions. Why does an orthopyroxene grain parallel to the c-crystal axis always show straight extinction? Explain with illustrations.





## PART—II
**(Marks : 20)**

Answer ***any four*** questions :

**1.** *(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; (213) and (122).

*(c)* What is Symmetry? 2+2+1=5

**2.** *(a)* "The form {111} is the general form of Orthorhombic system" — Explain. What is the general form of Cubic system?

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

*(c)* What is the difference between 'Dome' and 'Sphenoid'? 2+1+2=5

**3.** *(a)* What point group is developed due to placement of 'm' perpendicular to c-axis in the point group 2 mm?

*(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 a diagram. 1+2+2=5