

RAN-2403000503043001

S.Y.B.Sc. (Sem. III) Examination March - 2026
Mathematics - MH-MDC-301 : Group of Symmetries

[Total Marks: 50

સૂચના : / Instructions (1) ઉપરોક્ત દર્શાવેલ વિગતો ઉત્તરવહી પર અવશ્ય લખવી. Fill up strictly the above details on your answer book (2) All questions are compulsory. (3) Figures to the right indicate marks of the corresponding question.	Seat No.: <table border="1" style="width: 100%; height: 20px; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> </table> Student's Signature						

- Q.1. Answer the following (Any ten) 10**
1. Show that inverse of an element in a group is unique.
 2. Write all possible symmetries of a rectangle.
 3. Define : Subgroup.
 4. The order of group of symmetries of NH_3 is same as that of _____
(an isosceles triangle, a rectangle, an Equilateral triangle)
 5. Write the order of the multiplicative group of all square roots of unity.
 6. Check the validity of the statement: CHCl_3 is a planer molecule.
 7. State symmetry elements in a space.
 8. Define: symmetry operation.
 9. Write the order of Reflection symmetry operation.
 10. If commutative property is satisfied in a group, then the group is known as _____
group. (subgroup, cyclic group, abelian group)
 11. Define: Isomorphism of two groups.
 12. The Identity symmetry operation is denoted by _____ (I, R, E, σ)
- Q.2. Answer the following (Any two) 10**
1. Show that the set of all nonzero complex numbers with operation of multiplication is a group.
 2. Define subgroup. Show that $(\mathbb{Z}, +)$ is a subgroup of $(\mathbb{C}, +)$.
 3. Prove the following in a group $(G, *)$: (i) Identity element is unique. (ii) $(a^{-1})^{-1} = a$
- Q.3. Answer the following (any two) : 10**
1. Explain Rotation symmetry with illustration.
 2. Explain Identity symmetry operation and Inversion symmetry operation.
 3. Discuss about the all possible symmetries of an English capital letter 'X'.
- Q.4. Answer the following (any two) : 10**
1. Show that the set of all possible symmetries of an isosceles triangle is a group under operation of composition of symmetries. Also write order of each element.
 2. Explain by drawing figures, different types of symmetries of a square.
 3. Show that the set of all possible symmetries of H_2S is a group under composition of symmetry.

Q.5. Answer the following (Any two)

10

1. Explain Isomorphism of two groups with illustration.
 2. Check whether the multiplicative group $G = \{6, 12, 18, 24\}$ with X_{30} is isomorphic to group of symmetries of a rectangle.
 3. Show that the group of symmetries of an Equilateral triangle isomorphic to that of NH_3 .
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