



RAN-2403000503043001

S.Y.B.Sc. (Sem. III) Examination November - 2025
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.:

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Student's Signature

Q-1. Answer the following (Any ten) 10

1. Show that the identity element in a group is unique.
2. Define: symmetry operation.
3. State symmetry elements in a space.
4. Define : Group.
5. Write the order of Identity symmetry operation.
6. Check the validity of the statement: PCL_3 is a planer molecule.
7. The Reflection symmetry operation is denoted by _____ (I, R, E, σ)
8. If there exists a generator in a group, then the group is known as _____ group.
(subgroup, cyclic group, abelian group)
9. Define: Isomorphism of two groups.
10. Write all possible symmetries of an Isosceles Triangle.
11. Write the order of the multiplicative group of all square roots of unity.
12. The order of group of symmetries of H_2O_2 is same as that of _____
(an isosceles triangle, a rectangle, an Equilateral triangle)

Q-2. Answer the following (Any two) 10

1. Show that the set of all complex numbers with operation of addition is a group.
2. Define subgroup. Show that $(\mathbb{Q}, +)$ is a subgroup of $(\mathbb{C}, +)$.
3. In a group (G, o) , prove that $(aob)^{-1} = b^{-1} oa^{-1}$.

Q-3. Answer the following (any two) : 10

1. Explain the general idea of symmetry with illustrations.
2. Explain Rotation symmetry with illustration.
3. Discuss about the all possible symmetries of an English capital letter 'H'

Q-4. Answer the following (Any two) 10

1. Explain by drawing figures, different types of symmetries of a square.
2. Show that the set of all possible symmetries of a rectangle is a group under operation of composition of symmetries. Is it cyclic group? Justify your answer.
3. Explain by drawing figures, different types of symmetries of a NH_3 .

- Q-5.** **Answer the following (Any two)** **10**
1. Prove that the multiplicative group $G = \{1, 5, 7, 11, 13, 17\}$ with X_{18} is isomorphic to group of symmetries of an Equilateral triangle.
 2. Explain Isomorphism of two groups with illustration.
 3. Show that the group of symmetries of a rectangle is isomorphic to that of H_2O_2 .
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