

1903000203040054
EXAMINATION FEBRUARY-MARCH 2024
BACHELOR OF SCIENCE (THIRD SEMESTER)
GROUPS OF SYMMETRIES – I – (EG-3002) LEVEL 4

[Time: As Per Schedule]

[Max. Marks: 50]

Instructions:

1. Fill up strictly the following details on your answer book

- a. Name of the Examination: **BACHELOR OF SCIENCE (THIRD SEMESTER)**
- b. Name of the Subject: **GROUPS OF SYMMETRIES – I (EG-3002) LEVEL 4**
- c. Subject Code No: **1903000203040054**

2. Sketch neat and labelled diagram wherever necessary.
3. Figures to the right indicate full marks of the question.
4. All questions are compulsory.

Seat No:

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Student's Signature

Q.1 Answer the following [Any 4]:

8

1. Define: Abelian group, cyclic group.
2. State the respective angles of Rotation in the symmetry operations C_3 , C_6 , C_2 .
3. Define symmetry operation.
4. Check the validity of the following statements:
 - a. Order of Rotation symmetry operation is 1.
 - b. Improper Rotation symmetry operation is a combination of identity symmetry and rotation symmetry.
5. Define Identity element in a group.
6. Show that in a group inverse of an element is unique.

Q.2 Answer the following [Any 2]:

14

1. Show that the set $G = \{m^a : a \in \mathbb{Z}, m \text{ is a fixed non-zero integer}\}$ is an infinite abelian group with the operation of multiplication.
2. Show that the set of all possible cube roots of unity is a group under operation of multiplication. Is it a cyclic group?
3. Show that the set $G = \{0,1,2,3,4\}$ is a group with addition modulo 5. Is it a Commutative group?

Q.3 Answer the following [Any 2]:

14

1. Show that a non-empty subset H of a group G is a subgroup of G if and only if Following conditions are satisfied.
 - i. $a, b \in H \Rightarrow ab \in H$ and
 - ii. $a \in H \Rightarrow a^{-1} \in H$
2. (i) Show that in a group inverse of an inverse element is the element itself.
(ii) Explain Identity symmetry operation
3. Define subgroup. Show that $(\mathbb{I}, +)$ is a subgroup of $(\mathbb{C}, +)$.

Q.4 Answer the following [Any 2]:

14

1. Define: Reflection symmetry and Inversion symmetry. Explain Inversion symmetry operation.
2. Explain Rotation symmetry with illustration.
3. Discuss about the all possible symmetries of an English capital letter 'T'
