DF-3020
Second Year B. Sc. (Sem. III) Examination
March / April - 2016
EG-Mathematics
(Group of Symmetries - I)
(New Course)

Time : 2 Hours] [Total Marks : 50

Instructions :
(1) Fill up strictly the details of signs on your answer book.

Name of the Subject :
EG-Mathematics (New) Group Symmetries - I

Subject Code No. : 3 0 2 0 Section No. (1, 2,.....) Nil

Seat No. :

(2) All questions are compulsory.

(3) Figures to the right indicate marks of the corresponding question.

(4) There are three sections A, B, C in this question paper having 26 questions.

(5) There is only one correct answer for each question.

(6) Follow usual symbols.

SECTION - A : Questions 1 to 11 each of 1 marks
SECTION - B : Questions 12 to 17 each of 2 marks
SECTION - C : Questions 18 to 26 each of 3 marks

O.M.R. Sheet भरवा अंगे-नी अन्यभी सूजनाओ अपेक्षा और O.M.R. Sheet-वी पात्र नाही पूर्ण वेळा. Important instructions to fill up O.M.R. Sheet are given on back side of the provided O.M.R. Sheet.

DF-3020_D | 1 [ Contd...
1 If there are more than one C2 operations, they are denoted by __________.
   (A) \( C_2^1, C_2^2, C_2^3, \ldots \)
   (B) \( C_2^{(1)}, C_2^{(2)}, C_2^{(3)}, \ldots \)
   (C) \( C_{2_1}, C_{2_2}, C_{2_3}, \ldots \)
   (D) \( C_{2_1}, C_{2_2}, C_{2_3}, \ldots \)

2 The multiplicative identity in a set of real numbers is __________
   (A) 1
   (B) -1
   (C) 0
   (D) e

3 Identity symmetry operation keeps __________ fixed.
   (A) a line
   (B) a point
   (C) everything
   (D) a plane

4 In a group \((G, \circ)\) an element \( e \in G \) is an identity element if __________
   (A) \( aoe = eoa = a, \forall e \in G \)
   (B) \( aoe = eoa = e, \forall a \in G \)
   (C) \( aoe = eoa = a, \forall a \in G \)
   (D) \( aoe = eoa = e, \forall e \in G \)

5 The order of Reflection symmetry operation is __________.
   (A) 1
   (B) 0
   (C) 4
   (D) 2

6 The Improper rotation symmetry operation is denoted by __________.
   (A) E
   (B) R
   (C) S
   (D) I

DF-3020_D ] 2 [ Contd...
7 A non-empty subset H of a group G is a subgroup of G if and only if

(A) $a, b, c \in H \Rightarrow a(bc) \in (ab)c$

(B) $a, b \in H \Rightarrow ab^{-1} \in H$

(C) None of these

(D) $a, b \in H \Rightarrow ab \in H$

8 Improper rotation symmetry operation keeps _______ fixed.

(A) a line

(B) a point

(C) everything

(D) a plane

9 A group \((G, \cdot)\) is called a cyclic group if it _______

(A) satisfies commutative property

(B) has infinite number of elements

(C) has a generator

(D) has finite number of elements

10 Every object has. ________.

(A) at least one symmetry I

(B) at least one symmetry E

(C) no symmetry

(D) may or may not have any symmetry

11 In a group \((G, \cdot)\) for any \(a, b \in G\) ________

(A) \((aob)^{-1} = b^{-1} o a^{-1}\)

(B) \((aob)^{-1} = ao b^{-1}\)

(C) \((aob)^{-1} = a^{-1} ob\)

(D) \((aob)^{-1} = a^{-1} o b^{-1}\)
12 If the reflection plane is oblique, horizontal or vertical then the symmetry operations are denoted by _______ respectively.

(A) $Ra, Rh, Rv$

(B) $\sigma_a, \sigma_h, \sigma_v$

(C) $\sigma_o, \sigma_h, \sigma_v$

(D) $Co, Ch, Cv$

13 The Identity symmetry is denoted by _______ and its order is _______.

(A) $E, 1$

(B) $I, 2$

(C) $E, 2$

(D) $I, 1$

14 In a group $(G, \cdot)$ the left cancellation law and right cancellation laws are _______.

(A) $ac = bc \Rightarrow a = b$, and $ca = cb \Rightarrow a = b$, $\forall a, b, c \in G$, respectively

(B) $coa = cob \Rightarrow a = b$, and $aoc = boc \Rightarrow a = b$, $\forall a, b, c \in G$, respectively

(C) $ca = cb \Rightarrow a = b$, and $ac = bc \Rightarrow a = b$, $\forall a, b, c \in G$, respectively

(D) $aoc = boc \Rightarrow a = b$, and $coa = cob \Rightarrow a = b$, $\forall a, b, c \in G$, respectively
15 The set \( H = \{ m^a / a \in \mathbb{Z}, m \) is a fixed nonzero integer \( \} \) is a subgroup of a group \( \). 

(A) \( (\mathbb{R}_0, x) \)  
(B) \( (\mathbb{Q}_0, +) \)  
(C) \( (\mathbb{R}_0, +) \)  
(D) \( (\mathbb{R}, x) \)  

16 Rotation symmetry keeps \( \) fixed and is called. \( \)  

(A) point, point of rotation  
(B) line, line of rotation  
(C) None of these  
(D) plane, plane of rotation  

17 Set \( \mathbb{N} \) of all natural numbers with the operation of multiplication \( \). 

(A) satisfies closure property but doesn't hold associative property.  
(B) satisfies closure property, associative property but hasn't identity element.  
(C) satisfies closure property, associative property and holds identity element.  
(D) satisfies closure property, associative property and holds inverse of each element.
18 The set \[ \quad \] is a group with respect to operation of addition.

(A) \( \mathbb{R} \)

(B) \( \mathbb{R} \setminus \{0\} \)

(C) \( \mathbb{C} \setminus \{0\} \)

(D) \( \mathbb{N} \)

19 The English letter "H" has \( \quad \) symmetries.

(A) \( I, E, C_2 \)

(B) \( C_6, I, S \)

(C) \( R, I, E \)

(D) \( E, C_4, I \)

20 In a group \( G = \{6, 12, 18, 24\} \) with the operation multiplication modulo 30 inverse elements of 6, 12, 18, 24 are \( \quad \) respectively.

(A) 12, 6, 24, 18

(B) 6, 18, 12, 24

(C) 6, 18, 24, 12

(D) 6, 12, 18, 24
21 The set ________ is a subgroup of a group \((I, +)\)

(A) \(H=\{m^a / a \in \mathbb{Q}, m \text{ is a fixed nonzero integer}\}\)

(B) \(H=\{m^a / a \in I, a \text{ is a fixed integer}\}\)

(C) \(H=\{ma / a \in \mathbb{Z}, m \text{ is a fixed nonzero integer}\}\)

(D) \(H=\{ma / a \in \mathbb{Q}, m \text{ is a fixed nonzero integer}\}\)

22 The symmetry elements of Reflection symmetry, Rotation symmetry and Inversion symmetry operation are ________ respectively.

(A) point of inversion, plane of reflection, axis of rotation

(B) plane of reflection, axis of rotation, point of inversion

(C) plane of reflection, point of rotation, axis of inversion

(D) axis of reflection, point of rotation, plane of inversion

23 The symmetry elements are ________

(A) plane of rotation, axis of reflection, point of inversion

(B) plane of inversion, axis of reflection, point of rotation

(C) plane of reflection, axis of inversion, point of rotation

(D) plane of reflection, axis of rotation, point of inversion
24  The multiplicative inverse of $a + ib$ in the set of all nonzero complex numbers is

(A) $\frac{a}{a^2 - b^2} - \frac{ib}{a^2 - b^2}$

(B) $\frac{a}{a^2 + b^2} + \frac{ib}{a^2 + b^2}$

(C) $\frac{a}{a^2 + b^2} - \frac{ib}{a^2 + b^2}$

(D) $\frac{a}{a^2 - b^2} + \frac{ib}{a^2 - b^2}$

25  If the angle of rotation is $90^\circ, 180^\circ, 60^\circ$, then the rotation symmetry is denoted by ________ respectively.

(A) $C4, C2, C6$

(B) $C3, C4, C6$

(C) $C2, C6, C3$

(D) $C2, C4, C6$

26  The set $(Q, X)$ is not a subgroup of a group $(R_0, X)$ because ________

(A) $(Q, X)$ satisfies associative property but does not satisfy closure property

(B) $(Q, X)$ satisfies closure property but is not a subset of $(R_0, X)$

(C) $(Q, X)$ satisfies closure property but does not hold identity element

(D) $(Q, X)$ satisfies closure property but does not satisfy associative property