UNIT TEST

Duration: 1 hour **Marks: 30**

SECTION A

Each carry 1 mark

1. A relation R in set A = {1, 2, 3} is defined as $R = \{(1,1), (1,2), (2,2), (3,3)\}$ which of the following ordered pair in R shall be removed to make it an equivalence relation in A.

(a) (1, 1) (b) (1, 2) (c) (2, 2) (d) (3, 3)

2. Let the relation R in the set $A = \{x \in Z: 0 \leq x \leq 12\}$, given $R = \{(a, b): |a - b| \text{ is a multiple of } 4\}$. Then [1], the equivalence class containing 1 is

(a) {1, 5, 9} (b) {0, 1, 2, 5} (c) ϕ (d) A

3. A relation R is defined on N. Which of the following is the reflexive relation?

(a) $R = \{(x, y): x > y, x, y \in N\}$ (b) $R = \{(x, y): x + y = 10, x, y \in N\}$

(c) $R = \{(x, y): xy \text{ is the square number}, x, y \in N\}$ (d) $R = \{(x, y): x + 4y = 10; x, y \in N\}$

4. Assertion: The number of onto functions from a set P containing 5 elements to a set Q containing 2 elements is 30.

Reason: Number of onto functions from set containing m elements to set containing n elements is n^m.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

SECTION B

Each carry 2 marks

5. A relation R is defined on a set of real numbers $\mathbb{R}$ as $R = \{(x, y): x \cdot y \text{ is an irrational number }\}$.

Check whether R is reflexive, symmetric and transitive or not.

6. Let $f: \mathbb{R} - \left\{-\frac{4}{3}\right\} \rightarrow \mathbb{R}$ be a function defined as $f(x) = \frac{4x}{3x+4}$. Show that in

$f: R - \left\{-\frac{4}{3}\right\} \rightarrow$ Range,f is one-one and onto.

7. Show that the relation R on the set Z of all integers given by $R = \{(a, b): 2 \text{ divides } (a - b)\}$ is an equivalence relation.

SECTION C

Each carry 3 marks

8. A function $f: [-4,4] \rightarrow [0,4]$ is given by $f(x) = \sqrt{16 - x^2}$. Show that f is an onto fucnrtion but not a one-one function. Further, find all possible values of a for which $f(a) = \sqrt{7}$.

9. Let $A = R - \{3\}, B = R - \{1\}$. If $f: A \rightarrow B$ be defined by $f(x) = \frac{x-2}{x-3}, \forall x \in A$. Then show that f is bijective.

SECTION D

Each carry 5 marks

10. Prove that a function $f: [0, \infty) \rightarrow [-5, \infty)$ defined as $f(x) = 4x^2 + 4x - 5$ is both one-one and onto.

11. Let $\mathbb{N}$ be the set of all natural numbers and R be a relation on $\mathbb{N} \times \mathbb{N}$ defined by $(a, b)R(c, d) \Leftrightarrow ad = bc$ for all $(a, b), (c, d) \in \mathbb{N} \times \mathbb{N}$. Show that R is an equivalence relation on $\mathbb{N} \times \mathbb{N}$. Also, find the equivalence class of (2, 6). i.e., [(2,6)].

SECTION E

12. An organization conducted bike race under two different categories – Boys and Girls. There were 28 participants in all. Among all of them, finally three from category 1 and two from category 2 were selected for the final race. Ravi forms two sets B and G with these participants for his college project.

Let $B = \{b_1, b_2, b_3\}$ and $G = \{g_1, g_2\}$ where B represents the set of Boys and G the set of Girls selected for the final race.

Based on the above information, answer the following questions:

(i) How many relations are possible from B to G?

(ii) Among all the possible relations from B to G, how many functions can be formed from B to G?

(iii) Let $R: B \to B$ be defined by R = {(x, y): x and y are students of the same sex}. Check if R is an equivalence relation.

(Or)

A function $f: B \to G$ be defined by $f = \{(b_1, g_1), (b_2, g_2), (b_3, g_1)\}$. Check f is bijective. Justify your answer.

UNIT TEST ANSWERS

1. (b) (1, 2)

2. (a) {1, 5, 9}

3. (c) $R = \{(x, y): xy$ is the square number, $x, y \in N\}$

4. (c) Assertion (A) is true but Reason (R) is false.

5. Symmetric but not reflexive and transitive.

6. Proof

7. Proof

8. $a = \pm 3$

9. Proof

10. Proof

11. $\{(1,3), (2,6), (3,9), \ldots \ldots \ldots\}$

12. (i) 64 (ii) 8 (iii) R is an equivalence relation (Or) f is not bijective.