

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

Test - 1 Examination February 2024

B.Sc. (Maths & Computing) II Semester/B.Tech. IV Semester (ECE)

COURSE CODE(CREDITS): 22BS1MA211/ 18B11MA413 (3)

MAX. MARKS: 15

COURSE NAME: Discrete Mathematical Structures/Discrete Mathematics

COURSE INSTRUCTOR: Dr R K Bajaj*

MAX. TIME: 1 Hour

Note: (a) All questions are compulsory. (b) Marks are indicated against each question in square brackets. (c) The candidate is allowed to make suitable numeric assumptions wherever required.

1. Suppose $D_n = \left(-\frac{1}{n}, \frac{1}{n}\right)$ where $n \in N$, the set of positive integers. (2) [CO-1]

Find (i) $D_3 \cup D_5$. (ii) $D_4 \cap D_{10}$ (iii) $\bigcap_{i \in N} D_i$.

2. Explain the problem of Tower of Hanoi and use the principle of mathematical induction to prove the formula for the number of moves required. (2) [CO-1]

3. Let $A = \{1, 2, 3, 4\}$, $B = \{4, 5, 6\}$ and $C = \{5, 6, 7, 8\}$. Define relation $R: A \rightarrow B: xRy$ if $x + y = 2k$; $S: B \rightarrow C: xSy$ if $y - x = 1$. Determine M_R, M_S and $M_{R \circ S}$. (3) [CO-1]

4. Find the zero-one matrix of the transitive closure of the relation R where (2) [CO-1]

$$R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$$

5. Let N denotes the set of all natural numbers and let R be a relation on $N \times N$ defined by $(a, b)R(c, d)$ iff $ad(b + c) = bc(a + d)$. (CO-1)

Show that R is an equivalence relation and find the equivalence class of $(2, 3)$ and $(3, 5)$. (3)

6. Solve the following recurrence relation using the concept of generating function: (3)

$$a_k = 2a_{k-1} - a_{k-2}; a_0 = 1.; a_1 = 7; k \geq 2. \quad \text{[CO-1]}$$
