JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

B.Tech-IV Semester (CSE/IT/ECE)

COURSE CODE (CREDITS): 18B11CI414/18B11MA413 (3) MAX. MARKS: 25

COURSE NAME: Discrete Computational Mathematics / Discrete Mathematics

COURSE INSTRUCTORS: RKB*, PKP MAX. TIME: 1.5 Hr

Note: (a) All questions are compulsory. (b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

Q.No	Question	CO	Marks
Q1	Consider a relation R on $\mathbb{Z}^+$ such that $(a, b) \in R$ iff $a^2 + b$ is even. Prove or disprove that R is an equivalence relation.	CO-3	3
Q2	For $A = \{1,2,3,4,5,6,7,9,10\}$ and $B = \{1,3,5,8,9,10\}$. Compute $A \Delta B$ and find the cardinality of the power set of $A \Delta B$.	CO-2	3
Q3	Consider the poset $(D_{60}, \mid)$. (a) Define *lub* ($\vee$) and *glb* ($\wedge$) in this context and show that $(D_{60}, \vee, \wedge)$ is a lattice. Also, draw its Hasse diagram. (b) Compute the *complement* of all the elements (if it exists) for the $(D_{60}, \mid)$ lattice.	CO-2	5
Q4	Consider an equivalence relation $\sim$ on $\{0,1,2,3,4,5,6,7,11,12\}$ defined by $x \sim y$ iff $3 \mid (x - y)$. Compute the equivalence classes [1] and [2].	CO-3	2
Q5	Consider a recursive function G from set of positive integers to integers as follows: $G(n) = \begin{cases} 1 & \text{if } n = 1 \\ 1 + G\left(\frac{n}{2}\right) & \text{if } n \text{ is even} \\ G(3n-1) & \text{if } n \text{ odd and } n > 1. \end{cases}$ Is G a well-defined function? Justify your answer.	CO-3	2
Q6	Test the validity of the following argument using truth table: *I will buy a new goat or a used Yugo. If I buy both a new goat and a used Yugo, I will need a loan. I bought a used Yugo and I don't need a loan. Therefore, I didn't buy a new goat.*	CO-1	3
Q7	A programmer is analyzing the execution time of a recursive algorithm that divides a problem into smaller subproblems. The time complexity T_n of the algorithm satisfies the recurrence relation $T_n = 7T_{n-1} - 12T_{n-2}\,; n \geq 2$, where T_{n-1} and T_{n-2} represent the time taken for smaller subproblems and the coefficients represent number of recursive calls made at each step. $T_0 = 1$ and $T_1 = 7$ represent the base execution times. Use the generating function method to find a closed-form expression for T_n and compute the time complexity for $n = 20$.	CO-7	4
Q8	A graph has 12 edges with two vertices of degree 3, two vertices of degree 4 and other vertices are of degree 5. Find the number of vertices in the graph. Also, find the number of edges in the complete graph K_{100}.	CO-4	3