

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 2 EXAMINATION (October 2025)

B.C.A. - I Semester

COURSE CODE (CREDITS): 25B11MA111 (3)

MAX. MARKS: 25

COURSE NAME: FUNDAMENTALS OF MATHEMATICS

COURSE INSTRUCTORS: RKB*

MAX. TIME: 1 Hr, 30 Mins

Note: All questions are compulsory. Use of scientific calculator is allowed. The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

Q.No	Question	CO	Marks
Q1	Let $D_n = \left(0, \frac{1}{n}\right)$ where $n \in \mathbb{N}$, the set of positive integers. Find (i) $D_3 \cup D_5$, (ii) $D_4 \cap D_{10}$ (iii) $\bigcup_{i \in A} D_i$ where A is a subset of $\mathbb{N}$.	CO-1	3
Q2	Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be defined as $f(x) = 2x^2 - 5x + 4$, find $f^{-1}(3)$ and $f^{-1}(0)$.	CO-2	3
Q3	Suppose that the performance of an algorithm, the time complexity function is given by $T(n) = \frac{3n^3 + 5n^2 + 4}{4n^3 - 3n^2 + 4n - 5}$, where n represents the input size. Find the performance for very large input size, i.e., $n \rightarrow \infty$.	CO-3	3
Q4	Suppose $f(x) = \begin{cases} a + bx, & x < 1 \\ 4, & x = 1 \\ b - ax, & x > 1 \end{cases}$ and $\lim_{x \rightarrow 1} f(x) = f(1)$ then find the values of a and b .	CO-3	3
Q5	Find the slope of the tangent to the curve $y = \frac{2x-1}{3x+2}$, $x \neq -\frac{2}{3}$ at $x = 5$.	CO-3	3
Q6	The number of data packets received by a server at time t seconds is modeled by the function: $f(t) = \log(\sin(t^2 + 1))$. Find the derivative to find the rate of change of packets with respect to time. Also, evaluate this rate at $t = 5$ seconds.	CO-3	3
Q7	In computer graphics, an approximation of the sine function is often used to render animations efficiently. Suppose we want to approximate $\sin x$ around $x = 0$ using Taylor's series. (a) Write the Taylor series expansion of $\sin x$ up to the x^4 term. (b) Use this expansion to approximate $\sin(0.2)$.	CO-3	3
Q8	In performance analysis of an algorithm, the execution time (in milliseconds) of a function depends on the size of the input n and is modeled by $T(n) = n^3 - 15n^2 + 70n + 50$, $n \geq 0$. (a) Find the critical points of $T(n)$. (b) Determine the values of n at which $T(n)$ attains a maximum or minimum.	CO-3	4
