JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 3 EXAMINATION (December 2025)

B.C.A. - I Semester

COURSE CODE (CREDITS): 25B11MA111 (3) MAX. MARKS: 35

COURSE NAME: FUNDAMENTALS OF MATHEMATICS

COURSE INSTRUCTORS: RKB* MAX. TIME: 2 Hrs

Note: All questions are compulsory. Use of scientific calculator is not allowed. The candidate is allowed to make suitable numeric assumptions wherever required for solving problems

Q.No	Question	CO	Marks
Q1	Suppose $X = \{1, 2, 3, 5, 7, 9, 11, 13\}$ is universal set, $A = \{1, 5, 9, 11\}$ and $B = \{3, 7, 9, 13\}$. Find $(AUB)^c, A^cUB$. Find the symmetric difference of A and B. Also, find the number of elements in the power set of AUB^c.	CO-1	3
Q2	Show that the relation R on the set $A = \{x \in \mathbb{Z} : 0 \leq x \leq 14\}$, given by $R = \{(a,b): \lvert a-b \rvert \text{ is a multiple of } 4\}$ is an equivalence relation. Find the set of all elements related to 1, *i.e.*, equivalence class [1].	CO-2	3
Q3	Evaluate $\lim_{x\to 0}\left(\frac{\sqrt{3-x}-\sqrt{3+x}}{x}\right)$	CO-2	2
Q4	In a computer graphics application, the position of a moving object along a path is modeled by the function $y = x^3 + 6x^2 - 15x + 5$. Find the points at which the object attains its maximum and minimum positions. Also classify these points using the first or second derivative test.	CO-3	3
Q5	Find the slope of the tangent to the curve $y = x^3 - 3x + 2$ at the point whose x-coordinate is 3.	CO-3	3
Q6	Find the derivative of the function $f(x) = \frac{x^4+8x+5}{x}$ with respect of x.	CO-3	3
Q7	Evaluate the integral $\int \frac{3x}{\sqrt{(1+x^2)}}dx$.	CO-3	3
Q8	Evaluate the definite integral $\int_0^{\frac{\pi}{2}} \frac{\sqrt{sinx}}{\sqrt{sinx}+\sqrt{cosx}}dx$.	CO-3	3

Q9	Let $v_1 = (1,1,0), v_2 = (1,3,2), v_3 = (4,9,5)$ be three vectors. Check linear dependency/independency of these vectors by a suitable method (linear combination/rank).	CO-4	3
Q10	Using Gauss Elimination method, determine the value of k for which the system of linear equations $x + y + z = 2; x + 2y + x = -2; x + y + (k-5)z = k;$ has (a) no solution (b) has unique solution (c) infinitely many solutions.	CO-4	4
Q11	In computer graphics and geometric transformations, a circular ring of radius 1 is represented in the 2D plane where eigenvalues and eigenvectors play a key role. A linear transformation is applied to this ring using the matrix $\begin{pmatrix} 5 & 1 \\ 2 & 4 \end{pmatrix}$. Find the eigenvalues and eigenvectors of A. Also, find the modal matrix and inverse of the modal matrix. Also, write the diagonalization scheme of the matrix.	CO-4	5

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