JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech-I Semester (CSE/IT/ECE/CE/M&C)

COURSE CODE (CREDITS): 25B11MA113 (4) MAX. MARKS: 35

COURSE NAME: MATHEMATICS-I

COURSE INSTRUCTORS: PKP*,NKT,RKB,MDS MAX. TIME: 2 Hours

Note: *(a) All 12 questions are compulsory.*

(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

(c) Answer the questions in ascending order (i.e., 1,2,3,4,5,6,7,8,9,10,11,12).

Q.No.	Question	CO	Marks
Q1	Suppose a signal is given by $f(t) = \begin{cases} 3t-1, t \leq 1 \\ 2t+3, t \geq 1 \end{cases}$. Check the continuity of the function at $t = 1$.	CO1	2
Q2	To model a procedural surface, a computer graphics shader employs a height function $f(x,y) = \sin x \cos y$. Compute the directional derivative of $f(x,y)$ at the point $(\pi/2, 0)$ in the direction $\vec{u} = i + 2j$.	CO2	3
Q3	Using the double integrals, compute the area enclosed between a parabola $y = x^2$ and a straight line $y = 2 - x$.	CO3	3
Q4	Find the work done by the vector field $\vec{F}(x,y,z) = x\hat{\imath} + 3xy\hat{\jmath} - (x+z)\hat{k}$, on a particle moving along the line segment that goes from (1,4,2) to (0,5,1).	CO3	3
Q5	A surface is given by $F(x,y,z) = xe^{yz} + y - 4 = 0$. At the point (1,0,4) find: (i) The unit normal vector to the surface. (ii) The tangent plane in vector form.	CO3	3
Q6	Solve $(4D^2 + 12D + 9)(D^2 + 4)y = 0$.	CO4	3
Q7	Solve the differential equation $\frac{d^2y}{dx^2} + 4y = e^x + \sin 2x$	CO4	3
Q8	Find the Laplace transform of $t(\cos at - \cos bt)$.	CO4	3
Q9	Using Convolution theorem evaluate $L^{-1}\left\{\frac{1}{(s+a)(s+b)}\right\}$.	CO4	3

Q10	In a machine learning workflow, the feature correlation matrix of a dataset is represented by $A=\begin{pmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{pmatrix}$. Determine the rank of this matrix.	CO5	2
Q11	Using Gauss elimination method, solve the following system of linear equations: $x + 3y - 2z + 5t = 4; 2x + 8y - z + 9t = 9, 3x + 5y - 12z + 17t = 7.$	CO5	4
Q12	A dataset's covariance structure is represented by a 3×3 covariance matrix $C = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$. Compute the eigenvalues of the matrix C.	CO5	3

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