RV College of Engineering®

USN | 1RV24IS005

DEPARTMENT OF MATHEMATICS

Academic year 2025-2026 (Odd Semester)

Date : 15 December 2025	**CIE - II**	**Max Marks : 10+50**
Time: 09:00 AM to 11 :00 AM	**UG**	**Duration : 120 mins**
Semester: III BE (CS, CY, CD, IS)		
Course Title: LINEAR ALGEBRA AND PROBABILITY THEORY		**Course Code: MA231TC**

- Answer all the questions.
- Answer the quiz within first two pages of the answer booklet.
- Marks will not be awarded for direct answers without supporting steps.
- Second year Mathematics Handbook for B.E. program is allowed.

PART-A

Q. Nos.	Question	M	CO	BT
1	Determine the value of k such that the vectors, $v_1 = (1,2,k,3)$ and $v_2 = (3,k,7,5)$ are orthogonal.	1	1	1
2	The singular values of matrix $\begin{bmatrix} 2 & 4 \\ 4 & 2 \end{bmatrix}$ are ____________.	2	1	1
3	If $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ and $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$ are the eigenvectors of a matrix A with corresponding eigenvalues 4 and 2 respectively, then determine the matrix A.	2	2	2
4	Let $C[0,2]$ be the inner product space with $<f,g> = \int_0^2 f(x)g(x)dx$. Find $\parallel f \parallel$, if $f(x) = x^2$.	2	1	2
5	Let $F(x) = \frac{x+3k}{10}$, for $x = 0,1,2,3$ be the cumulative distribution of a random variable X. The value of k is ____________.	1	2	1
6	If $p(x) = kx,\ 0 \le x \le c$, and $P\left(X < \frac{1}{2}\right) = \frac{1}{4}$, find k.	2	1	1

PART-B

Q. Nos.	Question	M	CO	BT
1a	Let S be the subspace of $\mathbb{R}^4$ spanned by the vectors $v_1 = (1,1,1,1)$, $v_2 = (1,-1,2,2)$, $v_3 = (1,2,-3,-4)$. Apply Gram-Schmidt orthogonalization process to find an orthogonal basis of S and hence find the projection of $v = (1,2,-3,\ 4)$ onto S.	6	1	2
1b	A box contains 6 defective and 4 good electronic components. A technician randomly selects 2 components for testing. He earns ₹10 for each good component selected and incurs a loss of ₹6 for each defective component selected. Find his expected earning.	4	2	2

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2	Find the QR factorization of the matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ -1 & 1 & 2 \\ -1 & 0 & 1 \\ 1 & 1 & 2 \end{bmatrix}$.	10	2	2
3	Obtain a diagonal matrix D and an orthogonal matrix P such that $A = PDP^T$, where $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$.	10	3	3
4	Obtain the singular value decomposition of the matrix $\begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix}$.	10	3	3
5a	If X is a random variable with $p(x) = \frac{1}{2}\left(\frac{2}{3}\right)^x$, where $x = 1, 2, 3, \ldots$ Verify $p(x)$ is probability distribution function, hence find $P(X = even)$.	4	3	2
5b	The probability density function of a random variable X is given by $f(x) = \begin{cases} 1 - x, & 0 < x < 1 \\ x - 1, & 1 \le x < 2 \\ 0, & Otherwise \end{cases}$. (i) Determine the cumulative density function $F(x)$. ii) Find $P(X > 1.4)$.	6	2	3

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	6	20	24	-	-	24	26	-	-	-
	Quiz		7	3	-	-	6	4	-	-	-	-

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