



Date: 05-05-2025

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 PM

SECTION A - K1 & K2 (CO1)

Q.No	Levels	Answer ALL the Questions	(10 x 2 = 20)										
1	K1	State Cayley Hamilton theorem.											
2		Examine the derivatives of $x^2 + 2\sin x - 3e^x$											
3		Evaluate $\int xe^{3x}dx$.											
4		Tabulate the forward difference table for the following data: <table><tr><td>x</td><td>4</td><td>6</td><td>8</td><td>10</td></tr><tr><td>y</td><td>1</td><td>3</td><td>8</td><td>16</td></tr></table>	x	4	6	8	10	y	1	3	8	16	
x		4	6	8	10								
y	1	3	8	16									
5	Write the Spearman's formula for rank correlation coefficient.												
6	K2	Classify symmetric and skew symmetric matrices.											
7		If $y = \cos x$, express that $y + y_2 = 0$..											
8		Describe integration by parts.											
9		Differentiate interpolation and extrapolation											
10		Explain the concept of regression.											

SECTION B – K3 & K4 (CO2)

		Answer ALL the Questions	(4 x 10 = 40)																						
11	K3	Using Cayley-Hamilton theorem, find A^{-1} given that $A = \begin{pmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{pmatrix}$.																							
		[OR]																							
12		If $u = \log (\tan x + \tan y + \tan z)$, then show that $\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} + \sin 2z \frac{\partial u}{\partial z} = 2$.																							
13		Using partial fraction method, compute $\int \frac{2x+3}{(1-x^2)(1+3x)} dx$.																							
		[OR]																							
14		Calculate the standard deviation for the following data 14, 22, 9, 15, 20, 17, 12, 11.																							
15	K4	If $A = \begin{pmatrix} -1 & 2+i & 5-3i \\ 2-i & 7 & 5i \\ 5+3i & -5i & 2 \end{pmatrix}$, show that A is Hermitian and iA is skew Hermitian.																							
		[OR]																							
16		A recruiting agency shortlisted 10 candidates for final selection they were examined in written and oral communication skills. They were ranked as follows:																							
		<table><tr><td>Written skill</td><td>8</td><td>7</td><td>2</td><td>10</td><td>3</td><td>5</td><td>1</td><td>9</td><td>6</td><td>4</td></tr><tr><td>Oral skill</td><td>10</td><td>7</td><td>2</td><td>6</td><td>5</td><td>4</td><td>1</td><td>9</td><td>8</td><td>3</td></tr></table>	Written skill	8	7	2	10	3	5	1	9	6	4	Oral skill	10	7	2	6	5	4	1	9	8	3	
Written skill	8	7	2	10	3	5	1	9	6	4															
Oral skill	10	7	2	6	5	4	1	9	8	3															
		Analyse whether there is any correlation between the written and oral communication skills of the shortlisted candidates.																							

17		Find the equation of the tangent to the parabola $y^2 = 4ax$ at (x_1, y_1) .										
		[OR]										
18		Using Lagrange's interpolation formula, evaluate $y(10)$ from the following table:										
		<table><tr><td>x</td><td>5</td><td>6</td><td>9</td><td>11</td></tr><tr><td>y</td><td>12</td><td>13</td><td>14</td><td>16</td></tr></table>	x	5	6	9	11	y	12	13	14	16
x	5	6	9	11								
y	12	13	14	16								

SECTION C – K5 & K6 (CO3)

	Answer ALL the Questions					(2 x 20 = 40)				
19	K5	Discover the characteristic roots and their associated characteristic vectors for the matrix $A = \begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}.$								
		[OR]								
20		From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age 46 and 63.								
		Age x:		45	50	55	60	65		
		Premium y:		114.54	96.16	83.32	74.48	68.48		
21	K6	(a) If $r^2 = x^2 + y^2$ then formulate that $\frac{\partial^2 r}{\partial x^2} + \frac{\partial^2 r}{\partial y^2} = \frac{1}{r} \left[\left(\frac{\partial r}{\partial x} \right)^2 + \left(\frac{\partial r}{\partial y} \right)^2 \right].$								
		(b) Evaluate $\int \frac{dx}{x^2 + 2x + 5}.$								
		(12+8)								
		[OR]								
22		Using Karl Pearson's method, estimate the coefficient of correlation for the following heights (in inches) of fathers (x) nd their son's (y).								
		X	65	66	67	67	68	69	70	72
		Y	67	68	65	68	72	72	69	71

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