



Date: 20-11-2024

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 Leibnitz formula for the n^{th} derivative of product of two functions.	
2		Write the binomial expansion of $(x+a)^n$.	
3		State Cayley Hamilton theorem.	
4		Point out the Laplace transform of e^{at} .	
5		Identify the inverse Laplace transform of $\frac{1}{s^4}$.	
6	K2	Compute subtangent to the curve $y = a^x$.	
7		Expand $\log\left(\frac{1+x}{1-x}\right)$.	
8		Recall symmetric matrix.	
9		Why are Laplace Transforms particularly useful for solving initial value problems?	
10		Explain Laplace inverse transforms.	

SECTION B – K3 & K4 (CO2)

		Answer ALL the Questions	(4 x 10 = 40)
11	K3	Evaluate the length of the tangent, normal, sub-tangent and sub-normal to the curve $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ at $\theta = \frac{\pi}{2}$.	
		[OR]	
12		Determine the Laplace transform of $t \sin at$.	
13		Apply exponential series and find the value of the series $\sum_{n=1}^{\infty} \frac{n^2+1}{n+2} \frac{x^n}{n!}$.	
		[OR]	
14		Determine the inverse of a matrix $\begin{pmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$.	
15	K4	Determine y_n , where $y = \frac{5}{(x+2)(x-1)}$.	
		[OR]	
16		Obtain the Inverse Laplace transform of $\frac{s+4}{s(s-1)(s^2+4)}$.	

17	List any five properties eigen vectors.
18	Evaluate $L^{-1}\left(\frac{1}{(s^2+a^2)^2}\right)$.

SECTION C – K5 & K6 (CO3)		
	Answer ALL the Questions	(2 x 20 = 40)
19	(i) Examine the maximum and minimum values of the function $f(x)=x^3-9x^2+15x$. (5 marks)	
	K5 (ii) If $y=\sin(m\sin^{-1}x)$, prove that $(1-x^2)y_2-x y_1+m^2 y=0$ and defend that $(1-x^2)y_{n+2}-(2n+1)x y_{n+1}+(m^2-n^2)y_n=0$. (15 marks)	
20	[OR] (i) Sum the series $1+\frac{5}{8}+\frac{5.8}{8.12}+\frac{5.8.11}{8.12.16}+\dots$ to infinity (10 marks) (ii) If a, b, c are three consecutive integers, then prove that $\log_e b = \frac{1}{2} \log_e a + \frac{1}{2} \log_e c + \frac{1}{2ac+1} + \frac{1}{3} \cdot \frac{1}{(2ac+1)^3} + \dots$ (10 marks)	
21	K6 (i) Verify Cayley Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$. (10 marks) (ii) Evaluate the eigen values and the corresponding eigen vectors of the matrix $\begin{pmatrix} -2 & 5 & 4 \\ 5 & 7 & 5 \\ 4 & 5 & -2 \end{pmatrix}$. (10 marks)	
22	[OR] (i) Evaluate the Laplace transform of $f(t)$, where $f(t) = \begin{cases} t, & 0 < t < b \\ 2b-t, & b \leq t < 2b \end{cases}$ (8 marks) (ii) Using Laplace transforms, compile the solution of the initial value problem $y''+9y=6\cos 3t, y(0)=2, y'(0)=0$. (12 marks)	

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