

Reg.No.: 

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN  
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 20010**

B.E. / B.Tech. - DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2025

Second Semester

Computer Science and Engineering

U19MA202 – LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

(Common to All)

(Regulation 2019)

Time : Three Hours

Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Find the sum and product of eigen values of $A = \begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 4 \\ 3 & 6 & 7 \end{bmatrix}$ .	2	K1	CO1
2.	Determine the nature of the following quadratic form $f(x_1, x_2) = x_1^2 + 2x_2^2$ .	2	K2	CO1
3.	If $\phi$ is a scalar point function, prove that $\text{curl}(\text{grad } \phi) = 0$ .	2	K1	CO2
4.	Find the unit normal to the surface $x^2 + xy + z^2 = 4$ at $(1, -1, 2)$ .	2	K2	CO2
5.	State Stokes theorem.	2	K1	CO3
6.	Evaluate $\int_C (5y^2 dx - 2x^2 dy)$ along the parabola $y = x^2$ from $(0,0)$ to $(2,4)$ .	2	K2	CO3
7.	Prove that $w = \sin 2z$ is an analytic function.	2	K1	CO4
8.	Find the fixed points of the bilinear transformation $w = \frac{z-1}{z+1}$ .	2	K2	CO4
9.	State initial and final value theorems on Laplace transforms.	2	K1	CO5
10.	Find the Laplace transform of $f(t) = \frac{t}{e^t}$ .	2	K2	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$	8	K3	CO1
	ii. Verify Cayley – Hamilton Theorem. Find the inverse of the matrix $A^{-1}$ and $A^4$ if the matrix is	8	K3	CO1

$$A = \begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

(OR)

b)	Reduce the following Quadratic forms to the canonical form through an orthogonal transformation and hence find its nature $8x_1^2 + 7x_2^2 + 3x_3^2 - 12x_1x_2 - 8x_2x_3 + 4x_3x_1$ .	16	K3	CO1
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12. a)	i. Show that $\vec{F} = (x^2 + xy^2)\vec{i} + (y^2 + x^2y)\vec{j}$ is irrotational and then find its scalar potential.	8	K3	CO2
	ii. Show that $\nabla^2 r^n \vec{r} = n(n+3)r^{n-2}\vec{r}$ .	8	K3	CO2

(OR)

b)	i. Find the directional derivative of $4x^2z + xy^2z$ at $(1, -1, 2)$ in the direction of $2\vec{i} - \vec{j} + 3\vec{k}$	8	K3	CO2
	ii. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$ .	8	K3	CO2

13. a)	Verify Green's theorem in the XY-plane for $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ , where C is the boundary of the region defined by $x = y^2, y = x^2$ .	16	K5	CO3
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(OR)

b)	Verify Gauss divergence theorem for $\vec{F} = x^2\vec{i} + z\vec{j} + yz\vec{k}$ over the cube bounded by $x = \pm 1, y = \pm 1, z = \pm 1$ .	16	K5	CO3
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14. a) i. Show that  $u = \frac{1}{2} \log(x^2 + y^2)$  is harmonic. Determine the corresponding analytic function  $u + iv = f$ . 8 K3 CO4
- ii. Find the analytic function, whose real part is  $\frac{\sin 2x}{(\cos h 2y - \cos 2x)}$ . 8 K3 CO4
- (OR)
- b) i. Find the image of  $|z| = 2$  under the mapping  
a)  $w = z + 3 + 2i$   
b)  $w = 3z$ . 8 K5 CO4
- ii. Find the image of the infinite strips  
a)  $\frac{1}{4} < y < \frac{1}{2}$   
b)  $0 < y < \frac{1}{2}$  under the transformation  $w = \frac{1}{z}$ . 8 K5 CO4
15. a) i. Using Laplace transform solve the differential equation  $y'' + 9y = \cos 2t$  where,  $y(0) = 1, y(\frac{\pi}{2}) = -1$ . 8 K3 CO5
- ii. Find  $L[te^{-t} \sin 3t]$  and  $L\left[\frac{\cos at - \cos bt}{t}\right]$  8 K3 CO5
- (OR)
- b) i. Find the Laplace transform of the following triangular wave function given by  $f(t) = \begin{cases} t, & 0 < t < 1 \\ 2 - t, & 1 < t < 2 \end{cases}$  with  $f(t+2) = f(t)$ . 8 K3 CO5
- ii. Evaluate  $L^{-1}\left(\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}\right)$  using convolution theorem. 8 K3 CO5