



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

**Question Paper Code: 20017**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. / FEB. 2026

Second Semester

Computer Science and Engineering

U19MA202 - LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

(Common to ECE & BME)

(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.	If the eigen values of a matrix A are 5,6,7 find the eigen values of $A^{-1}$ and $A^2$ .	2	K1	CO1
2.	Write down the quadratic form corresponding to the matrix $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$	2	K2	CO1
3.	Find the Unit normal vector to the surface $x^2y + 2xz^2 = 8$ at the point (1,0,2).	2	K2	CO2
4.	Determine the constant $a$ so that the vector $\vec{F} = (x+z)\vec{i} + (3x+ay)\vec{j} + (x-5z)\vec{k}$ is such that its divergence is zero.	2	K1	CO2
5.	State Green's Theorem.	2	K1	CO3
6.	Find the work done, when a force $\vec{F} = (x^2 - y^2 + x)\vec{i} - (2xy + y)\vec{j}$ moves a particle from the origin to the point (1,1) along $y^2 = x$ .	2	K2	CO3
7.	Determine whether the function $2xy + i(x^2 - y^2)$ is analytic or not.	2	K1	CO4
8.	Find the fixed points of $w = \frac{2zi + 5}{z - 4i}$ .	2	K1	CO4

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|-----|--|---|----|-----|
| 9.  | Find the Laplace transform of $t \sin 2t$ .              | 2 | K2 | CO5 |
| 10. | Verify the Initial value theorem for $f(t) = 3e^{-2t}$ . | 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 $A = \begin{bmatrix} 3 & -4 & 4 \\ 1 & -2 & 4 \\ 1 & -1 & 3 \end{bmatrix}$	8	K3	CO1
	ii. Make use of Cayley Hamilton theorem to find $A^{-1}$ if the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 2 & 1 \\ 1 & 1 & 3 \end{bmatrix}$ .	8	K3	
(OR)				
	b) Reduce the quadratic form $-x^2 + y^2 + 4yz + 4zx$ into a canonical form by an orthogonal reduction also find the rank, index and signature.	16	K3	CO1
12. a)	i. Prove that $\nabla^2(r^n) = n(n+1)r^{n-2}$ , where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r =  \vec{r} $ and hence, deduce $\nabla^2\left(\frac{1}{r}\right)$ .	8	K3	CO2
	ii. Find the Directional derivative of $\phi = x^2yz + 4xz^2 + xyz$ at $(1, -2, -1)$ in the direction of $2\vec{i} - \vec{j} - 2\vec{k}$ .	8	K3	
(OR)				
	b) i. Prove $\vec{F} = (y^2 \cos x + z^3)\vec{i} + (2y \sin x - 4)\vec{j} + 3xz^2\vec{k}$ is irrotational and find its scalar potential.	8	K3	CO2
	ii. Find the angle between the surfaces $x^2 - y^2 - z^2 = 11$ and $xy + yz - zx = 18$ at the point $(6, 4, 3)$ .	8	K3	
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
(OR)				
	b) Verify Gauss Divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$ .	16	K5	CO3

14. a) i. Determine the analytic function  $f(z) = u + iv$  if 8 K3 CO4  

$$u = \frac{\sin 2x}{\cosh 2y - \cos 2x}.$$
- ii. Find the bilinear transformation which maps the points 8 K3  
 $z = 0, 1, \infty$  onto  $w = i, -1, -i$ .
- (OR)
- b) i. If  $f(z) = u + iv$  is a regular function of  $z$  in a domain  $D$ , 8 K3 CO4  
then Prove that  $\nabla^2 |f(z)|^2 = 4|f'(z)|^2$ .
- ii. Find the image of the infinite strip  $\frac{1}{4} < y < \frac{1}{2}$  under the 8 K5  
transformation  $w = \frac{1}{z}$ .
15. a) i. Find the Laplace transform of the following triangular 8 K5 CO5  
wave function given by  

$$f(t) = \begin{cases} t, & 0 < t < a \\ 2a - t, & a < t < 2a \end{cases} \text{ with } f(t + 2a) = f(t)$$
- ii. Using Convolution Theorem find 8 K3  

$$L^{-1} \left[ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right]$$
- (OR)
- b) i. Find the Laplace transform of  $\left[ \frac{e^{-at} - \cos bt}{t} \right]$ . 8 K3 CO5
- ii. Using Laplace transform solve the differential equation 8 K3  
 $y'' - 3y' + 2y = e^{-t}$  with  $y(0) = 1 = y'(0)$ .