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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: 2011

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – AUG. / SEP. 2023

Second Semester

U19MA202– LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

(Regulation 2019)

(Common to all Branches)

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 of the eigen values of the inverse of $A = \begin{pmatrix} -2 & 0 & 0 \\ -2 & 1 & 0 \\ -4 & -2 & -2 \end{pmatrix}$	2	K3	CO1
2.	Write down the quadratic form corresponding to the matrix $\begin{pmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{pmatrix}$	2	K4	CO1
3.	Find the value of a , if $\vec{F} = (2x - 5y)\vec{i} + (x + ay)\vec{j} + (3x - z)\vec{k}$ is solenoidal.	2	K2	CO2
4.	Find the function ϕ , if $\text{grad } \phi = (y^2 - 2xyz^3)\vec{i} + (3 + 2xy - x^2z^3)\vec{j} + (6z^3 - 3x^2yz^2)\vec{k}$	2	K2	CO2
5.	Evaluate $\int xdy - ydx$ around the circle $x^2 + y^2 = 1$.	2	K1	CO3
6.	State Green's theorem.	2	K1	CO3
7.	Check whether the function $f(z) = e^x(\cos y - i \sin y)$ is analytic.	2	K2	CO4
8.	Find critical point of a transformation $w^2 = (z - \alpha)(z - \beta)$.	2	K2	CO4
9.	Find the Laplace transform of $t \sin 3t$.	2	K3	CO5
10.	If $L[f(t)] = \frac{1}{s(s+1)(s+2)}$ then find $\lim_{t \rightarrow \infty} f(t)$.	2	K3	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.	Questions	Marks	KL	CO
11. a) i	Verify Cayley- Hamilton theorem for the matrix $A = \begin{pmatrix} 2 & 2 & -2 \\ 2 & 1 & -2 \\ -2 & -2 & 1 \end{pmatrix}$ and hence find A^{-1}	8	K3	CO1
ii	Find the eigen values and eigen vectors of $\begin{pmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$	8	K3	CO1
(OR)				
b)	Reduce the quadratic form $2x_1x_2 + 2x_2x_3 + 2x_3x_1$ to canonical form by an orthogonal transform and hence find its rank, index, signature and nature.	16	K4	CO1
12. a) i	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	K2	CO2
ii	Show that $\vec{F} = (y^2 + 2xz^2)\vec{i} + (2xy - z)\vec{j} + (2x^2z - y + 2z)\vec{k}$ is irrotational and hence find its scalar potential.	8	K2	CO2
(OR)				
b) i	Find the equation of the tangent plane to the surface $xz^2 + x^2y = z - 1$ at the point $(1, -3, 2)$.	8	K2	CO2
ii	Find the value of n , if $r^n\vec{r}$ is both solenoidal and irrotational, when $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$.	8	K2	CO2
13. a)	Verify Stoke's theorem for $\vec{F} = xy\vec{i} - 2zy\vec{j} - zx\vec{k}$ where S is the open surface of the rectangular parallelopiped formed by the planes $x = 0, x = 1, y = 0, y = 2$ and $z = 3$ above the xoy -plane.	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 the lines $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.	16	K5	CO3
14. a) i	Determine the analytic function $f(z) = u + iv$, given that $u = \frac{\sin 2x}{\cosh 2y - \cos 2x}$	8	K3	CO4
ii	Verify that the families of curves $u = c_1$ and $v = c_2$ cut orthogonally, when $w = z^3$.	8	K3	CO4
(OR)				

- b) i If $f(z)$ is regular function of z , prove that 8 K3 CO4

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^2 = 4|f'(z)|^2$$
- ii Find the bilinear transformation which maps the points $0, 1, \infty$ of the z -plane into the points $i, 1, -i$ of the w -plane respectively. 8 K3 CO4
15. a) i Find the Laplace transform $\frac{e^{-at} - e^{-bt}}{t}$ 8 K3 CO5
- ii Using Laplace transform, solve the differential equation 8 K3 CO5
 $y'' - 3y' + 2y = 4t, \quad y(0) = 0 \text{ and } y'(0) = 0.$
 (OR)
- b) i Find the Laplace transform of 8 K3 CO5
 $f(t) = \begin{cases} t, & 0 \leq t \leq a \\ 2a - t, & a \leq t \leq 2a \end{cases}$ and $f(t + 2a) = f(t)$
- ii Using convolution theorem, find the inverse Laplace 8 K3 CO5
 transform of $\frac{s^2}{(s^2+4)^2}$
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