Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B.Tech. (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

(Common to all branches except for CSE)

MA5158 ENGINEERING MATHEMATICS I

(Regulation 2019)

Time: 3 hours | Max.Marks:100

CO1	Use the matrix algebra methods for solving practical problems.
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems.
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems.

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20 Marks)

(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	If $A = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$, find the eigenvalues of A^2.	2	1	L2
2	Write down the quadratic form corresponding to the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 0 & 3 \\ 3 & 3 & 1 \end{pmatrix}$.	2	1	L1
3	If $f(x) = \begin{cases} ax + 5 \; if \; x \le 2 \\ x - 1 \; if \; x > 2 \end{cases}$ is continuous at $x = 2$. Find the value of $'a'$.	2	2	L2
4	If $y = x^2 e^{sinx}$, then find $\frac{dy}{dx}$.	2	2	L3
5	If $x = rcos\theta, y = rsin\theta$ then find $\frac{\partial(x,y)}{\partial(r,\theta)}$.	2	3	L2
6	Find the stationary points of $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.	2	3	L2
7	Evaluate $\int_1^{\frac{\pi}{2}} \frac{\sin x}{1+cos^2 x} dx$.	2	4	L3
8	Evaluate $\int \frac{x^2-3x+2}{x} dx$.	2	4	L3
9	Change the order of integration $\int_0^1 \int_0^x x^2 dydx$.	2	5	L2
10	Find $\int_0^{\frac{\pi}{2}} \int_0^{\sin\theta} rdrd\theta$.	2	5	L2

PART- B (5x 13=65 Marks)

Q.No.	Questions	Marks	CO	BL
11(a)(i)	Verify Cayley-Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$.	7	1	L3
(ii)	Find the eigenvalues and eigenvectors of $A = \begin{pmatrix} 1 & 1 \\ 3 & -1 \end{pmatrix}$.	6	1	L3
	OR			

11 (b)	Reduce the quadratic form $x_1^2+5x_2^2+x_3^2+2x_1x_2+2x_2x_3+6x_1x_3$ to canonical form through an orthogonal transformation.	13	1	L4
12(a)(i)	Find the derivative of $x^{sinx}+(sinx)^x$ with respect to x.	7	2	L4
(ii)	Find the absolute maximum and absolute minimum values of the function $f(x)=x^3-3x^2+1, \left[\frac{-1}{2},4\right]$.	6	2	L4
	OR			
12(b)(i)	Find the local maxima and local minima of the function $f(x)=2x^3+3x^2-36x+5$.	7	2	L4
(ii)	Find the equation of the tangent and normal to the curve $y=\frac{x-1}{x-2}$ at the point (3,2).	6	2	L4
13(a)(i)	If $u=log(x^2+y^2)+tan^{-1}\left(\frac{y}{x}\right)$, then prove that $u_{xx}+u_{yy}=0$.	7	3	L3
(ii)	If $u=tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$ then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$.	6	3	L3
	OR			
13(b)(i)	Examine $f(x,y)=x^3+y^3-12x-3y+20$ for its extreme values.	7	3	L4
(ii)	Expand $e^x\log(1+y)$ as the Taylor's series in the neighborhood of (0,0), upto second degree.	6	3	L3
14(a)(i)	Evaluate $\int\frac{1}{2x^2+3x-5}dx$.	7	4	L4
(ii)	Evaluate $\int x tan^{-1}(x)dx$ by using integration by parts.	6	4	L4
	OR			
14(b)(i)	Evaluate $\int\frac{x^2+x+1}{(x-2)(x-1)^2}dx$ by using partial fraction.	7	4	L3
(ii)	Evaluate $\int\frac{x^3 sin(tan^{-1}(x^4))}{1+x^8}dx$.	6	4	L3
15(a)(i)	Find the smaller of the areas bounded by $y=2-x$ and $x^2+y^2=4$.	7	5	L3
(ii)	By changing the order of integration, evaluate $\int_0^4\int_{\frac{x^2}{4}}^{2\sqrt{x}}dydx$.	6	5	L3
	OR			
15(b)(i)	Evaluate $\iint x^2ydydx$ over the positive quadrant of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.	7	5	L3
(ii)	Find the value of $\int_0^1\int_0^{1-x}\int_0^{x+y}xdzdydx$.	6	5	L3

PART- C (1x 15=15 Marks)

Q.No.	Questions	Marks	CO	BL
16.(i)	The temperature T at any point (x,y,z) in space is $T=400xyz^2$. Find the highest temperature on the surface of the unit sphere $x^2+y^2+z^2=1$.	8	3	L6
(ii)	Find the area between the parabola $y^2=4x$ and the straight line $y=x$.	7	5	L5