Q. Code:577394

Reg. No. | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2024

First Semester

MA18151 – ENGINEERING MATHEMATICS – I

(Common to all branches except MR)

(Regulation 2018 / 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO1 To develop the use of matrix algebra techniques which is needed for practical applications.

CO2 To apply the skill to solve statistical problems under correlation and regression and acquire the knowledge for fitting the straight line and parabola.

CO3 To apply the concepts of differential calculus to find the evolutes and envelopes of curves.

CO4 To explore functions of several variables and to find the maxima and minima of functions of two or more variables.

CO5 To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Find the sum and product of the Eigens value of the matrix $\begin{bmatrix} 2 & -2 & 2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$.	**1**	**2**
2.	Find the matrix of the quadratic form $2x_1^2+5x_2^2-4x_1x_2$.	**1**	**2**
3.	Given two regression lines $2y+x=4$ and $x+3y=5$ find σ_x if $\sigma_y=2$.	**2**	**2**
4.	Write the normal equations to fit a straight line $y=ax+b$ by the method of least squares.	**2**	**1**
5.	Find the curvature of the circle $2x^2+2y^2+5x-2y+1=0$ at any point on it.	**3**	**2**
6.	Find the envelope of the family of curves $\frac{x\cos\alpha}{a}+\frac{y\sin\alpha}{b}=1$ where α is the parameter.	**3**	**2**
7.	Evaluate $\lim_{\substack{x\to 0\\ y\to 0}} \frac{x-y}{x+y}$.	**4**	**2**
8.	If $u=\frac{y^2}{x}$ and $v=\frac{x^2}{y}$ then find $\frac{\partial(x,y)}{\partial(u,v)}$.	**4**	**2**
9.	Evaluate $\int_1^2 \int_x^{x\sqrt{3}} xydydx$.	**5**	**3**

			Marks	CO	RBT LEVEL
10.	Sketch the region of integration in $\int_0^a \int_0^{\sqrt{a^2-y^2}} f(x,y)\,dxdy$.		5	3	

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)	(i)	Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.	(7)	1	3
	(ii)	Use Cayley-Hamilton theorem, to find the value of the matrix given by $A^6-5A^5+8A^4-2A^3-9A^2+35A+6I$ where $A=\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$.	(7)	1	3
		(OR)			
	(b)	Reduce the quadratic form $x_1^2+2x_2^2+x_3^2-2x_1x_2+2x_2x_3$ to the canonical form through an orthogonal transformation and hence show that it is positive semi-definite.	(14)	1	3
12. (a)	(i)	Ten students got the following percentage of marks in Physics and chemistry:	(7)	2	3

Students	1	2	3	4	5	6	7	8	9	10
Marks in Physics	78	36	98	25	75	82	90	62	65	39
Marks in chemistry	84	51	91	60	68	62	86	58	63	47

Calculate the rank correlation coefficient.

	(ii)	Fit a parabola, by the method of least squares, to the following data; also estimate y at $x=6$.	(7)	2	3

x	1	2	3	4	5
y	5	12	26	60	97

(OR)

	(b)	Obtain the equations of the lines of regression from the following data:	(14)	2	3

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

13. (a)	**(i)**	Find the radius of curvature of the cycloid $x=a(\theta+\sin\theta)$, $y=a(1-\cos\theta)$.	**(7)**	**3**	**3**
	(ii)	Find the envelope of $\frac{x}{a^2}+\frac{y}{b^2}=1$ where a and b are the parameters and are connected by the relation $a^2+b^2=1$.	**(7)**	**3**	**3**
		(OR)			
(b)	**(i)**	Find the centre of curvature of $y=3x^3+2x^2-3at(0,-3)$.	**(7)**	**3**	**3**
	(ii)	Find the equation of evolutes of the parabola $x^2=4ay$.	**(7)**	**3**	**3**
14. (a)	**(i)**	If y = f(x + at) + g(x – at), show that $\frac{\partial^2 y}{\partial t^2}=a^2\frac{\partial^2 y}{\partial x^2}$ where 'a' is constant.	**(7)**	**4**	**3**
	(ii)	Expand $f(x,y)=\sin(xy)$ in powers of (x – 1) and (y – π/2) through quadratic form.	**(7)**	**4**	**3**
		(OR)			
(b)	**(i)**	Prove u = x + y + z, v = xy + yz + zx, w = $x^2 + y^2 + z^2$ are functionally dependent and find the functional relationship between them.	**(7)**	**4**	**3**
	(ii)	Using Lagrange's multiplier method, determine the dimensions of a rectangular tank, open at the top, if the surface area is 108 sq.cm.	**(7)**	**4**	**3**
15. (a)	**(i)**	Evaluate $\iint_{\square} r^2\,dr d\theta$ over the region bounded by the semicircle $r=a\cos\theta$ above the initial line.	**(7)**	**5**	**3**
	(ii)	Change of order of integration in $\int_0^a\int_y^a \frac{x}{x^2+y^2}\,dx\,dy$ and hence evaluate.	**(7)**	**5**	**3**
		(OR)			
(b)	**(i)**	Convert $\int_0^2\int_0^{\sqrt{2x-x^2}}(x^2+y^2)\,dy\,dx$ into polar coordinates and then evaluate.	**(7)**	**5**	**3**
	(ii)	Evaluate $\iiint_V (x+y+z)\,dxdydz$ where V is the volume bounded by the parallelopiped $x=0, x=a, y=0, y=b, z=0, z=c$.	**(7)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Examine $f(x,y) = x^3 + y^3 - 12x - 3y + 20$ for its extrême values.	**(10)**	**4**	**3**

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