Reg. No.															

B.Tech. / M.Tech (Integrated) DEGREE EXAMINATION, JANUARY 2023
First Semester

21MAB101T – CALCULUS AND LINEAR ALGEBRA
(For the candidates admitted from the academic year 2022-2023)

Note:
(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
(ii) **Part – B** and **Part – C** should be answered in answer booklet.

Time: 3 Hours Max. Marks: 75

PART – B (5 × 8 = 40 Marks)
Answer **ALL** Questions

Q. No.		Question	Marks	BL	CO	PO
21.	a.	Find the Eigen values and Eigen vectors of the matrix $\begin{pmatrix} 10 & -2 & -5 \\ -2 & 2 & 3 \\ -5 & 3 & 5 \end{pmatrix}$.	8	3	1	1
		(OR)				
	b.	Verify Cayley Hamilton theorem for the matrix $\begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.	8	4	1	2
22.	a.	Expand $e^x \cos y$ at $\left(1, \frac{\pi}{4}\right)$ as a Taylor series upto second degree terms.	8	4	2	1
		(OR)				
	b.	If $u = u(x, y)$ and $x = e^r \cos\theta$ and $y = e^r \sin\theta$ show that $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 = e^{-2r}\left[\left(\frac{\partial u}{\partial r}\right)^2 + \left(\frac{\partial u}{\partial \theta}\right)^2\right]$.	8	3	2	1
23.	a.	Solve $\left(D^2 + 2D + 1\right)y = e^{3x} + \sin 2x$.	8	3	3	1
		(OR)				
	b.	Solve $\left(D^2 + 1\right)y = \tan x$ by the method of variation of parameters.	8	4	3	2
24.	a.	Find the radius of curvature of the curve $r = a(1 + \cos\theta)$ at the point $\theta = \frac{\pi}{2}$.	8	3	4	2
		(OR)				
	b.	Find the evolute of the parabola $y^2 = 4ax$.	8	4	4	2

		Marks	BL	CO	PO
25. a.	Test the convergence of the series $\sum_{n=1}^{\infty}\left(\sqrt{n^4+1}-\sqrt{n^4-1}\right)$.	8	4	5	2
	(OR)				
b.	Test the convergence of the series, $\frac{2}{3.4}+\frac{2.4}{3.5.6}+\frac{2.4.6}{3.5.7.8}+\frac{2.4.6.8}{3.5.7.9.10}+.....\infty$.	8	4	5	2

PART – C (1 × 15 = 15 Marks)

Answer **ANY ONE** Question

		Marks	BL	CO	PO
26.	Reduce the quadratic form $3x^2-2y^2-z^2-4xy+8xz+12yz$ to canonical form by an orthogonal transformation. Discuss the nature of the quadratic form and also find rank, index, and signature.	15	4	1	1
27.	Find the dimensions of the rectangular box open at the top, of maximum capacity whose surface area is 432 sq.cm.	15	4	2	2

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