ANURAG Engineering College
(An Autonomous Institution)
I B.Tech I Semester Supplementary Examinations, January – 2025
MATHEMATICS – I
(COMMON TO ALL BRANCHES)

Time: 3 Hours   **Max. Marks: 75**

Section – A (Short Answer type questions)   (25 Marks)

Answer All Questions

		Course Outcome	B.T Level	Marks
1.	Verify Rolle's Theorem for $f(x) = x^2 - 1$ in [-1, 1].	CO1	L1	2M
2.	If $x = r\cos\theta$, $y = r\sin\theta$ then find $\frac{\partial(x,y)}{\partial(r,\theta)}$.	CO1	L2	3M
3.	Define rank of a matrix	CO2	L1	2M
4.	If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ find the value of $A^2 - 5A + 7I$	CO2	L1	3M
5.	Find the Eigen values of A^{-1} if $A = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{bmatrix}$	CO3	L2	2M
6.	If 1,2,3 are Eigen values of the matrix A then find the Eigen values of $3A^2 + 5A + 3I$	CO3	L1	3M
7.	Solve $x\frac{dy}{dx} + y = logx$	CO4	L1	2M
8.	Solve $xdx + ydy = \frac{a^2(xdy - ydx)}{x^2 + y^2}$	CO4	L2	3M
9.	Find the solution of $(D^2 + 5D + 6)y = 0$	CO5	L1	2M
10.	Find the Particular Integral of $(D^2 + 4)y = \cos 2x$	CO5	L2	3M

Section B (Essay Questions)

Answer all questions, each question carries equal marks.   (5 X 10M = 50M)

			Course Outcome	B.T Level	Marks
11.	A)	Prove that if$(0 < a < b < 1)$, $\frac{b-a}{1+b^2} < tan^{-1}b - tan^{-1}a < \frac{b-a}{1+a^2}$ Hence S.T $\frac{\pi}{4} + \frac{3}{25} < tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$		CO1	L3	10M
		OR				
	B)	If $x = u(1-v), y = uv$ then Prove that $\frac{\partial(x,y)}{\partial(u,v)} \cdot \frac{\partial(u,v)}{\partial(x,y)} = 1$		CO1	L2	10M
12.	A)	Determine the rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ by reducing to the normal form		CO2	L2	10M
		OR				
	B)	Solve the following system of equations $x + y + z = 9$, $2x - 3y + 4z = 13$, $3x + 4y + 5z = 40$ by Gauss Jordan method		CO2	L3	10M

13. A) Determine the Eigen values and Eigen vectors of the Matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$	CO3	L2	10M

OR

B) Verify the Cayley – Hamilton theorem for the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ also find A^{-1} and A^4	CO3	L3	10M

14. A) Solve $[x^4 e^x - 2mxy^2]dx + 2mx^2 y dy = 0$	CO4	L2	10M

OR

B) A body originally at $80^0 c$ cools down to $60^0 c$ in 20 min. the temperature of the air being $40^0 c$. what will be the temperature of the body after 40 min.	CO4	L3	10M

15. A) Solve $(D^2 - 4D - 5)y = e^{2x} + 3\cos(4x + 3)$	CO5	L2	10M

OR

B) Solve $(D^2 + a^2)y = \tan ax$ by the Method of variation of Parameters	CO5	L3	10M