

**ANURAG Engineering College**

(An Autonomous Institution)

I B.Tech I Semester Supplementary Examinations, June/July - 2024

**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. State Lagrange's Mean Value Theorem.	CO1	L1	2M
2. Write geometrical interpretation of Rolle's theorem.	CO1	L1	3M
3. Define the rank of the matrix and give example.	CO2	L1	2M
4. State the condition when the system of non-homogeneous equations $AX = B$ will have i) unique solution ii) Infinite no. of solutions	CO2	L2	3M
5. State Cayley Hamilton theorem.	CO3	L2	2M
6. If $\lambda$ is an Eigen value of a matrix A, then prove that $\frac{1}{\lambda}$ is the Eigen value of $A^{-1}$ .	CO3	L2	3M
7. State Newton's law of cooling.	CO4	L2	2M
8. Define Bernoulli's equation.	CO4	L1	3M
9. Solve $(D^3 - 3D + 2)y = 0$	CO5	L2	2M
10. Define linear differential equation.	CO5	L1	3M

**Section B (Essay Questions)****Answer all questions, each question carries equal marks.****(5 X 10M = 50M)**

11. A) If  $a < b$ , prove that  $\frac{b-a}{1+b^2} < \tan^{-1}b - \tan^{-1}a < \frac{b-a}{1+a^2}$   
Using Lagrange's mean value theorem and deduce that  $\frac{\pi}{4} + \frac{3}{25} < \tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$ .
- OR**
- B) Find the maximum and minimum values  
 $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$
12. A) Solve the equations  $x + y + z = 6, 3x + 3y + 4z = 20, 2x + y + 3z = 13$  using Gauss-Elimination method.
- OR**
- B) Find the rank of the matrix by reducing it to the normal form
- $$\begin{bmatrix} 4 & 3 & 2 & 1 \\ 5 & 1 & -1 & 2 \\ 0 & 1 & 2 & 3 \\ 1 & -1 & 3 & -2 \end{bmatrix}$$
13. A) Find matrix P which transforms the matrix  $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$  into diagonal form and hence calculate  $A^4$

**OR**

- B) State Cayley-Hamilton theorem and use it to find the inverse of matrix  $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$ . CO3 L3 10M
14. A) Solve  $(1 + y^2)dx = (\tan^{-1}y - x)dy$  CO4 L3 10M  
OR  
B) Find the orthogonal trajectories of the circle  $x^2 + (y - c)^2 = c^2$ . CO4 L3 10M
15. A) Solve  $(D^2 - 4)y = 2\cos^2 x$ . CO5 L3 10M  
OR  
B) Solve  $(D^2 - 4D + 4)y = x^2 \sin x + e^{2x} + 3$ . CO5 L3 10M