Question Paper Code: R15A11HS01

R15

ANURAG Engineering College

(An Autonomous Institution)

I B.Tech I Semester Supplementary Examinations, Jan/Feb-2024

MATHEMATICS – I

(COMMON TO ALL BRANCHES)

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

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

Answer All Questions

	Question	Course Outcome	B.T Level	Marks
1.	State Cauchy's mean value theorem.	CO1	L2	2M
2.	Verify Lagrange's mean value theorem for $f(x) = log_e x \ in \ [1, e]$.	CO1	L2	3M
3.	Define normal form of a matrix and give example.	CO2	L1	2M
4.	Find the value of 'k' if the rank of the matrix A is 2 where A = $\begin{bmatrix} 1 & 2 & 7 \\ 2 & k & 7 \\ 3 & 6 & 10 \end{bmatrix}$.	CO2	L1	3M
5.	If $\lambda^3 + \lambda^2 - 21\lambda - 45 = 0$ is the characteristic equation of matrix A find $\det(A)$.	CO3	L2	2M
6.	Let A be a square matrix of order 3 with Eigen values 2 ,2 and 3 and A is diagonalizable then find rank of (A-2I).	CO3	L2	3M
7.	Form the differential equation by eliminating the arbitrary constant $y^2 = (x - c)^2$.	CO4	L2	2M
8.	Define Orthogonal Trajectories in Cartesian co-ordinates	CO4	L1	3M
9.	Find the general solution of f(D)y=0	CO5	L1	2M
10.	Solve $(D^2 - 4D + 13)y = e^{2x}$.	CO5	L2	3M

Section B (Essay Questions)

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

	Question	Course Outcome	B.T Level	Marks
11. A)	Prove that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1}\left(\frac{3}{5}\right) < \frac{\pi}{6} + \frac{1}{8}$ using suitable mean value theorem.	CO1	L3	10M
	OR			
B)	Verify Rolle's theorem for the function $f(x) = log\left\{\frac{x^2+ab}{x(a+b)}\right\}$ in [a, b] where a>0, b>0.	CO1	L3	10M
12. A)	Reduce the matrix $\begin{bmatrix} 10 & -2 & 3 & 0 \\ 2 & 10 & 2 & 4 \\ -1 & -2 & 10 & 1 \\ 2 & 3 & 4 & 9 \end{bmatrix}$ to echelon form and hence find it's rank.	CO2	L3	10M
	OR			
B)	Find the inverse of the matrix A = $\begin{bmatrix} -1 & -3 & 3 & -1 \\ 1 & 1 & -1 & 0 \\ 2 & -5 & 2 & -3 \\ -1 & 1 & 0 & 1 \end{bmatrix}$ using Gauss-Jordan method.	CO2	L3	10M

13. A)	Find Eigen values and Eigen vectors of $\begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$.	CO3	L3	10M
	OR			
B)	State Cayley-Hamilton theorem and verify the Cayley-Hamilton for the matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$.	CO3	L3	10M
14. A)	Solve $(x^2 - y^2)dx = 2xy\,dy$.	CO4	L3	10M
	OR			
B)	A body kept in air with temperature 25^0C cool from 140^0C to 80^0C in 20 minutes. Find when the body cools down to 35^0C.	CO4	L3	10M
15. A)	Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{2x}$.	CO5	L3	10M
	OR			
B)	A particle is executing simple harmonic motion of period T about a centre O and it passes through position P (OP=b) with velocity v in the direction OP. Show that the time that elapses before it returns to P $\frac{T}{\pi} Tan^{-1} \frac{vT}{2\pi b}$.	CO5	L3	10M