Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET A

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2024

Semester : Semester I - 2023
Course Code : MAT1001
Course Name Calculus and Linear Algebra
Program : B.Tech.

Date : 10-JAN-2024
Time : 9:30AM - 12:30 PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **5 X 2M = 10M**

1. Find the sum and product of the eigenvalues of the matrix $\begin{bmatrix} -1 & 1 & 1 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.

(CO1) [Knowledge]

2. State Cayley-Hamilton theorem.

(CO1) [Knowledge]

3. Define a homogeneous function of degree n.

(CO2) [Knowledge]

4. Find the value of the integral $\int_0^\infty x^{-1/2}e^{-x}dx$.

(CO3) [Knowledge]

5. If the roots of a second order linear ODE are imaginary, then its complementry function is _____.

(CO4) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **5 X 10M = 50M**

6. Find all the eigenvalues and only the eigenvector of the greatest eigenvalue of $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.

(CO1) [Comprehension]

7. Find $\frac{du}{dt}$ as a function of t where $u = \sin\left(\frac{x}{y}\right), x = e^t, y = t^2.$

(CO2) [Comprehension]

8. Verify that $\int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{1}{4\sqrt{2}}\beta\left(\frac{1}{4}, \frac{1}{2}\right).$

(CO3) [Comprehension]

9. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dxdy.$

(CO3) [Comprehension]

10. Solve $y'' - 8y' + 16y = 3e^{4x}$ given that $y = 0$ at $x = 0$ and $x = 2$.

(CO4) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **2 X 20M = 40M**

11. a) Find the maximum and minimum values of $f(x, y) = x^3 + y^3 - 3x - 12y + 20.$ (15 marks)
b) Solve $(D^2 - 6D + 9)y = 0$. (5 marks)

(CO2) [Application]

12.
a) Solve $y'' + 2y' + 3y = e^x cosx.$ (15 marks)
b) Evaluate $\int_0^\infty x^{5/2} e^{-x} dx.$ (5 marks)

(CO4) [Application]