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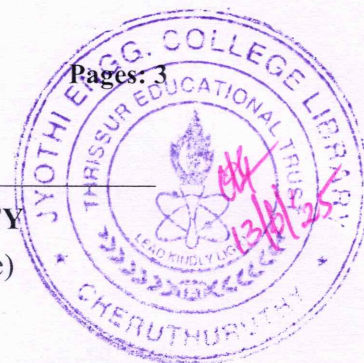
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Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (S) Examination May 2025 (2024 Scheme)



Course Code: GYMAT101

Course Name: MATHEMATICS FOR ELECTRICAL SCIENCE AND
PHYSICAL SCIENCE - 1

Max. Marks: 60

Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

- | | | CO | Mark
s |
|---|--|------|-----------|
| 1 | Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 6 & 7 \\ 2 & 3 & -1 & 6 \\ 3 & 5 & 5 & 13 \end{bmatrix}$ | CO 1 | (3) |
| 2 | Find the eigen values of the matrix $A = \begin{bmatrix} 1 & 6 & -2 \\ 0 & 2 & 1 \\ 0 & 0 & 3 \end{bmatrix}$
What are the eigen values of A^2, A^{-1} ? | CO 1 | (3) |
| 3 | Show that $\{\sin x, \cos x\}$ form a basis of solutions for the ODE $y'' + y = 0$ | CO 2 | (3) |
| 4 | Find the general solution of the ODE $y'' + 6y' + 9y = 0$ | CO 2 | (3) |
| 5 | Find $L[e^{2t} \cos 3t]$ | CO 3 | (3) |
| 6 | Find $L^{-1}\left[\frac{1}{s^2 - 2s - 15}\right]$ | CO 3 | (3) |
| 7 | Obtain the Maclaurin's series expansion of $\frac{1}{1-x}$ | CO 4 | (3) |
| 8 | Expand e^{-x} as a Taylor's series about $x = 1$ | CO 4 | (3) |

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

- 9 a) Use Gauss elimination to find the solutions of: $x + y + z = 6$, $x - y + 2z = 5$, $2x + y - z = 1$ CO 1 (4)
- b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 0 & 0 & -2 \\ 1 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$ CO 1 (5)
- 10 Diagonalize: $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ CO 1 (9)

Module -2

- 11 a) Solve using method of undetermined coefficients: $y'' - y' - 2y = x^2$ CO 2 (4)
- b) Solve using the method of variation of parameters: $y'' - 2y' + y = \frac{e^x}{x}$ CO 2 (5)
- 12 a) Find a homogeneous second order ODE with the basis of solutions $e^{-x}\cos x, e^{-x}\sin x$ CO 2 (4)
- b) Solve the initial value problem $y'' + 4y' - 5y = 0, y(0) = 2, y'(0) = -5$ CO 2 (5)

Module -3

- 13 a) Find $L^{-1}\left[\frac{2s+5}{s^2-4s+13}\right]$ CO3 (4)
- b) Use Laplace transform to solve: $y'' - 3y' + 2y = 4, y(0) = 2, y'(0) = 3$ CO3 (5)
- 14 a) Find $L[3u(t-2)\cos(t-2)]$ CO3 (4)

b) Using Convolution theorem, find

$$L^{-1}\left[\frac{1}{s^2(s^2 + a^2)}\right] \quad \text{CO3} \quad (5)$$

Module -4

15 Obtain the Half-range Fourier cosine and sine series of $f(x) = x \sin(0, \pi)$ CO4 (9)

16 Obtain the Fourier series expansion of $f(x) = x^2$ in $-\pi < x < \pi$. CO4 (9)

Hence show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$
