A 03GYMAT101122403 Pages: 3



Reg No.:_______________ Name:___________________________

**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 | Marks |
|---|---|---|---|
| 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 $e^{-x}cosx, e^{-x}sinx$ | 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 $L^{-1}\left[\frac{1}{s^2(s^2+a^2)}\right]$ CO3 (5)

**Module -4**

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

16 Obtain the Fourier series expansion of $f(x) = x^2$ in $-\pi < x < \pi$. Hence show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots = \frac{\pi^2}{12}$ CO4 (9)

***