

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (R,S) Examination December 2025 (2024 Scheme)

Course Code: GYMAT101

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

Max. Marks: 60

Duration: 2hours30minutes

## PART A

(Answer all questions. Each question carries 3 marks)

CO Marks

- 1 Find the rank of the matrix  $\begin{bmatrix} 1 & -1 & 1 & -9 \\ 2 & -2 & 2 & -18 \\ -3 & 3 & -3 & 27 \end{bmatrix}$  CO1 (3)
- 2 Show that  $X = \begin{bmatrix} -1 \\ -2 \end{bmatrix}$  is an eigenvector of  $A = \begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$ . Find the corresponding eigenvalue. CO1 (3)
- 3 Find the general solution of ODE  $y'' - 4y' - 21y = 0$ . CO2 (3)
- 4 Find the homogeneous second order ODE with the basis of solutions  $e^{5x}, xe^{5x}$ . CO2 (3)
- 5 Find the Laplace transform of  $5^{-t}$ . CO3 (3)
- 6 Find the inverse Laplace transform of  $\frac{1}{(s-3)^2+16}$  CO3 (3)
- 7 Find the Maclaurin's series for the function  $e^{2x}$ . CO4 (3)
- 8 Find the Fourier coefficient  $a_n$  for the function  $f(x) = |x|$  in the interval  $-\pi < x < \pi$ . CO4 (3)

## PART B

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

## Module -1

- 9 a) Check whether the set of vectors  $[1 \ -2 \ -2 \ 3]$ ,  $[1 \ -1 \ 3 \ 1]$ ,  $[-1 \ 1 \ 2 \ 4]$  is linearly independent or not. CO1 (4)
- b) Find the eigenvalues of  $A = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ , also find eigenvectors corresponding to any one of the eigenvalue. CO1 (5)
- 10 a) Find a relation connecting  $a$ ,  $b$ ,  $c$  under which the system of equations  $2x - 4y + 2z = 2a$ ,  $2x - y - z = -b$ ,  $x + y - 2z = c$  has infinitely many solutions. CO1 (4)
- b) Let  $A = \begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}$ . Find the matrix  $P$  and  $P^{-1}$  such that  $P^{-1}AP = D$ , where  $D$  is a diagonal matrix, hence evaluate  $A^3$ . CO1 (5)

### Module -2

- 11 a) Using the method of variation of parameters, find the general solution of  $y'' + y = \sec x$ . CO2 (4)
- b) Using the method of undetermined coefficients, find the solution of  $y'' - 4y' - 5y = e^x + x + 2$ ,  $y(0) = 1$ ,  $y'(0) = 0$ . CO2 (5)
- 12 a) Using the method of undetermined coefficients, find the general solution of  $y'' + 3y' + 2y = 2 \cos x - \sin x$ . CO2 (4)
- b) Using the method of variation of parameters, find the general solution of  $y'' - 2y' + y = e^x x^3$ . CO2 (5)

### Module -3

- 13 a) Write the following function using unit step function, hence evaluate its Laplace transform.  $f(t) = \begin{cases} t & \text{if } 0 < t < 2 \\ t^2 & \text{if } t > 2 \end{cases}$  CO3 (4)
- b) Using Laplace transform, solve the initial value problem  $y'' - 2y' - 3y = 40 \sin t$ . CO3 (5)

14 a) Find  $L^{-1}\left(\frac{3s+4}{(s-2)(s^2+1)}\right)$  CO3 (4)

b) Use convolution theorem to find  $L^{-1}\left(\frac{3}{s^2(s^2+9)}\right)$  CO3 (5)

#### Module -4

15 a) Find the half range sine series of  $\pi - x$  in  $0 < x < \pi$ . CO4 (4)

b) Find the half range cosine series of  $x^2$  in  $0 < x < 3$ . Hence evaluate CO4 (5)

$$1 - \frac{1}{2^2} + \frac{1}{3^2} - \dots$$

16 Find the Fourier series of the periodic function  $f(x)$  given by CO4 (9)

$$f(x) = \begin{cases} 2x & -2 < x < 0 \\ x & 0 < x < 2 \end{cases}, f(x+4) = f(x). \text{ Hence}$$

evaluate

(i)  $1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ , (ii)  $1 - \frac{1}{3} + \frac{1}{5} - \dots$

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