

Ex/ME/5/Math/T/111/2025

**B.Mechanical(Evening). Examination, 2025**

**(1ST YR, 1ST SEM)**

**MATHEMATICS**

**PAPER - III**

**Full Marks : 100**

**Time: Three hours**

**Part - I**

**Answer any four questions**

**12.5 × 4 = 50**

1.(a) Find the Z-Transformations of the following functions:

$$(i) f(n) = n \quad (ii) f(n) = 2^n$$

(b) Solve the equation using Z-Transformation

$$f(n+1) + 2f(n) = 0, \text{ given : } f(0) = 1.$$

2. Find the Laplace Transformations of the following functions:

$$(i) F'(t) \text{ and } (ii) F''(t).$$

(ii) Solve by using Laplace Transformation

$$y'' + 9y = 0, \text{ given : } y(0) = 0, y'(0) = 2.$$

3. Find the Fourier Transformations of the following functions

$$(i) e^{-|t|} \quad (ii) f(t) = e^{-t^2}$$

[ Turn over

4. State Dirichlet's conditions for convergence of a Fourier series.  
Find the Fourier series of the function

$$f(x) = -x, \text{ when } -\pi < x \leq 0 \\ = x, \text{ when } 0 \leq x \leq \pi$$

5.(i) Find inverse Laplace Transformation of the function

$$F(z) = \frac{z}{z^2 - z + 8}$$

(ii) Find the Laplace Transformations of the following functions:

$$f(t) = \frac{t}{T}, \quad 0 < t < T \\ = 1, \quad t > T$$

## Part-II

Answer any two questions:

15 × 2 = 30

6. (i) Solve the equation:

$$\frac{dy}{dx} = \frac{x + y - 2}{2x - y - 1}$$

(ii). Find general solution and singular solution:

$$p = \tan\left(x - \frac{p}{1 + p^2}\right), \text{ where } p = \frac{dy}{dx}$$

7. Find the general solution:

$$(D^2 - D - 6)y = x^2, \text{ where } D = \frac{d}{dx}$$

8. Solve the Legendre's differential equation.

**Part-III****Answer the following questions:****10 × 2 = 20**

11. Solve the equations:

$$(i) (y + z)p + (z + x)q = x + y, \quad (ii) z^2 - pz + qz + (x + y)^2 = 0$$

$$\left[ \text{where } p = \frac{\partial z}{\partial x}, \quad q = \frac{\partial z}{\partial y} \right]$$

11. Solve the equation using the method of separation of variables.

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$