

Ex/ME/5/Math/T/111/2024(S)

B.Mechanical(Evening) SUPPLEMENTARY

Examination, 2024

(1ST YR, 1ST SEM)

MATHEMATICS

PAPER - III

Full Marks : 100

Time: Three hours

Part - I

Answer any four questions

12.5 × 4 = 50

1. Find the Z-Transformations of the following functions:

(i) $f(n) = na^n$ (ii) $f(n) = 5$ (iii) $f(n) = e^{inx}$

2. a. Find the Laplace Transformations of the following functions:

(i) $F'(t)$ and (ii) $F''(t)$.

b. Find the Laplace Transformation of the following function:

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

3. Solve the equation using Z-Transformation

$f(n + 2) - 3f(n + 1) + 2f(n) = 0$, given: $f(0) = 1$, $f(1) = 2$.

4. Find the Fourier Transformations of the following functions

(i) $e^{-|x|}$ (ii) $f(t) = e^{-x^2}$.

[Turn over

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

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

$$= \frac{\pi x}{4}, \text{ when } 0 \leq x \leq \pi$$

Part-II

Answer any three questions:

10 × 3 = 30

6. Solve the equation:

$$x dy - y dx = \sqrt{y^2 + x^2} dx$$

7. Find general solution and singular solution:

$$p = \ln(px - y), \text{ where } p = \frac{dy}{dx}$$

8. Find the general solution:

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

9. Solve the Legendre's differential equation.

Part-III

Answer the following questions:

10 × 2 = 20

10. Solve the equations:

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

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

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

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$$