

**MATHEMATICS – II**  
(Common to CE and ME)

Time: 3 hours

Max. Marks: 70

**PART – A**  
(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

- (a) Given matrix  $A = \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ , check whether it is symmetric or not.
- (b) Define a normal form of matrix.
- (c) Explain Lagrange's interpolation formula for unequal intervals.
- (d) State Regula-Falsi method for equal intervals.
- (e) Compute  $y$  at  $x = 0.25$ ,  $y' = 2xy$ ,  $y(0) = 1$  by Euler's method.
- (f) Is  $f(x) = \cosh ax$ ,  $-\pi < x < \pi$  even?
- (g) Explain half range cosine series in the interval  $(0, l)$ .
- (h) Write the formula of Fourier sine Transform.
- (i) Derive a partial differential equation by eliminating the arbitrary function  $f$  from the relation:  $f(x^2 + y^2, x^2 - z^2) = 0$ .
- (j) Give the One Dimensional wave equation for a stretched string.

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

2 Find the characteristic equation of the matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$  hence find  $A^{-1}$  and the matrix represented by  $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$ .

**OR**

3 Reduce the quadratic form  $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$  to the canonical form. Also specify the matrix of transformation.

**UNIT – II**

4 Derive formula to find the cube root of 'N' using Newton's formula and also find the cube root of 15.

**OR**

5 Apply Newton's forward interpolation formula to compute the value of  $\sqrt{5.5}$  up to three decimal places. Given that  $\sqrt{5} = 2.236$ ,  $\sqrt{6} = 2.449$ ,  $\sqrt{7} = 2.646$ , and  $\sqrt{8} = 2.828$ .

**UNIT – III**

6 Compute the integral  $\int_0^6 \frac{dx}{1+x^2}$ , using (i) Trapezoidal rule. (ii) Simpson's 1/3<sup>rd</sup> rule.

**OR**

7 Given  $y' = y + e^x$ ,  $y(0) = 0$  using modified Euler's method, find  $y(0.2)$  and  $y(0.4)$ .

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**UNIT - IV**

8 Find the Fourier sine series for  $f(x) = 2x - x^2$  in  $0 < x < 3$ .

**OR**

9 Find the Fourier transform of  $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| \leq 1 \\ 0 & \text{for } |x| > 1 \end{cases}$  and hence

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos\left(\frac{x}{2}\right) dx \text{ and } \int_0^{\infty} \frac{x \cos x - \sin x}{x^3} dx$$

**UNIT - V**

10 Form the P.D.E of the following by eliminating the arbitrary functions:

- (a)  $Z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$ .  
 (b)  $xyz = f(x^2 + y^2 + z^2)$ .

**OR**

11 A string is stretched and fastened to two points  $l$  apart. Motion is started by displacing the string into the form  $y = k(lx - x^2)$  from which it is released at time  $t = 0$ . Find the displacement of a string at a distance of  $x$  from one end at a time  $t$ .

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