

MATHEMATICS – II

(Common to CE and ME)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

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

- Define rank of a matrix.
- State Cayley Hamilton theorem.
- Define Transcendental Equation and give one example.
- Explain about Newton's Formulae for Interpolation.
- Apply Euler's method to solve $y' = x + y$, $y(0) = 1$ and find $y(0.2)$ taking step size $h = 0.1$.
- Write formula for Simpsons 3/8 rule.
- Write Linear Property of Fourier transform.
- Write Dirichlet conditions for Fourier Expansion.
- Solve $u_{xx} - u_y = 0$ by separation of variable.
- Form the partial Differential Equation by eliminating arbitrary constants a and b from:

$$z = ax + by + a^2 + b^2$$

PART – B

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

UNIT – I

2 Test for consistency and solve the following system of equations:

$$x + 2y + z = 3$$

$$2x + 3y + 2z = 5$$

$$3x - 5y + 5z = 2$$

$$3x + 9y - z = 4$$

OR3 Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to canonical form by orthogonal reduction.**UNIT – II**

- Find the root of the equation $xe^x = 2$ using Newton Raphson method correct to three decimal places.
- By the method of least squares, find the straight line that best fits the following data:

x	1	3	5	7	9
y	1.5	2.8	4.0	4.7	6.0

OR

- Find the cubic polynomial which takes the following values

X	0	1	2	3
f(x)	1	0	1	10

Hence calculate $f(4)$.

- Using Lagrange Interpolation formula find the value of y corresponding to $x = 10$ from the following table.

X	5	6	9	11
Y	12	13	14	16

Contd. in page 2

UNIT – III

- 6 (a) Given that

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$

- (b) A rocket is launched from the ground. Its acceleration is measured every 5 seconds and is tabulated below. Find the velocity and the position of the rocket at $t = 40$ seconds. Use Trapezoidal rule.

t(sec)	0	5	10	15	20	25	30	35	40
a(t)(cm/sec ²)	40.0	45.25	48.50	51.25	54.35	59.48	61.5	64.3	68.7

OR

- 7 (a) Solve $y' = x - y^2$, $y(0) = 1$ using Taylor's series method and compute $y(0.1)$ & $y(0.2)$.
 (b) Apply the fourth order Runge-Kutta method, to find an approximate value of y when $x = 1.2$ in steps of 0.1, given that $y' = x^2 + y^2$, $y(1) = 1.5$

UNIT – IV

- 8 Obtain the Fourier series in $(-\pi, \pi)$ for the function $f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \sin x, & 0 < x < \pi \end{cases}$

OR

- 9 Find the Fourier Cosine Transform of $f(x)$ defined by $f(x) = \frac{1}{1+x^2}$ and hence find Fourier sine Transform of $f(x) = \frac{x}{1+x^2}$.

UNIT – V

- 10 A tightly stretched string of length l with fixed end points is initially in an equilibrium position. It is set vibrating by giving each point a velocity $v_0 \sin^3\left(\frac{\pi x}{l}\right)$. Find the displacement $y(x, t)$.

OR

- 11 An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is π ; this end is maintained at a temperature u_0 at all points and the other edges are at zero temperature. Determine the temperature at any point of the plate in the steady state.
