



# MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : OEC-IT601A Numerical Methods

UPID : 006587

Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

## Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (I) How many predictor and corrector steps does the fourth-order Runge-Kutta method use ?
- (II) Distinguish between Round off error and Truncation error.
- (III) If  $y = f(x)$  are known only at  $(n+1)$  distinct interpolating points, then what is the LaGrange polynomial degree.
- (IV) The degree of precision of Trapezoidal rule is.
- (V) When do you call a System of Linear Equation  $AX = B$  to be Consistent?
- (VI) Find a root of the equation  $x^2 - 2x - 5 = 0$  by Newton – Raphson method.
- (VII) If  $5/3$  is approximated to 1.6667, then absolute error is
- (VIII) Find Newton's backward difference interpolation polynomial against the tabulated values:

Find a root of the equation  $x^2 - 2x - 5 = 0$  by Newton – Raphson method.

(VII) If  $5/3$  is approximated to 1.6667, then absolute error is

(VIII) Find Newton's backward difference interpolation polynomial against the tabulated values:

<b>x:</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>f(x):</b>	<b>6</b>	<b>24</b>	<b>60</b>	<b>120</b>

- (IX) The degree of precision of Weddle's rule is
- (X) What is the principle of LU factorization method ?
- (XI) Find the forward interpolation polynomial for the function  $f(x)$  where  $f(0) = -1, f(1) = 1, f(2) = 1$  and  $f(3) = -2$ .
- (XII) Simpson's one third rule is applicable only if the number of sub-interval is

## Group-B (Short Answer Type Question)

Answer any three of the following :

[ 5 x 3 = 15 ]

2. Find the missing term from the following Interpolation table.

[5]

<b>x</b>	<b>F(x)</b>
2	45
3	49.2
4	54.1
5	?
6	67.4

3. Evaluate  $\int_{0.1}^{0.8} (e^x + 2x) dx$  by Trapezoidal Rule taking  $h=0.1$ , correct up to 5-decimal places.

[5]

4. Using following data, find the value of y at x = 5 by the Newton's forward interpolation polynomial. [5]

X	0	10	20	30	40
Y	7	18	32	48	85

5. Solve the following equation by LU Decomposition methods: [5]

$$\begin{aligned}x + y + z &= 1, \\ 4x + 3y - z &= 6, \\ 3x + 5y + 3z &= 4.\end{aligned}$$

6. Using Newton's backward interpolation formula, find the annual premium at the age of 33 from the following data [5]

Age in years (x):	24	28	32	36	40
Annual premium(y):	28.06	30.19	32.75	34.94	40

#### Group-C (Long Answer Type Question)

Answer any three of the following :

[ 15 x 3 = 45 ]

7. (a) Evaluate  $\int_0^1 x^3 dx$ , by Trapezoidal Rule, with n = 5. [ 7 ]

- (b) Evaluate  $\int_0^{\pi/2} \sqrt{1 - 0.162 \sin^2 \phi} d\phi$ , by Simpson's One Third Rule, correct up to two decimal places. [ 8 ]

8. (a) Find y(0.10) and y(0.15), by Euler's Method, from the differential equation,  $\frac{dy}{dx} = x^2 + y^2$ , y(0) = 0, correct upto four decimal places, taking step length h = 0.05. [ 7 ]

- (b) Solve by Euler's modified method the following differential equation for x = 0.02, by taking step length h = 0.01, [ 8 ]

$$\frac{dy}{dx} = x^2 + y, y = 1 \text{ when } x = 0.$$

9. (a) Using Lagrange Interpolation find the value of y at x=8 Given y(0) = 18, y(1) = 42, y(7) = 57 and y(9) = 90 ? [ 8 ]

- (b) Compute the value of f(7.5) from the following table [ 7 ]

x:	3	4	5	6	7	8
f(x):	27	64	125	216	343	512

10. (a) Find the value of the given variables by using Gauss elimination method: [ 7 ]

$$\begin{aligned}x + 3y + 6z &= 10 \\ x + 4y + 5z &= 14 \\ x + 6y + 7z &= 18\end{aligned}$$

(b) Solve the system of equations  $x_1 + x_2 + x_3 = 1$ ,  $3x_1 + x_2 - 3x_3 = 5$  and  $x_1 - 2x_2 - 5x_3 = 10$  by [ 8 ]

LU factorization method.

11. (a) [ 8 ]

Find the population of the city in 1925. The population of a city is given as:

Year(x)	Population(Thousand)
1891	46
1901	66
1911	81
1921	93
1931	101

(b) Find the missing value of the following table: [ 7 ]

x:	2	4	6	8	10
y:	5.6	8.6	13.9	-	35.6

\*\*\* END OF PAPER \*\*\*