



**MAULANA ABUL KALAM AZAD UNIVERSITY OF  
TECHNOLOGY, WEST BENGAL**

Paper Code : M(CS)-401

**NUMERICAL METHODS**

**Time Allotted : 3 Hours**

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

- iii) Error in 4<sup>th</sup> order Runge-Kutta method is of the order of  
a)  $h^2$       b)  $h^3$   
c)  $h^4$       d) none of these.
- iv) The degree of precision of Simpson's 1/3<sup>rd</sup> rule is  
a) 1      b) 2  
c) 3      d) none of these.
- v) In Trapezoidal rule, the portion of curve is replaced by  
a) straight line      b) parabolic path  
c) circular path      d) none of these.
- vi) One root of the equation  $x^2 + 2x - 2 = 0$  lies between  
a) 1 and 2      b) 0 and 0.5  
c) 0.5 and 1      d) none of these.
- vii) The accuracy attainable with Newton-Raphson method does not depend upon the value of the derivative  $f'(x)$ . The above statement is  
a) True      b) False



xii) To solve the ordinary differential equation

$$3 \frac{dy}{dx} + xy^2 = \sin x, y(0) = 5, \text{ by Runge-Kutta 2nd}$$

order method, you need to rewrite the equation as

a)  $\frac{dy}{dx} = \sin x - xy^2, y(0) = 5$

b)  $\frac{dy}{dx} = \frac{1}{3}(\sin x - xy^2), y(0) = 5$

c)  $\frac{dy}{dx} = \frac{1}{3}\left(-\cos x - \frac{xy^3}{3}\right), y(0) = 5$

d) None of these.

### GROUP - B

#### ( Short Answer Type Questions )

Answer any three of the following.  $3 \times 5 = 15$

2. From the following table, find the value of  $f(1.5)$  by Newton forward interpolation formula :

$x$	1	2	3	4	5	6
$f(x)$	10	15	20	25	30	35

3. Solve the following system by Matrix Inversion Method :  $n^5$

$$2x + y + z = 4$$

$$3x + 2y + 3z = 8$$

$$x + 4y + 9z = 14$$

4. Using Euler's method obtain the solution of  $\frac{dy}{dx} = x - y$ ,  $y(0) = 1$ , and  $h = 0.1$  at  $x = 0.5$
5. Find out the root of the following equation using Regula Falsi method :  
 $xe^x - \cos x = 0$ , that lies between 0 and 1 (correct to four decimal places). <http://www.makaut.com>
6. Evaluate the approximate value of  $\int_0^1 \frac{dx}{1+x^2}$  by Simpsons  $\frac{1}{3}$  rule for 4 sub-interval, correct up to 4 decimal places.

### GROUP - C

#### ( Long Answer Type Questions )

Answer any three of the following.  $3 \times 15 = 45$

7. a) Using appropriate formula find  $f(0.29)$  from the following table : 7



$x:$	0.20	0.22	0.24	0.26	0.28	0.30
$f(x):$	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

- b) Compute the value of  $\int_{1.2}^{1.6} (x + \frac{1}{x}) dx$ , taking  $h = 0.05$  correct up to five decimal places by using  
 (i) Trapezoidal rule, (ii) Simpson's  $\frac{1}{3}$ rd rule. 4 + 4

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8. a) Solve by Gauss-Seidel iterative method :

$$3x + 9y - 2z = 11$$

$$4x + 2y + 13z = 24$$

$$4x - 2y + z = -8$$

Correct up to four significant figure.

8

- b) Find a +ve root of  $x + \ln x - 2 = 0$  by Newton-Raphson method, correct up to six significant figure.

7

9. a) Compute  $y(0.8)$ , by Runge-Kutta method correct up to five decimal places from the equation  $\frac{dy}{dx} = xy, y(0) = 2$  taking  $h = 0.2$ .

7

- b) Solve by LU decomposition method :

$$2x - 6y + 8z = 24$$

3

$$5x + 4y - 3z = 2$$

$$3x + y + 2z = 16$$

8

10. a) Find  $f(8)$  using Newton's divided difference formula given that

$x:$	4	5	7	10	11	13
$f(x):$	48	100	294	900	1210	2028

7

- b) Derive the expression of Newton's forward interpolation formula where the function  $f(x)$  is known for  $n + 1$  distinct equispaced arguments.

8

11. a) Solve by matrix inversion method :

$$2x - 3y + 10z = 3$$

$$-x + 4y + 2z = 20$$

$$5x + 2y + z = -12$$

8

b) Use modified Euler method to find the value of  
 $y(0.02)$  by taking  $h = 0.01$  of the differential  
equation  $\frac{dy}{dx} = x^2 + y$ , given that  $y(0) = 1$ . 7

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