

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Derive the final expression of Gregory-Newton interpolation formula.
- (10 1/3)

- (b) Fit a cubic through the first four points of the following table and use it to find the interpolated value for
- $x = 3.0$
- .
- (13)

x	3.2	2.7	1.0	4.8	5.6
f(x)	22.0	17.8	14.2	38.3	51.7

2. (a) Write short notes on:
- (12)

(i) Cramer's rule, (ii) Gauss Elimination method, (iii) Modified Euler's method

- (b) Invert the following matrix using Gauss-Jordan method:
- (11 1/3)

$$\begin{bmatrix} 7 & -3 & 4 \\ -3 & 2 & 6 \\ 2 & 5 & 3 \end{bmatrix}$$

3. (a) Explain Runge-Kutta method.
- (8 1/3)

- (b) The results of an experiment is as follows:
- (15)

x	0.73	0.78	0.81	0.86	0.875	0.89
y	0.0788	0.0788	0.064	0.0788	0.0681	0.0703

x	0.95	1.02	1.03	1.055	1.135	1.14
y	0.0703	0.0681	0.0681	0.079	0.0575	0.0681

Fit the above data with the following curve:

$$y(x) = \frac{A}{x} \left(1 - e^{-\lambda x^2} \right)$$

4. (a) Explain Milne's Predictor-Corrector method.
- (4 1/3)

- (b) Solve the following problem by using Runge-Kutta second order formula:
- (9)

$$\frac{dy}{dx} + (\sin x) y^2 = \cos x$$

$$y(0) = 0$$

Find solution for $x = \frac{\pi}{5}$ and $\frac{2\pi}{5}$.

Contd P/2

(c) Solve the following system using Crout's method:

(10)

$$x_1 + x_2 - 2x_3 = 3$$

$$4x_1 - 2x_2 + x_3 = 5$$

$$3x_1 - x_2 - 3x_3 = 8$$

SECTION - B

There are **FOUR** questions in this section. Answer **Q. No. 5** and any **TWO** from the rest.

Question No. 5 is COMPULSORY.

5. (COMPULSORY) Answer any 8 of the following 10 short questions:

(8×3=24)

- (i) What is transcendental equation? What are its characteristics?
- (ii) Describe the concept applied in the bracketing methods used for solving non-linear equations.
- (iii) How do you decide initial guess values for solving a polynomial equation using bracketing method?
- (iv) Discuss the situations where the fixed point iteration process may not converge to a solution.
- (v) What is divided difference table? Construct a divided difference table for four data points.
- (vi) Prove that in calculus of finite difference $E \equiv 1 + \Delta$.
- (vii) What is numerical differentiation? Where is numerical differentiation required?
- (viii) State the conditions of using trapezoidal and Simpson's rules in numerical integration.
- (ix) Obtain an iterative formula to determine the reciprocal of a number using Newton-Raphson method.
- (x) What is meant by stopping criteria? State some of the tests that can be used for terminating an iterative process.

6. (a) Derive the general Quadrature formula and hence deduce Simpson's $\frac{1}{3}$ rule.

(12)

(b) Use Secant method to find a real solution of the equation, $e^{-x} - x = 0$ lying between 0 and 1.0. Use $\epsilon = 0.001$.

(11)

Contd P/3

এ্যালগরিদম তৈরী করার পদ্ধতি আবিষ্কার করেন আবু জাফর মুহম্মদ মূসা ইবনে আল খারিজমী। এই এ্যালগরিদমের ফর্মুলাটা প্রয়োগ করেই কম্পিউটারের ক্যালকুলেশনের লজিকটা তৈরী করা হয়।

7. (a) A curve is given by the points of the Table given below: (12)

x	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	23	19	14	11	12.5	16	19	20	20

Calculate the area bounded by the curve, the x-axis and the extreme ordinates using Romberg's method. Use $h (= 2.0)$, $h/2$ and $h/4$.

(b) In the following Table, the values of y are consecutive terms of a series of which the number 31 is the 5th terms. Find the first term of the series using calculus of finite difference and Newton interpolation formula. (11)

x	3	4	5	6	7	8
y	13	21	31	43	57	73

8. (a) The following Table gives the co-ordinates (x, y) of points on a certain polynomial curve. (12)

x	0	0.2	0.4	0.6	0.8	1.0	1.2
y	0.710	1.175	1.811	2.666	3.810	5.292	7.232

Calculate the radius of curvature at the point $x = 0.6$. The radius of curvature is given by

$$\rho = \frac{\left[1 + \left(\frac{dy}{dx} \right)^2 \right]^{3/2}}{\frac{d^2y}{dx^2}}$$

(b) Use Muller's method to find a root of the equation $x^3 - x - 2 = 0$ with $x_1 = 1$, $x_2 = 1.2$ and $x_3 = 1.4$. Use 3 iterations. (11)

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কোরআনের ছায়াতলে জীবন অতিবাহিত করতে পারাটা এক বিশাল অনুগ্রহ। এ ব্যাপারটি কেবল তাদের দ্বারাই উপলব্ধি করা সম্ভব যারা এর অভিজ্ঞতা লাভ করতে পেরেছে। এ এক এমন সমৃদ্ধ অভিজ্ঞতা যা জীবনকে উদ্দেশ্যমন্ডিত করে এবং তাকে বাঁচার উপযোগী করে তোলে।
 – উস্তায় সাইয়িদ কুতুব