Code : 121202

2 0 1 2 (A)

COMPUTATIONAL TECHNIQUES

Time : 3 hours   Full Marks : 70

Instructions :

(i) All questions carry equal marks.

(ii) There are **TEN** questions in this paper.

(iii) Attempt any **FIVE** questions.

1. (a) Write a program to find root of $f(x) = 0$ by Newton-Raphson method.

   (b) Compute the approximate value of the real root of equation $2x - \log_{10} x - 7 = 0$ by using Newton-Raphson method.

2. (a) Write a program and define the parameter value N and number of points suitable for Lagrange interpolation.

   (b) Evaluate, using Lagrangian interpolation formula, the value of $f(2)$ from the following table :

x	:	0	1·2	2·5	4	5·1	6	6·5	7
$f(x)$	:	3	6·84	14·25	27	39·21	51	58·25	66

3. (a) Write a program to solve an ordinary differential equation $\frac{dy}{dx} = f(x, y)$, $y(x,0) = y_0$ using Euler's method.

   (b) Discuss, in detail, fourth order Runge-Kutta method for solving the initial value problem

   $$\frac{dy}{dx} = f(x, y); \ y(x_0) = y_0$$

4. (a) Write a program to solve

   $$\frac{dy}{dx} = f(x, y); \ y(x_0) = y_0$$

   using Runge-Kutta method.

   (b) For different values of x the values of $\sin x$ are presented in a tabular form. From the difference table and using this find $\sin 32°$.

x	30°	35°	40°	45°	50°	55°
sin x	0·5000	0·5736	0·6428	0·7071	0·7660	0·8192

5. Using method of second order convergence find a real root of equation $x^3 + x^2 + 3x + 4 = 0$, correct to four decimal places. Also discuss Newton-Raphson method for finding approximate solution of algebraic and transcendental equation. Show that the method has a second order convergence.

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6. *(a)* Find a real root of the equation $x \log_{10} x = 1 \cdot 2$ by regula falsi method, correct to four decimal places.

(b) Determine the constants a and b by the method of least squares such that $y = ae^{bx}$ fits the following data :

x :	2	4	6	8	10
y :	4·077	11·084	30·128	81·897	222·62

7. Assuming that the following values of y belong to a polynomial of degree 4 compute the next three values :

x :	0	1	2	3	4	5	6	7
y :	1	−1	1	−1	1	—	—	—

8. *(a)* Write a flow chart to solve a problem using regula falsi method.

(b) Predict the mean radiation dose at an altitude of 3000 feet by fitting an exponential curve to the given data :

Altitude (x) :	50	450	780	1200	4400	4800	5300
Dose of radiation (y) :	28	30	32	36	51	58	69

9. *(a)* What is the difference between FORTAN and C++ programming?

(b) Given the system of equations

$$Ax = b, \text{ where } A = \begin{bmatrix} \frac{1}{2} & \frac{1}{3} & \frac{1}{4} \\ \frac{1}{3} & \frac{1}{4} & \frac{1}{5} \\ \frac{1}{4} & \frac{1}{5} & \frac{1}{6} \end{bmatrix}$$

the vector b consists of three quantities measured with an error bounded by c. Derive error bounds for—

(i) the components of x;

(ii) the sum of components $y = x_1 + x_2 + x_3$.

10. Write short notes on :

(a) High-level programming

(b) Simpson's one third rule

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