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(2125)

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B. Tech 6th Semester Examination

Numerical and Statistical Methods and Scientific Computing (IT) (OS)

AS-6001

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the sub parts of the question in section E. Use of non programmable calculators is allowed.

SECTION - A

1. (a) Derive Newton-Raphson's formula to solve algebraic equations. Also discuss convergence of this method. (10)

   (b) Find a real root of $x^4 - 12x^2 - 3 = 0$ (correct to two decimal places) by bisection method. (10)

2. (a) What will be percentage error in the time period T of a pendulum, where $T = 2\pi\sqrt{\frac{l}{g}}$, if there is an error of 1% in l and 2% in g. (10)

[P.T.O.]

   (b) Using Newton-Raphson's method find the solution of the following system of non-linear equations near x = 2 and y = 1

   $x^2 + y^2 - y = 5$

   $y - e^{-x} = 1$ (10)

SECTION - B

3. (a) Use the Newton interpolation formula to find y when x = 1.55 from the table:

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

(10)

   (b) Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ using Simpson's 1/3rd rule by taking $h = \frac{1}{4}$. (10)

4. (a) Evaluate f(5) using Lagrange's interpolation formula from the data

x	–1	0	3	6	7
f(x)	3	–6	39	822	1611

(10)

   (b) Given that

x	1.7	1.8	1.9	2.0	2.1	2.2	2.3
y	5.474	6.050	6.686	7.389	8.166	9.025	9.974

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.7 (10)

SECTION - C

5. (a) Using modified Euler's method, find y when x = 0.2 in steps of h = 0.1, given that

$$\frac{dy}{dx} = \frac{x^2 + y^2}{10} \text{ and } y(0) = 1. \quad (10)$$

(b) Using the Gauss-Seidal method solve the system of equations correct to three decimal places;

$5x_1 - x_2 + x_3 = 14$, $2x_1 + 8x_2 - x_3 = -7$, $-4x_1 + x_2 + 10x_3 = 21$. (10)

6. (a) Apply Gaussian elimination method to solve the equations $5x_1 + 2x_2 + 4x_3 = 24$, $3x_1 + x_2 + 7x_3 = 18$, $8x_1 + 4x_2 + 5x_3 = 41$ (10)

(b) Use 2nd order Runge-Kutta method to solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ for the interval $0 \leq x \leq 0.2$ with $h = 0.1$. (10)

SECTION - D

7. Discuss the parabolic curve fitting method by method of least square and hence fit the parabolic curve to the following data:

Year (x)	1951	1961	1971	1981	1991
Production (y): in thousand tons	80	100	120	100	160

(20)

8. (a) Use Jacobi's method to find eigen values and corresponding eigen vectors of the matrix

$$A = \begin{bmatrix} 0 & 1 & 4 \\ 1 & 3 & 1 \\ 4 & 1 & 0 \end{bmatrix}. \quad (10)$$

(b) Discuss the procedure in steps to perform χ^2 test for determining the goodness of fit. (10)

[P.T.O.]

SECTION - E

9. (i) Define rate of convergence and radius of convergence.

(ii) Explain briefly the representation of integers and real numbers in computers.

(iii) What is the error in 2nd order Runge-Kutta formula?

(iv) Write Euler's formula to solve a differential equation

(v) State the order of convergence and convergence condition of Newton-Raphson method

(vi) State Miline's predictor and corrector formulae,

(vii) Write the Gregory Newton Backward difference interpolation formula.

(viii) Define unitary transformations,

(ix) When we should use Chi-square test?

(x) Why crossover probability is more than mutation probability? (2×10=20)