Roll No. | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 07

B.Sc. (IT) (Sem.–4th)

# COMPUTER ORIENTED NUMERICAL METHODS

Subject Code : BS-208

Paper ID : [B0416]

Time : 3 Hrs. Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SIX questions carrying TEN marks each and students has to attempt any FOUR questions.**

## SECTION-A

**1. Write briefly :**



(i) Find the solution of $x^2 - 1000x + 25 = 0$ using floating point arithmetic with 4 digit mantissa. Give comments on the result so obtained.

(ii) Show that $x_{n+1} = \frac{1}{2} x_n \left( 3 - \frac{x_n^2}{\alpha} \right)$ has second order convergence near $\sqrt{\alpha}$.

(iii) Show that the **order of convergence** of Newton-Raphson method is quadratic.

(iv) What do you understand by ill-conditioned system of equations? Illustrate your answer with the help of suitable example.

(v) Prove that $(1 + \Delta)(1 - \nabla) = 1$.

(vi) Construct divided difference table for the data

| | | | | | |
|---|---|---|---|---|---|
| **X :** | 1 | 2 | 4 | 8 | 10 |
| **Y :** | 0 | 1 | 5 | 21 | 27 |

(vii) Derive dy/dx and $d^2y/dx^2$ from Stirling formula

(viii) Evaluate $\frac{dy}{dx}$ at $x = 2$ when

| **X:** | 0 | 1 | 3 | 6 |
|---|---|---|---|---|
| **Y:** | 18 | 10 | -18 | 40 |

(ix) Find λ such that the quadrature formula

$$\int_0^1 \frac{f(x)}{\sqrt{x}}\,dx = A\,f(0) + B\,f(\lambda) + C\,f(1)$$

may be exact for polynomial of degree 3.

(x) Write the expression of improved Euler's method.

## SECTION-B



2. (i) Discuss Newton-Raphson method for the system of non-linear equations and solve $x^2 + y = 11$, $y^2 + x = 7$ starting with x = 3.5 and y = - 1.8.

(ii) Discuss the comparison of Newton Raphson with Regula Falsi method. (7+3)

3. (i) Solve the system of equations x + y + z = 6, 3x + (3 + $\in$)y + 4z=20, 2x + y + 3z = 13 using Gauss Elimination method where $\in$ is small such that $1 \pm \in^2 = 1$. What happens if we do not use partial pivoting at second step?

(ii) Write algorithm of Gauss-Seidel Method. (6+4)

4. (i) Using Lagranges interpolation formula express $\frac{x^2 + 6x - 1}{(x-1)(x-4)(x-6)}$

as a sum of partial fractions.

(ii) Obtain the cubic spline for the data

| **X :** | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| **Y :** | 2 | - 6 | - 8 | 2 |

(3+7)

5. (i) Obtain a relation of the form $y = ab^x$ for the data

| | | | | | |
|---|---|---|---|---|---|
| **X :** | 2 | 3 | 4 | 5 | 6 |
| **Y :** | 8.3 | 15.4 | 33.1 | 65.2 | 126.4 |

By method of least squares.

(ii) Find the error in Simpson's 1/3 rd rule. (5+5)

6. From the following table of values of x and y, obtain dy/dx and $d^2y/dx^2$ for x = 1.2, 2.2 and 1.6

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **X :** | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 |
| **Y :** | 2.7183 | 3.3201 | 4.0552 | 4.9530 | 6.0496 | 7.3891 | 9.0250 |

(10)

7. (i) Using Milne's method, solve $y' = 1 + y^2$ with y(0) = 0, y(0.2) = 0.2027, y(0.4) = 0.4228, y(0.6) = 0.6841, obtain y(0.8).

(ii) Given the initial value problem $y' = 1 + y^2$, y(0) = 0. Find y(0.4) by Runge-Kutta fourth order method by taking h = 0.2. (5+5)