Tribhuvan University
Institute of Science and Technology
2079

Bachelor Level / Second Year/ Third Semester/ Science
Computer Science and Information Technology (CSc. 207)
(Numerical Method)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Section A

Attempt any TWO questions: (2×10=20)

1. How secant method can approximate the root of a non-linear equation? Explain with necessary derivation. Estimate a real root of following equation using secant method. Assume error precision of 0.01.
   $x^3 + 2x - \cos(x) = 4$
2. How spline interpolation differs with the Lagrange's interpolation? Estimate the value of $f(0)$ and $f(4)$ using cubic spline interpolation from the following data.

x	-1	1	3	5
$f(x)$	-10	-2	14	86

3. What is pivoting? Why is it necessary? Write an algorithm and program to solve the set of n linear equations using Gaussian elimination method.

Section B

Attempt any EIGHT questions: (8×5=40)

4. Calculate a real root of the following function using bisection method corrrect up to 3 significant figures.
   $x^2 - e^{-x} = 3$
5. What is fixed point iteration method? How can it converge to the root of a non-linear equation? Also explain the diverging cases with suitable examples.
6. Write down program for solving ordinary differential equation using Heun's method.
7. Fit the quadratic function for the data given below using least square method.

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	2.7	4	5.8	8.3	11.2	15	19

8. Estimate the integral value of following function from $x = 1.2$ to $x = 2.4$ using Simpson's 1/3 rule.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6
$f(x)$	1.53	2.25	3.18	4.32	5.67	7.23	8.98	10.94	13.08

9. What is Gaussian integration formula? Evaluate the following integration using Gaussian integration three ordinate formula.

$$\int_0^1 \frac{\sin x}{x} dx$$

10. Solve the following set of equations using Gauss Seidel method.

$$x + 2y + 3z = 4$$
$$6x + 4y + 5z = 16$$
$$5x + 2y + 3z = 12$$

11. Solve the following differential equation for $0 \le x \le 1$, taking $h = 0.5$ using Runge Kutta 4th order method.

$$y'(x) + y = 3x, \text{ with } y(0) = 2$$

12. Solve the Poisson's equation $\nabla^2 f = 3x^2 y$ over the square domain $0 \le x \le 3, 0 \le y \le 3$ with $f = 0$ on the boundary and $h = 1$.

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