Tribhuvan University
Institute of Science and Technology
2075

Bachelor Level / Second Year/ Third Semester/ Science — Full Marks: 60
Computer Science and Information Technology (CSc. 207) — Pass Marks: 24
(Numerical Method) — Time: 3 Hours
(NEW COURSE)

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Group A

Attempt any Two questions: (10x2=20)

1. What is non-linear equation? Derive the required expression to calculate the root of non-linear equation using secant method. Using this expression find a root of following equation.

$$x^2 + \cos(x) - e^{-x} - 2 = 0$$

2. What is matrix factorization? Factorize the given matrix A into LU using Dolittle algorithm and also solve $Ax = b$ for given b using L and U matrices.

$$A=\begin{bmatrix} 2 & 4 & -4 & 0 \\ 1 & 5 & -5 & -3 \\ 2 & 3 & 1 & 3 \\ 1 & 4 & -2 & 2 \end{bmatrix} \text{ and } b=\begin{bmatrix} 12 \\ 18 \\ 8 \\ 8 \end{bmatrix}$$

3. What is initial value problem and boundary value problem? Write an algorithm and program to solve the boundary value problem using shooting method.

Group B

Attempt any Eight questions: (5x8=40)

4. Calculate a real negative root of following equation using Newton's method for polynomial.

$$x^4 + 2x^3 + 3x^2 + 4x = 5$$

5. What is least squares approximation of fitting a function? How does it differ with polynomial interpolation? Explain with suitable example.

6. Find the lowest degree polynomial, which passes through the following points:

X	-2	-1	1	2	3	4
F(x)	-19	0	2	-3	-4	5

Using this polynomial estimate f(x) at x = 0.

7. Fit function of type $y=a + bx$ for the following points using least square method.

X	-1	1.2	2	2.7	3.6	4
F(x)	*1*	20	27	33	41	45

8. Calculate the integral value of the function given below from x = 1.8 to x = 3.4 using Simpson's 1/3 rule.

X	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.42
F(x)	0.003	0.778	1.632	2.566	3.579	4.672	5.845	8.429

9. Evaluate the following integration using Romberg integration.

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

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

x + 2y + 3z = 4
6x — 4y + 5z — 10
5x + 2y + 2z = 25

11. From the following differential equation estimate y(1) using RK 4`[11] order method.

$\frac{dy}{dx} + 2x^2 y = 4$ with y(0) = 1, [Take h = 0.5].

12. Solve the Poison's equation $\nabla^2 f = 2xy$ over the square domain $0 \leq x$ 1.5, $0 \leq y$1.5 with f = 0 on the boundary and h = 0.5.