

Tribhuvan University
Institute of Science and Technology
2075



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 far as practicable.
The figures in the margin indicate full marks.

Group A

Attempt any Two questions:

(10×2=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.

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

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

Group B

Attempt any Eight questions:

(5×8=40)

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

$$x^4 + 2x^3 + 3x^2 + 4x = 5 \quad (3)$$

5. What is least squares approximation of fitting a function? How does it differ with polynomial interpolation? Explain with suitable example. (3)

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. $f(x) = \frac{f(x+h) - f(x-h)}{2h}$ (3)

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

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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	3.2	3.4
$F(x)$	0.003	0.778	1.632	2.566	3.579	4.672	7.097	8.429	8.429

5.845

9. Evaluate the following integration using Romberg integration.

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

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

$$x + 2y + 3z = 4$$

$$6x - 4y + 5z = 10$$

$$5x + 2y + 2z = 25$$

11. From the following differential equation estimate $y(1)$ using RK 4th order method.

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

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