

**Tribhuvan University**  
**Institute of Science and Technology**  
 2071

Bachelor Level/ Second Year/ Third Semester/ Science  
**Computer Science and Information Technology (CSc.204)**  
 (Numerical Method)

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.*

**Attempt all questions:**

1. How is the bisection method convergent to a root of an equation? Apply the bisection method to find a root of the equation

$$x \tan x - 1 = 0 \quad (3+5)$$

2. Define interpolation. Find the Lagrange interpolation polynomial to fit the following data. Estimate the value

|                |   |        |       |        |
|----------------|---|--------|-------|--------|
| i              | 0 | 1      | 2     | 3      |
| x,             | 0 | 1      | 2     | 3      |
| y <sub>i</sub> | 0 | 1.7183 | 6.389 | 19.085 |
|                |   |        | 1     | 5      |

of e" (1+6+1)

3. Derive Simpson's 1/3 rule to evaluate numerical integration. Using this formula evaluate

$$\int_0^2 (e^{x^2} - 1) dx \text{ with } n = 8. \quad (4+4)$$

4. What do you mean by ill-conditioned systems? Solve the following system using Dolittle LU decomposition method.  $3x_1 + 2x_2 + x_3 = 24$

$$\begin{aligned} 2x_1 + 3x_2 + 2x_3 &= 14 \\ x_1 + 2x_2 + 3x_3 &= 14 \end{aligned}$$

(2+6)

5. Solve the following boundary value problem using shooting method.

$\frac{d^2y}{dx^2}$

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$$2x^2y = 1, \text{ with } y(0) = 1 \text{ and } y(1) = 1 \text{ [Take } h = 0.5].$$

6. Write the finite difference formula for solving Poisson's equation. Hence solve the Poisson's equation  $\nabla^2 f = 2x^2y^2$  over the domain  $0 < x < 3$  and  $0 < y < 3$  with  $f = 0$  on the boundary and  $h = 1$ .
7. Write an algorithm and a C-program for the fixed point iteration method to find the roots of non-linear equation. **(4+8)**

**OR**

Write an algorithm and a C-program for the Lagrange's interpolation to approximate the functional value at any given x from given n data.