**Tribhuvan University**
**Institute of Science and Technology**
**2069**
✡

Bachelor Level/ Second Year/ Third Semester/Science — Full Marks: 60
**Computer Science and Information Technology (CSc 204)** — Pass Marks: 24
(Numerical Method) — 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. Derive a formula to solve nonlinear equation using secant method. Using your formula estimate a real root of following nonlinear equation using secant method correct up to decimal places $x^2 + \ln x = 3$. **(3+5)**

2. Estimate f(3) from the following data using Cubic Spline Interpolation.

| x | 1 | 2.5 | 4 | 5.7 |
|---|---|---|---|---|
| f(x) | -2.0 | 4.2 | 14.4 | 31.2 |

**(8)**

**OR**

Find the best fitting quadratic polynomial from following data using least square approximation.

| x | -2 | -1.2 | 0 | 1 | 1.2 | 2.5 | 3 | 4.5 | 6.3 |
|---|---|---|---|---|---|---|---|---|---|
| f(x) | 10.39 | 2.96 | -2.0 | -2.63 | -2.46 | 0.83 | 3.1 | 12.8 | 30.4 |

3. (a) For the function $f(x) = e^x\sqrt{\sin x + lnx}$ estimate $f'(6.3)$ and $f"(6.3)$ $[take\ h = 0.01]$ **(4)**

   (b) Evaluate $\int_1^2 (\ln x + x^2 \sin x)dx$ using Gauss integration 3 point formula. **(4)**

4. Solve the following system of linear equations using Gauss-elimination or Gauss Jordan method.

$$3x_1 + 5x_2 - 3x_3 + x_4 = 16$$
$$2x_1 + x_2 + x_3 + 4x_4 = 9$$
$$43 - 4x_2 - x_4 = 1$$
$$2x_1 + x_2 - 3x_3 + 9x_4 = 5$$

**(8)**

5. How can you solve higher order differential equation? Explain. Solve the following differential within $0 \leq x \leq 1$ using Heun's method. **(3+5)**

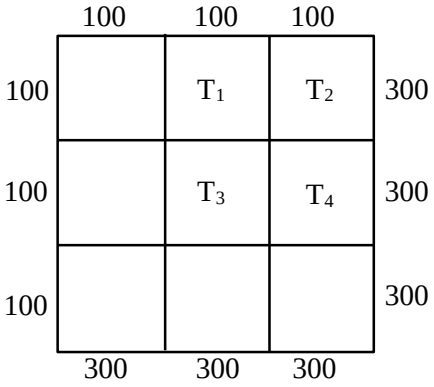
 

$$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2xy = 1 \text{ with } y(0) = 1 \text{ and } y'(0) = 1 \; [take\ h = 0.5]$$

6. (a) How can you obtain numerical solution of a partial differential equation? Explain. **(3)**

   (b) The steady state two dimensional heat-flow in a metal plate is defined by $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$. Given the boundary conditions as sown in figure below, find the temperatures at interior points $T_1$, $T_2$, $T_3$ and $T_4$. **(5)**




7. Write an algorithm and C-program code to solve non-linear equation using Newton's method. Your program should read an initial guess from keyboard and display the following if the solution is obtained. **(5+7)**
   - Estimated root of the equation
   - Functional value at calculated root
   - Required number of iterations