

**Tribhuvan University**  
**Institute of Science and Technology**  
**2066**  
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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. Define the fixed-point iteration method. Given the function  $f(x) = x^2 - 2x - 3 = 0$ , rearrange the function in such a way that the iteration method converges to its roots. (2+3+3)
2. What do you mean by interpolation problem? Define divided difference table and construct the table from the following data set. (2+2+4)

$X_i$	3.2	2.7	1.0	4.8	5.6
$F_i$	22.0	17.8	14.2	38.3	51.7

**OR**

Find the least squares line that fits the following data.

x	1	2	3	4	5	6
y	5.04	8.12	10.64	13.18	16.20	20.04

What do mean by linear least squares approximation?

3. Derive the composite formula for the trapezoidal rule with its geometrical figure. Evaluate  $\int_0^1 e^{-x^2} dx$  using this rule with  $n = 5$ , upto 6 decimal places. (4+4)
4. Solve the following system of algebraic linear equations using Jacobi or Gauss-Seidel iterative method. (8)

$$\begin{aligned} 6x_1 - 2x_2 + x_3 &= 11 \\ -2x_1 + 7x_2 + 2x_3 &= 5 \\ x_1 + 2x_2 - 5x_3 &= -1 \end{aligned}$$

5. Write an algorithm and computer program to fit a curve  $y = ax^2 + bx + c$  for given sets of  $(x_i, y_i, g. o = 1, \dots, x)$  values by least square method. (4+8)

6. Derive a difference equation to represent an Poisson's equation. Solve the Poisson's equation  $\nabla^2 f = 2x^2y^2$  over the square to main  $0 \leq x \leq 3, 0 \leq y \leq 3$  with  $f = 0$  on the boundary and  $h = 1$ . (3+5)

7. Define ordinary differential equation of the first order. What do you mean by initial value problem? Find by Taylor's series method, the values of  $y$  at  $x = 0.1$  and  $x = 0.2$  to fine places of decimal form

$$\frac{dy}{dx} = x^2y - 1,$$

$$y(0) = 1$$

(2+6)