

Bismillahir Rahmanir Rahim
International Islamic University Chittagong
 Department of Computer Science & Engineering
B. Sc. In CSE Semester Final Examination, Spring 2023
 Course Code: CSE-4745 Course Title: Numerical Methods
 Total Marks: 50 Time: 2 Hours 30 Minutes

[Answer *all* the questions. Figures in the right hand margin indicate full marks.
 Separate answer script must be used for Group A and Group B]

Group A

- 1.a) Describe the *Gaussian Elimination method* to solve the system of linear equations. 5 CO1 U
OR
 Describe the *Gauss-Seidel method* to solve the system of linear equations.
- b) Solve the following system of equation by using Basic Gauss elimination with partial pivoting 4 CO2 A
 $2x_1 + 3x_2 + 4x_3 = 5$
 $3x_1 + 4x_2 + 5x_3 = 6$
 $4x_1 + 5x_2 + 6x_3 = 7$
- c) Write the *sufficient condition* for convergence of *Jacobi's Method* and *Gauss-Seidel method*. 1 CO1 U
2. What do you mean by **curve fitting**? Write the importance of curve fitting. 1 CO3 U
- a) Describe the *least square method* to fit a *straight line*. 5 CO3 U
- b) **OR**
 Describe the *least square method* to fit a *parabola*.
- c) The observations from an experiment are as given below 4 CO4 A

x	10	20	40	50
y	600	500	300	200

It is known that a relation of type $y = a + bx$ exists. Find the best possible values of **a** and **b**.

Group B

- 3.a) Determine the *first order* and *second order derivatives* using Newton's forward interpolation formula. 4 CO5 U

- b) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ and at $x = 0.6$ From the following table of values of x and y 4 CO6 A

x	0.4	0.5	0.6	0.7	0.8
y	1.5836494	1.7974426	2.0442376	2.3275054	2.6510818

- c) Explain how numerical differentiation can be used to find the *maximum* and *minimum* values of a tabulated function. 2 CO5 U

- 4.a) When do we need to use a numerical method instead of analytical method for *integration*? 1 CO5 U
Derive the general quadrature formula using Newton's forward difference formula 5 CO5 U

- b) **OR**
Derive the *Simpson's 1/3 rule* for integration using Newton's forward difference formula. A river is **80** unit wide. The depth d at a distance x unit from one bank is given by the following table 4 CO6 A

x	0	10	20	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

Find the area of cross-section of the river using i) *Trapezoidal rule* ii) *Simpson's 1/3 rule*.

- 5.a) Write the advantages of i) Taylor's series method ii) Euler's method 2 CO5 U
OR

Write down the major problem of Taylor series and Heun's method
Describe the *Euler's method* for the numerical solution of ordinary differential equation. 3 CO5 U

- b) **OR**
Describe the Heun's *method* for the numerical solution of ordinary differential equation.
Write the *classical fourth order Runge-Kutta method* formula. Using this formula solve 5 CO6 A

- c) $\frac{dy}{dx} = x + y^2$
 $y(0) = 1$
for the interval $0 < x \leq 0.2$, with $h = 0.1$.