1 A Use the Gauss-Jordan technique to solve the system. 7

$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$

$0.1x_1 + 7x_2 - 0.3x_3 = -19.3$

$0.3x_1 - 0.2x_2 + 10x_3 = 71.4$

B 8

i. Drive the formula of false position method with proper figure.

ii. Differentiate between Gauss-Jordan and Gauss elimination method.

$$x_2 = x_u + \frac{f(x_u)(x_l - x_u)}{f(x_l) - f(x_u)}$$

Dept. of Computer and Communication Engineering
Faculty of Computer Science and Engineering
Patuakhali Science and Technology University
Dumki, Patuakhali-8602, Bangladesh

Final Examination of B. Sc. Engineering in CSE Level: 3 Semester: I Session: 2019-2020

Course Code	Course Title	January-June-2022	Credit: 03
CCE-311	Numerical Methods		Time: 03 Hr
			Marks: 70

Answer any 05 out of 06 Questions (Split answers are highly discouraged)

1 A A total of 8,600 taka was invested in two accounts. One account earned 4 3/4 % annual interest and the other earned 6 1/2 % annual interest. If the total interest for one year was 431.25 taka, how much was invested in each account? Use Gauss-elimination Method to calculate the investment in each account. 7

1 B The cost of 4 kg onion, 3 kg wheat and 2 kg rice is 60 taka. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is 90 taka. The cost of 6 kg onion 2 kg wheat, and 3 kg rice is 70 taka. Find the cost of each item per kg by Cramer's rule. 7

2 A Apply Cholesky decomposition to the symmetric matrix. 7

$$[A] = \begin{bmatrix} 6 & 15 & 55 \\ 15 & 55 & 225 \\ 55 & 225 & 979 \end{bmatrix}$$

2 B Use the Newton-Raphson method to estimate the root of $f(x) = e^{-x} - x$, employing an initial guess of $x_0 = 0$. Iterate until ε_t less than 10^{-8} %. 7

3 A Implement the point-slope strategy to numerically integrate $dy/dx = -2X^3 + 12X^2 - 20X + 8.5$ from X=0 to X=3.0 with a step size 0.5. The initial condition at X=0 is Y=1. 7

3 B Use the secant method to estimate the root of $f(x) = e^{-x} - x$. Start with initial estimates of $X_{-1} = 0$ and $X_0 = 1.0$. The true root is 0.56714329. Iterate until $\varepsilon_t = 0.0048\%$. 7

4 A Use bisection method to solve the following problem up to approximate percent relative error $\varepsilon_a <= 0.422$. 7

$$f(c) = \frac{687.38}{c}(1 - e^{-0.146843c}) - 40$$

4 B Demonstrate the concepts of convergence and divergence through an appropriate example using the iteration method. 7

5 A 7

i. Derive the formula of false position method with proper figure.
ii. Differentiate between Gauss-Jordan and Gauss elimination method.

5 B Fit a second-order polynomial to the data of the following table. Also find out standard error $S_{y/x}$ 7

x_i	y_i
1	7.7
2	13.6
3	27.2

6 A Show a case where bisection is preferable to false position with a suitable example. 7

6 B Given dy/dx= ½ (x+y), y(0)=2, y(0.5)=2.636, y(1.0)=3.595, y(1.5)=4.968. Find y(2) by Milne's method. 7

Numerical

Answer any 02 out of 03 Questions

1 Resolve the following system using the Cramer's Rule. 7.5

$$0.14X_1-0.1X_2-0.2X_3= 7.85$$
$$0.10X_1+7X_2-0.3X_3= -19.3$$
$$0.30X_1-0.2X_2+10X_3= 71.4$$

2 Use the Gauss-Elimination technique to resolve the following system. 7.5

$$3X_1-0.1X_2-0.2X_3= 7.85$$
$$0.10X_1+7X_2-0.3X_3= -19.3$$
$$X_1-0.2X_2+10X_3= 71.4$$

3 Apply the Factorization process to locate the root of the following system 7.5

$$X_1+X_2-X_3= 2$$
$$2X_1+3X_2+5X_3= -3$$
$$3X_1+2X_2-3X_3= 6$$

• Wellds method (Just equat

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Final Examination of B. Sc. Engineering in CSE Level: 3 Semester: I Session: 2018-2019

Course Code	Course Title	January-June 2021	Credit: 03
CCE 311	Numerical Methods		Time: 03 Hr
			Marks: 70

Answer any 05 out of 06 Questions (Split answers are highly discouraged)

1 [A.] Resolve the following system using the Cramer Rule. 7

$$0.40X_1-0.1X_2-0.2X_3=7.85$$
$$0.10X_1+7X_2-0.3X_3=-19.3$$
$$0.30X_1-0.2X_2+10X_3=71.4$$

[B.] Use the Gauss-Elimination technique to resolve the following system. 7

$$0.3X_1-0.1X_2-0.2X_3=7.85$$
$$0.10X_1+7X_2-0.3X_3=-19.3$$
$$X_1-0.2X_2+10X_3=71.4$$

2 [A.] Apply the Choleski's process to locate the root of the following system 7

$$X_1+X_2-X_3=2$$
$$2X_1+3X_2+5X_3=-3$$
$$3X_1+2X_2-3X_3=6$$

[B.] 7

i. How can we eliminate the error in the Trapezoidal rule by applying the Simpson's rule?

ii. Integrate using Simpson's 3/8 rule.

$f(x)=0.2+25x-200x^2+675x^3-900x^4+400x^5$ from a=0 to b=0.8

3 [A.] Solve the following system using the Gauss-Jordan method. 7

$$0.7X_1-0.1X_2-0.2X_3=7.85$$
$$0.10X_1+7X_2-0.3X_3=-19.3$$
$$X_1-0.2X_2+10X_3=71.4$$

[B.] 7

i. Show two scenarios. In the case of an iteration process, there is convergence and divergence.

ii. Write down the algorithm of Bisection Method.

4 [A.] Fit a second-order polynomial to the data of the following table. Also find out standard error $S_{y/x}$ 7

x_i	y_i
0	2.1
1	7.7
2	13.6

[B.] Derive equation for linear regression and find out a_0 and a_1. 7

5 [A.] i. State Weddle's Rule. 7

ii. Show that $x_r=x_u-f(x_u)(x_l-x_u)/(f(x_l)-f(x_u))$ in case of false position method.

[B.] Given $dy/dx=\frac{1}{3}(x+y)$, $y(0)=2$, $y(0.5)=2.636$, $y(1.0)=3.595$, $y(1.5)=4.968$. Find y(2) by Milne's method. 7

6 [A.] Given $dy/dx=1+xy$ and $y(0)=1$. Calculate $y(0.1)$, $y(0.2)$ using Picard's method. 7

[B.] Use the Euler's method to numerically integrate $dy/dx=-2X^3+12X^2-20X+8.5$ from X=0 to X=4.0 with a step size 0.5. The initial condition at X=0 is Y=1. 7

Dept. of Computer and Communication Engineering
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Dumki, Patuakhali-8602, Bangladesh

Final Examination of B. Sc. Engineering in CSE Level: 3 Semester: I Session: 2017-2018

Course Code	Course Title	January-June 2020	Credit 03
CCE 311	Numerical Methods		Time: 03 Hr
			Marks: 70

Answer any 05 out of 06 Questions (Split answers are highly discouraged)

1 [A.] Resolve the following system using the Cramer Rule. 7

$$0.40X_1-0.1X_2-0.2X_3= 7.85$$
$$0.10X_1+7X_2-0.3X_3= -19.3$$
$$0.30X_1-0.2X_2+10X_3= 71.4$$

[B.] Use the Gauss-Elimination technique to resolve the following system. 7

$$0.3X_1-0.1X_2-0.2X_3= 7.85$$
$$0.10X_1+7X_2-0.3X_3= -19.3$$
$$X_1-0.2X_2+10X_3= 71.4$$

2 [A.] Apply the Choleski's process to locate the root of the following system 7

$$X_1+X_2-X_3= 2$$
$$2X_1+3X_2+5X_3= -3$$
$$3X_1+2X_2-3X_3= 6$$

[B.] 7

i. How can we eliminate the error in the Trapezoidal rule by applying the Simpson's rule?

ii. Integrate using Simpson's 3/8 rule.
$f(x)=0.2+25x-200x^2+675x^3-900x^4+400x^5$ from a=0 to b=0.8

3 [A.] Solve the following system using the Gauss-Jordan method. 7

$$0.7X_1-0.1X_2-0.2X_3= 7.85$$
$$0.10X_1+7X_2-0.3X_3= -19.3$$
$$X_1-0.2X_2+10X_3= 71.4$$

[B.] 7

i. Show two scenarios in the case of an iteration process, which are convergence and divergence.

ii. Write down the algorithm of Bisection Method.

4 [A.] How to fit a second-order polynomial on the data of the following table. Also find out standard error $S_{y/x}$ from this table data. 7

x_i	y_i
0	2.1
1	7.7
2	13.6

[B.] What is linear regression? Derive an equation for linear regression. How to estimate the parameter a_0 and a_1 through linear regression? 7

5 [A.] i. State Weddle's Rule. 7

ii. Show that $x_2=x_0-f(x_0)(x_0-x_1)/(f(x_0)-f(x_1))$ in case of false position method.

[B.] Given $dy/dx= \frac{1}{2}(x+y)$, $y(0)=2$, $y(0.5)=2.636$, $y(1.0)=3.595$, $y(1.5)=4.968$. Find $y(2)$ by Milne's method. 7

6 [A.] Given $dy/dx=1+xy$ and $y(0)=1$. Calculate $y(0.1)$, $y(0.2)$ using Picard's method. 7

[B.] Use the Euler's method to numerically integrate $dy/dx = -2X^3 + 12X^2 - 20X + 8.5$ from X=0 to X=4.0 with a step size 0.5. The initial condition at X=0 is Y=1. 7

[illegible] Science and Technology University

Final Examination of B.Sc. Engineering in CSE, Jan-June 2019

Course Code: CSE 312 | Course Title: Numerical Methods | Credits: 3

Time: 03 Hr

Answer any 05 out of 06 Questions (split answers are highly discouraged) | Marks: 70

1\. A. Use the Gauss-Jordan technique to solve the system:

$$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$$
$$0.1x_1 + 7x_2 - 0.3x_3 = -19.3$$
$$0.3x_1 - 0.2x_2 + 10x_3 = 71.4$$

B. Derive equation for linear regression and find out a_0 and a_1. 7

2\. A. Apply factorization process to the symmetric matrix: 7

$$[A] = \begin{bmatrix} 6 & 15 & 55 \\ 15 & 55 & 225 \\ 55 & 225 & 979 \end{bmatrix}$$

B. Given $dy/dx = \frac{1}{2}(x+y)$, $y(0)=2$, $y(0.5)=2.636$, $y(1.0)=3.595$, $y(1.5)=4.968$. Find $y(2)$ by Milne's method.

3\. A. Use the Euler-Cauchy's method to numerically integrate $dy/dx = -2X^3 + 12X^2 - 20X + 8.5$ from $X=0$ to $X=4.0$ with a step size 0.5. The initial condition at X=0 is Y=1. 7

3\. B.

i. Use Simpson's rule to integrate $f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$ from $a=0$ to $b=0.8$.

ii. Use it in conjunction with Simpson's 1/3 rule to integrate the same function for five segments.

4\. A. Use bisection method to solve the following problem up to approximate percent relative error ε_s [illegible] 7

$$f(c) = \frac{667.38}{c}\left(1 - e^{-0.146843c}\right) - 40$$

B. Given $dy/dx = 1 + xy$ and $y(0) = 1$. Calculate $y(0.1)$, $y(0.2)$ using Picard's method. 7

5\. A. 7

i. Drive the formula of false position method with proper figure.

ii. Differentiate between Gauss-Jordan and Gauss elimination method.

5\. B. Fit a second-order polynomial to the data of the following table. Also find out standard error $S_{y/x}$. 7

X	Y
1	7.2
2	13.6
3	27.2

6\. A. Show a case where bisection is preferable to false position with a suitable example.

6\. B. Clear the concept of convergence and divergence using iteration method with a suitable example.

Faculty of Computer Science and Engineering
Patuakhali Science and Technology University

Final Examination of B.Sc. Engineering in CSE Level: 3 Semester: I Session: 2015-16

Course Code	Course Title	January-June	Credit: 03
CCE 311	Numerical Methods	2018	Time: 03 Hr
			Marks: 70

Answer any 05 out of 06 Questions (Split answers are highly discouraged)

Put appropriate figure/example if necessary

1 A Determine the real roots of $f(x) = -0.4x^2 + 2.2x + 4.7$ 2+4
- i. Using the quadratic formula
- ii. Using three iterations of the bisection method to determine the highest root. Employ initial guesses of lower $x_l = 5$ and $x_u = 10$. Compute the estimated error ε_a and true error ε_t after each iteration.

1 B Explain accuracy and precision with example. Write down different types of error found in numerical analysis with the formula to calculate them 2+3

1 C Derive the formula of false position method with proper figure. 3

2 A How do you use Taylor series in the derivation of Newton-Raphson method? Explain the pitfalls of Netwan-Raphson method with example. 3+3

2 B Use simple fixed-point iteration to locate the root of $f(x) = -0.9x^2 + 1.7x + 2.5$ 5
Use an initial guess of $x_0 = 5$ and iterate until $\varepsilon_a <= 0.01\%$

2 C State the differences between secant and false-position method. 3

3 A Use Muller's method with guesses of x0, x1and x2 = 4.5, 3.5 and 5.5 respectively, to determine a root of the equation 6
$f(x) = x^3 - 13x - 12$
Note that the roots of this equation are -3, -1, and 4

3 B Apply Cholesky decomposition to the symmetric matrix 5
$$[A] = \begin{bmatrix} 6 & 15 & 55 \\ 15 & 55 & 225 \\ 55 & 225 & 979 \end{bmatrix}$$

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \qquad \begin{bmatrix} L_{11} & 0 & 0 \\ L_{21} & L_{22} & 0 \\ L_{31} & L_{32} & L_{33} \end{bmatrix}$$

3 C Write short notes on 1.5+1.5
- i. LU decomposition
- ii. Lower and Upper triangular matrix

4 A Fit a second-order polynomial to the data of the following table. Also find out standard error $S_{y/x}$ 7

x_i	y_i
1	7.7
2	13.6
3	27.2

4 B 7
- i. Use Simpson's 3/8 rule to integrate
  $f(x)=0.2+25x-200x^2+675x^3-900x^4+400x^5$ from a=0 to b=0.8
- ii. Use it in conjunction with Simpson's 1/3 rule to integrate the same function for five segments
- iii. Find out E_t for both cases. true val = 1.640533

5 A Derive equation for linear regression and show criteria for a "Best" fit. 7

5 B Given $dy/dx = \frac{1}{2}(x-y)$, $y(0)=2$, $y(0.5)=2.636$, $y(1.0)=3.595$, $y(1.5)=4.968$. Find $y(2)$ by Milne's method.

6 A Use the point-slope method to numerically integrate $dy/dx = -2x^3 + 12x^2 - 20x + 8.5$ from x=0 to x=4.0 with a step size 0.5. The initial condition at x=0 is y=1.

6 B Given $dy/dx = 4e^{0.8x} - 0.5y$ and $y(0) = 2$. Calculate $y(0.1)$, $y(0.2)$ using Heun's method.

Patuakhali Science and Technology University

5th semester (L-3, T-I) Final Examination of B.Sc. in Engg. (CSE), Jan-June-2016

Session: 2013-14, Course Code: CSE-311, Course Title: Numerical Methods

Marks-70, Time: 3 hour, Credit: 3.00

[Figure in the right margin indicates full marks. Split answering of any question is not recommended.]

Answer any 5 of the following questions.

1. a) Determine the normal equations for polynomial of the nth degree 6

b) Find the values of a, b and c so that $Y = a + bx + cx^2$ is best fit to the data 4

x	y
0	1
1	0
2	3
3	10
4	21

c) Fit a function of the form $y = ax^3$ to the following data 4

x	y	x	y
2	63	20	8
4	25	40	5
7	13	60	3
10	13	80	2

2. a) Derive the LU decomposition method for solving a system of n linear equations 7

b) Solve the following system 5

$$5x - 2y + z = 4$$
$$7x + y - 5z = 8$$
$$3x + 7y + 4z = 0$$

By the unit lower triangular and upper triangular (LU) method.

c) Write down the difference between Gauss elimination method and Gauss-Jordan method. 2

3. a) Explain the term 'interpolation' 3

b) Deduce Gauss's interpolation formula 6

c) Using Gauss's forward formula, find the value of $f(32)$ given that $f(25) = 0.2707$, $f(30) = 0.3027$, $f(35) = 0.3386$, $f(40) = 0.3794$ 5

4. a) Discuss the method of Bisection to find an approximate root of an equation $f(x) = 0$ 6

b) Find a real root of the equation $x^3 - x - 2 = 0$ by using Bisection Method and False position method. 4+4=8

5. a) Describe the Taylor Series Method for the solution of ordinary differential equation. 6

b) Given $\frac{dy}{dx} = 1 + xy$ when $y(0) = 2$ find $y(0.1)$ by Taylor Series Method and Runge Kutta 2nd order method. 6+4=8

6. a) Derive general integration formula to compute $\int_a^b f(x)dx$ and Simpson's 1/3 rule for the numerical integration. 3+4=7

b) Compute the integral $\int_0^{\frac{\pi}{2}} \frac{dx}{\sqrt{1+x^3}}$ upto 6 decimal place by using Trapezoidal rule and Simpson's 1/3 rule. 3+4=7

Patuakhali Science and Technology University

5th semester (L-3, S-I) Final Examination of B.Sc. in Engg. (...) Jan-June-2015

Session: 2012-13, Course Code: CCE-311, Course Title: Numerical Methods

Marks-70, Time. 3 hours, Credit: 3.00

[Figure in the right margin indicates full marks. Split answering of any question is not recommended.]

Answer any 5 of the following questions.

1. a) Define interpolation of a polynomial. 2

b) Deduce Newton's interpolation formula for a polynomial. 5

c) Values of x (in degrees) and $\sin x$ are given in the following table: 7

x (in degrees)	$\sin x$
15	0.2588190
20	0.3420201
25	0.4226183
30	0.50
35	0.5735764
40	0.6427876

Determine the values of $\sin 18^0$ and $\sin 38^0$

2. a) Determine the normal equations if the cubic polynomial $y = a_0 + a_1 x + a_2 x^2 + a_3 x^3$ is fitted to the data points $(x_i, y_i), i = 1,2,\cdots,m$ 6

b) Use the method of least squares to fit the straight line $y = a + bx$ to the data 4

x	y
0	2
1	5
2	8
3	11

Find the values of a and b.

c) The curve $y = ce^{bx}$ is fitted to the data 4

x	y
1	1.5
2	4.6
3	13.9
4	40.1
5	125.1
6	299.5

Find the best values of c and b.

3. a) Derive the Gauss elimination method for a system of n linear equations and hence write the difference between Gauss method and Gauss-Jordan method. 7

b) Solve the following system 7

$$5x - 2y + z = 4$$
$$7x + y - 5z = 8$$
$$3x + 7y + 4z = 10$$

by (*i*) Gauss elimination method and (*ii*) Gauss-Jordan method.

4. a) Derive the Bisection Method and False position method. 8

b) Find a real root of the equation $x^3 + x^2 - 1 = 0$ by using False position Method. 6

5. a) Derive the Trapezoidal rule and simpson's 1/3 rule. 7

b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Trapezoidal rule and Simpson's 1/3. 7

6. a) Describe the Runge Kutta 2nd order method for the solution of first order ordinary differential equation. 7

b) Solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ and find $y(0.2)$ by Runge Kutta 4th order method. 7

Patuakhali Science and Technology University

B.Sc. Engg. (CSE) Level: 3 Semester: I Final Examination of Session 2011-12, Jan-June 2014

Course Code: CCE 311 Course Title: Numerical Methods

Credit Hour: 03 Full Marks: 70 Duration: 03 Hours

[Figures in the right margin indicate full marks. Split answering of any question is highly discouraged. Write the full question number e.g. 1(B)(i) before the answer paragraph]

Answer any 5 of the following questions

1 A Use Gauss-Elimination technique to solve the following system 7

$$0.2x_1-0.7x_2-0.2x_3=7.85$$
$$0.10x_1+7x_2-0.3x_3=-19.3$$
$$0.30x_1-0.2x_2+x_3=71.4$$

1 B i. How can we remove the error of Trapezoidal rule by applying Simpson's rule? 7

ii. Sketch and state graphical depiction of singular and ill-conditioned systems.

2 A Show a case where Bisection is preferable to False Position. 7

2 B i. State Weddle's Rule. 7

ii. Solve the following system using Cramer's rule

$$0.3x_1-0.1x_2-0.2x_3=7.85$$
$$0.7x_1+0.7x_2-0.3x_3=-19.3$$
$$0.30x_1-0.2x_2+10x_3=71.4$$

3 A Apply Factorization process to find out the root of the following system 7

$$x_1+x_2-x_3=2$$
$$2x_1+3x_2+5x_3=-3$$
$$3x_1+2x_2-3x_3=6$$

3 B i. Write down the algorithm of Bolzano's Method 7

ii. Use Simpson's 3/8 rule to integrate

$f(x)=0.2+25x-200x^2+675x^3-900x^4+400x^5$ from a=0 to b=0.8

4 A Show the effect of reduced step size on Euler's method. 7

4 B i. Show two cases of iteration process.

ii. What is Lagrange's interpolation formula? In which case we use it? 7

5 A "Secant method can be classified as a bracketing method" --- is it true or false? Explain your answer clearly. 7

5 B i. Develop equation for linear regression. 7

ii. Show that $x_r=x_u-f(x_u)(x_l-x_u)/(f(x_l)-f(x_u))$ in case of false position method.

6 A Use N-R method to estimate the root of $f(x)=e^{-x}-x$, employing an initial guess of $x_0=0$ (True value=0.56714329) until $\varepsilon_t(\%)<10^{-4}$. 7

6 B Use Gauss-Jordan technique to solve the following system 7

$$3x_1-x_2-0.2x_3=7.85$$
$$0.10x_1+7x_2-0.3x_3=-19.3$$
$$0.30x_1-0.2x_2+x_3=71.4$$

ID: 1802026

Dept. of Computer and Communication Engineering

Mid: I Semester: 5th Batch : 16th Marks 15 Session 2018-2019

Course Code: CCE 312 Time: 1 hour Course Title: Numerical Method Sessional

1. In a market survey three commodities A, B and C were considered. In finding out the index number some fixed weights were assigned to the three varieties in each of the commodities. The table below provides the information regarding the consumption of three commodities according to the three varieties and also the total weight received by the commodity

Commodity / Variety	I	II	III	Total family
A	1	2	3	11
B	2	4	5	21
C	3	5	6	17

Find the weights assigned to the three varieties by using Cramer's Rule with python code.

2. Use Gauss-Jordan elimination to solve the system:

   $x+3y+2z=2$

   $2x+7y+7z=-1$

   $2x+5y+2z=7$

3. Solve the system of linear equations using the Gauss-Jordan elimination method.

   $2x+4y-6z=38$

   $X+2y+3z=7$

   $3x-4y+4z=-19$

4. Three masses are suspended vertically by a series of identical springs where mass 1 is at the top and mass 3 is at the bottom.

   If g = 9.81 m/s^2 , m1 = 2 kg, m2 = 3 kg, m3 = 2.5 kg, and the k's = 10 kg/s , solve for the displacements x.

5. Solve the following systems of linear equations by Gaussian *elimination method*

   $2x - 2y + 3z = 2, x + 2y - z = 3, 3x - y + 2z = 1$