University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part-II Even Semester Examination 2020
Course No : MATH2231 (Numerical Methods)
Marks: 35 Time: 2 Hours

(Answer any four questions taking at least two from each Section)

Section-A

1. (a) What are accuracy and precision? 1
   (b) Why do occur numerical errors? Explain different types of errors. 3
   (c) How can you measure absolute, relative and percentage errors? 3
   (d) Three approximate values of the number 1/3 are given as 0.30, 0.33 and 0.34. Which of these three is the best approximation? 1.75

2.(a) Describe the Bisection method for finding root of equation f(x)=0 with its merits and demerits 4.75
   (b) Find the real root of the equation $x^3-3x-5=0$ correct to three decimal places using Bisection method. 4

3. (a) Explain Shift Operator E, Average Operator μ and Differential Operator D used in interpolation formula. 1.5
   (b) Prove that $E = 1 + \Delta$, symbols have their ususal meaning. 2
   (c) Derive Newton's backward interpolation formula for equal spaced data. 3
   (d) Given the table 2.25

x	150	152	154	156
$y = \sqrt{x}$	12.247	12.329	12.410	12.490

Evaluate $\sqrt{155}$ using an interpolation formula.

Section-B

4. (a) What is curve fitting? Explain the purpose of it. 1.75
   (b) Describe the least square curve fitting procedure for power function $f(x) = ax^c$. 4
   (c) By the method of least squares, find a straight line that best fits the following data given in the table 3

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

5. (a) Explain Gauss elimination method to solve linear system of equations. 4.75
   (b) Solve the following equations using Gauss-Jordan method 4

$$x + y = 5$$
$$-2x - y + 2z = -10$$
$$3x + 6y + 7z = 14$$

6. (a) Derive Euler's method and modified Euler's method for solution of ordinary differential equations. 4.75
   (b) Solve the equation by Euler's method 4

$$\frac{dy}{dx} = y - x, \quad y(0) = \frac{1}{2}$$

Choose $h = 0.1$ and compute $y(0.2)$ and $y(0.4)$.

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part - II, Semester – Even, Examination 2019
Course No.: MATH2231 (Numerical Methods)
Marks: 35 Time: 2 Hours

(Answer any four questions taking at least two from each Section)

Section-A

1. (a) What is numerical method? Write the reasons to study it. 1.75
   (b) Explain inherent error, round-off error and truncation error. 3
   (c) How numbers are rounded-off ? Give the rule. 2
   (d) If $\frac{2}{3}$ is approximated to four significant digits, find absolute, relative and percentage errors. 2

2. (a) Briefly discuss the method to obtain a root using false position method. ~~4~~ 5
   (b) Use the iterative method to find, correct to four significant figures, a real root of the equation: $1+x^2=x^3$ 3.75

3. (a) Derive Newton's forward difference interpolation formula for equal distance data. 4
   (b) From the following table, find y when x=301 using Newton's divided difference formula. 3

x	300	304	305	307
y	2.4771	2.4829	2.4843	2.4871

   (c) Show that the divided differences are symmetrical in their arguments. 1.75

Section-B

4. (a) Define curve fitting. Explain the purpose of it. 1.75
   (b) Describe the least square curve fitting procedure for a straight line. 4
   (c) Find the values of a_0 and a_1 so that $Y = a_0 + a_1 x$ fits the data given in the table: 3

x	0	1	2	3	4
y	1.0	2.9	4.8	6.7	8.6

5. (a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ for $h = 0.5$ and 0.125 using Trapezoidal rule (correct to three decimal places). 3
   (b) Derive Romberg Integration formula. 4
   (c) State any two differences between direct and iterative methods for solving system of equations. 1.75

6. (a) From the Taylor series for $y(x)$, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies $y' = x - y^2$ and $y(0) = 1$. 4
   (b) Determine the value of y using modified Euler's formula when $x = 0.1$ given that $y(0) = 1$ *and* $y' = x^2 + y$ *and* $h = 0.05$. 4.75

University of Rajshahi

Department of Computer Science and Engineering

B.Sc. (Engg.) Part-2 Even Semester Examination-2018

Course: MATH2231 (Numerical Methods)

Marks: 35 Time: 2 Hours

[N.B. Answer any FOUR questions taking TWO from each section.]

Section-A

1. a) What is numerical method? Write the reasons to study it. 2
   b) Define the terms 'accuracy', 'precision' and 'bias'. 1.50
   c) What do you mean by significant figures? Write the rules for identifying significant figures with examples. 3.25
   d) What is the difference between algebraic and transcendental equations? 2

2. a) Define Bisection method. Find the real root of the equation $x^3-2x-5=0$, using bisection method. 5.75
   b) Explain the advantages and disadvantages of bisection method. 3

3. a) Derive Newton's forward difference interpolation formula for equal distance data. 3
   b) Define the divided differences $f[x_i; x_{i+1}; : : : ; x_{i+k}]$ for a function f(x). 3
   c) Use divided differences to construct the Newton interpolation polynomial $p_2(x)$ of degree 2 that passes through according to following table or the points (0.1, 0.1248), (0.2, 0.2562), and (0.4, 0.6108). 2.75

x	0.1	0.2	0.4
f(x)	0.1248	0.2562	0.6108

Section-B

4. a) Define curve fitting. Explain the purpose of it. 1.75
   b) Describe the least square curve fitting procedure for a polynomial of degree n. 4
   c) Derive a polynomial of degree 2 to the data points given in the table: 3

x	0	1	2
y	1.0	6.0	17.0

5. a) Solve the following system using Jaccobi iterative technique: 3.5

$$3x_1 + x_2 - 2x_3 = 9$$
$$-x_1 + 4x_2 - 3x_3 = -8$$
$$x_1 - x_2 + 4x_3 = 1$$

   b) Solve the following differential equation using Euler's method for $1 \leq x \leq 2$ with a step size of $h = 0.1$: $\frac{dy}{dx} = 3x^2y$ such that y=1 at x=1. 5.25

6. For the following set of data:

x	0	1	2	3	4
f(x)	0	0.5	0.75	0.79	0.99

   a) Construct a finite-difference table and numerically evaluate the first, second, third derivative at x=1 using forward differences. 4.5
   b) Use the Simpson's 1/3-Rule to numerically evaluate the integral $\int_0^4 f(x)dx$. 3
   c) How can you reduce the error in your estimate of the integral? 1.25

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University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.) Part-2, Even Semester Examination-2017
Course No.: MATH2231 (Numerical Methods)
Marks: 35 Time: 2:00 Hours

(Answer any four questions taking at least two from each Part)

Section-A

1. (a) What do you mean by numerical method? Distinguish between direct and numerical method. 3
   (b) Numerical method approaches are essential in modern science and engineering field, why? Explain. 2.75
   (c) Define numerical, algebraic and transcendental expressions with suitable example. 3

2. (a) Explain the geometrical interpretation of Newton-Raphson method. 3
   (b) Describe how can the convergence of root finding iteration method be accelerated. 3
   (c) Find a real root of the equation $x^3 - x^2 - 1 = 0$ correct to 3 decimal places by false position method. 2.75

3. (a) Define forward, backward, central differences and divided difference. 3
   (b) Derive Lagrange's interpolation for unequal distance data. 3
   (c) The following values of x and y are given. Find $y(0.543)$. 2.75

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7
y(x)	2.631	3.328	4.097	4.944	5.875	6.896	8.013

Section-B

4. (a) Define curve fitting. Explain the purpose of it. 1.75
   (b) Describe the least square curve fitting procedure for a straight line. 4
   (c) The exponential function $y = ae^{bx}$ is fitted to the data: 3

x	0	0.5	1.0	1.5	2.0	2.5
y	0.10	0.45	2.15	9.15	40.35	180.75

   Find the values of a and b.

5. (a) Describe the geometrical meaning of Trapezoidal rule. 2
   (b) Explain Gaussian Elimination method to solve linear system of equations. 4
   (c) Solve the following equations using Gauss-Seidel method 2.75

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22$$

6. (a) From the Taylor series for $y(x)$, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies $y' = x - y^2$ and $y(0) = 1$. 5
   (b) Determine the value of y using modified Euler's formula when $x = 0.1$ given that $y(0) = 1$ *and* $y' = x^2 + y$ *and* $h = 0.05$. 3.75

University of Rajshahi

Department of Computer Science and Engineering

B.Sc. (Engg.) Part-II (Even Semester) Examination-2016

Course: MATH2231 (Numerical Methods)

Full Marks: 35 **Time: 2 Hours**

[N.B. Answer any **Four** questions taking **Two** from each Part.]

Part A

1. (a) What is numerical method? Write the reasons to study it. 2.75
   (b) Define inherent error, round-off error and truncation error. 2
   (c) How can you measure absolute, relative and percentage errors? 2
   (d) Define algebraic and transcendental expression with example. 2

2. (a) Describe the bisection method for finding root of equation $f(x) = 0$ with its merits and demerits. 3.5
   (b) Describe Secant method for finding root of equation $f(x) = 0$. 2.25
   (c) To obtain a root correct to three decimal places of equation $x^3 - x - 4 = 0$ using false position method. 3

3. (a) What are forward differences? Briefly discuss the forward difference table. Determine the difference table for the values of y given in the following table: 3 3

x	3	4	5	6	7	8	9
y	2.7	6.4	12.5	21.6	34.3	51.2	72.9

   (b) Find the value of y(1) and y(2) derived from the above table using the difference table. 2.75

Part B

4. (a) Explain the purpose of curve fitting procedure. 1.75
   (b) Describe the least square curve fitting procedure for a straight line. 4
   (c) Find the values of a and b so that $Y = ae^{bx}$ fits the data given in the table: 3

x	1.0	1.2	1.4	1.6
y	40.170	73.196	133.372	243.02

5. (a) Classify System of Linear Equations and explain them based on graphical representation. 3.75
   (b) Solve the following set of simultaneous equations using the Gauss-elimination method: 5

$$2x - 4y + 6z = 5$$
$$x + 3y - 7z = 2$$
$$7x + 5y + 9z = 4$$

6. (a) Derive Euler's method and modified Euler's method for solution of ordinary differential equations. 5

   (b) Use Euler's method to solve the equation $\frac{dy}{dx} = x + y$, $y(0) = 0$. Choose $h = 0.2$ and compute $y(0.4)$ and $y(0.6)$. 3.75

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University of Rajshahi
Department of Computer Science and Engineering
B.Sc. (Engg.), Part-II, Even Semester, Examination 2015
Course No : MATH2231 (Numerical Methods)

Marks: 35 **Time: 2 Hours**

[Answer any Four (04) questions taking at least two from each Part.]

Part-A

1. (a) What is numerical method? Write the reasons to study it. 2
   (b) Why do occur numerical errors? Explain different types of errors. 3
   (c) How can you measure absolute, relative and percentage errors? 3
   (d) How numbers are rounded-off ? Write the rule. 0.75

2. (a) Describe Iterative method for finding root of an equation. Explain how can the convergence of root finding iteration method be accelerated. 5.75
   (b) Find a real root of the equation $x^3 - 2x - 5 = 0$ correct to 4 decimal places by false position method. 3

3. (a) Write the procedure of successive approximation method. 2
   (b) What is forward differences? Briefly discuss the forward difference table. 3
   (c) Determine the difference table for the values of y given in the following table. 3.75

x →	3	4	5	6	7	8	9
y →	2.7	6.4	12.5	21.6	34.3	51.2	72.9

Part-B

4. (a) Derive Langrange's interpolation formula for unequal distance. 4.75
   (b) Find the value of *tan(0.05)* from the following table. 4

x→	0.10	0.15	0.20	0.25	0.30
y→	0.1003	0.1511	0.2027	0.2553	0.3093

5. (a) Explain Gauss-Seidel method for solution of linear system. 4.75
   (b) Solve the following system using Gaussian Elimination method 4

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

6. (a) Derive Simpson's 1/3 rule for numerical integration. 4
   (b) Find the area bounded by the curve and the x-axis from x=7.47 to x=7.52 using Simpson's 1/3 rule form the following table. 4.75

x	7.47	7.48	7.49	7.50	7.51	7.52
f(x)	1.93	1.95	1.98	2.01	2.03	2.06

University of Rajshahi
Department of Computer Science and Engineering
B.Sc(Engg), Part-II Even Semester Examination 2014
Course: MATH 2231 (Numerical Methods)

Time: 2 Hours Marks: 35

(Answer any **FOUR** taking at least **TWO** from any part)

Part-A

1. (a) What do you mean by exact and approximate number? Give example. 2.75
   (b) How can you measure absolute, relative and percentage errors? 4
   (c) Round off the following numbers to four significant figures: 2
   i) 38.46235 ii) 0.70029 iii) 0.0022218 iv) 19.235101

2. (a) Describe False Position and Newton-Raphson method for finding root of an equation. 5.75
   (b) Find a real root of the equation $x^3 - x^2 - 1 = 0$ correct to 3 decimal places by false position method. 3

3. (a) Derive Netwon's forward difference interpolation formula for equal distance data. 4.75
   (b) The following values of x and y are given. Find y(0.543). 4

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7
y(x)	2.631	3.328	4.097	4.944	5.875	6.896	8.013

Part-B

4. (a) Describe the least square curve fitting procedure for a straight line. 4.75
   (b) Find the values of a_0 and a_1 so that $y = a_0 + a_1 x$ fits the data given in the table 4

x	1	2	3	4	6	8
y	2.4	3.1	3.5	4.2	5.0	6.0

5. (a) Is it possible to find solution of a system of linear equation with singular augmented matrix by Gaussian Elimination Method? Justify your answer. 4
   (b) Solve the following system by Gauss-Jordan Method. 4.75

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

6. (a) Derive Simpson's 3/8 rule for numerical integration. 5
   (b) Derive Trapezoidal rule. 2.25
   (c) From the Taylor series for y(x), find y(0.1) correct to five decimal places if y(x) satisfies $y' = x^2 y - 1$ and y(0)=1. 1.5

University of Rajshahi
Department of Computer Science and Engineering
B.Sc. Engg. Part-II Even Semester Examination 2013
Course No : MATH2231 (Numerical Methods)
Marks: 35 Time: 2 Hours

Answer any four questions taking two from each Part

Part-A

1. (a) Define inherent error, round-off error and truncation error. 3
   (b) How can you measure absolute, relative and percentage errors? 4
   (c) Define Numerical, Algebraic, and Transcendental expression with example. 1.75

2. (a) Define Bisection method. Find the real root of the equation $x^3-2x-5=0$, using bisection method. 5.75
   (b) Explain the advantages and disadvantages of bisection method. 3

3. (a) Describe how can the convergence of root finding iteration method be accelerated. 3.75
   (b) Using synthetic division, find the three roots of the following polynomial: $x^3 - x^2 -10x -8 = 0$. Use an initial estimate of $x_0 = 6$ for the first root. 5

Part-B

4. (a) Derive Lagrange's interpolation for unequal distance data. 3.75
   (b) Develop an interpolation polynomial for the following data using the finite difference approach. Estimate the f(x) for x = 2.7 5

5. (a) Classify System of Linear Equations and explain them based on graphical representation. 3.75
   (b) Solve the following set of simultaneous equations using the Gauss-Jordan method: 5

$$4x - 2y + 3z = 15.7$$
$$-2x + 4y - z = -14.1$$
$$3x + y - 3z = -4.2$$

6. (a) Derive Simpson's 3/8 rule for numerical integration. 5
   (b) From the Taylor series for $y(x)$, find $y(0.1)$ correct to five decimal places if $y(x)$ satisfies $y' = x^2y - 1$ and $y(0) = 1$. 2
   (c) What is the local error term in Trapezoidal formula and in Simpson's 1/3 rule? 1.75

x	1	2	3
f(x)	3	5	8

University of Rajshahi
Department of Computer Science and Engineering
B.Sc(Engg) 2nd year 2nd semister, 2012

Even Semester

Course- MATH2231 (Numerical Methods)

Time: 3 Hours **Marks :35**

$8\frac{3}{4} \times 4 = 35$

(Answer **FOUR** questions taking any **TWO** from each group)

Part-A

1.(a) Define absolute and relative errors by giving suitable example. $1\frac{3}{4}$

(b) Show that the order of convergence of Newton-Raphson method is two. 4

(c) Find a positive real root of equation $x^3 - 3x + 1 = 0$ by Newton- Raphson's method, correct to 4 decimal places. (with $\varepsilon = 0.0001$) 3

2. (a) Define transcendental equation with example. 1

(b) How do you consider the initial approximation to the root of the equation f(x)=0? $1\frac{3}{4}$

(c) Write the procedure of successive approximation method. When does this method converge? 3

(d) Use iteration method to evaluate $\sqrt{30}$ correct to three decimal places with an accuracy of 10^{-3}. 3

3. (a) What is forward differences? Briefly discuss the forward difference table. Determine the difference table for the values of y given in the following table. $5\frac{3}{4}$

x	3	4	5	6	7	8	9
y	2.7	6.4	12.5	21.6	34.3	51.2	72.9

(b) Find the value of y(1) and y(10) from the above table using the difference table. 3

Time: 04 Hours

Part-B

4. (a) What is meant by interpolation? Derive Lagrange's interpolation formula.

(b) Find the form of the function y(x) from the following table 4

X	0	1	3	4
Y	-12	0	12	24

5. (a) Derive Simpson's 1/3 rule for numerical Integration. $3\frac{3}{4}$

(b) Evaluate I= $\int_0^1 \frac{dx}{1+x}$, Correct to 3 decimal places using both Trapezoidal and Simpson's rule for h=0.25 5

6. (a) Describe the Modified Euler's method to solve the ordinary differential equation. What is the advantage of Modified Euler's method over Euler's method? 5

(b) Using Euler's formula, solve the following differential equation. $3\frac{3}{4}$

$\frac{dy}{dx} - 1 = y^2$, y(0)=0.

In each case take h=0.1 and y(0.1) and y(0.3).