

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2023

Programme: BE

Full Marks: 100

Course: Numerical Methods (New)

Pass Marks: 45

Time : 3hrs.

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 the questions.

1. a) Evaluate a real root of the given equation: $f(x) = 3x + \sin x - 2$ 7
 using Fixed point iterative method correct to four decimal places.

OR

Define error. Explain its type with sources of error in Numerical computation.

- b) Calculate the root of the equation: $4x^3 - 2x - 6 = 0$ correct upto 8
 three decimal places using Bisection Method.
2. a) What is interpolation? Find the value of $f(1.2)$ using appropriate 8
 interpolation technique.

x	1	1.4	1.8	2.2
$f(x)$	50	70	100	120

- b) If P is pull required to lift a load W by means of a Pulley, Find the 7
 law of form

$P = mW + C$, (where m and C are constants) using least square
 method for the following data:

P	12	15	21	25
W	50	70	100	120

OR

Use the suitable method to fit a curve $y = ax^b$ for the following data

x	-2	-1	0	1	2	3	4
y	38	6	0	-5	-41	130	300

3. a) Compute the following using Simpson's 1/3 rule for $n= 8$ with an accuracy to five decimal places.

$$\int_1^5 e^{-x^2} dx$$

b) Evaluate the following using Gaussian three point Integration formula: 8

$$\int_2^4 (x^4 + 1) dx$$

4. a) Solve the following system of Linear equations using partial pivoting method. 7

$$x + y + z = 4, x + 4y + 3z = 8, x + 6y + 2z = 6$$

b) Solve the following system of equations using Gauss Jacobi's method. 8

$$3x + 2y + z = 10, 2x + 3y + 2z = 14, x + 2y + 3z = 14$$

5. a) Find the largest Eigen value and Corresponding Eigen vector of given matrix using power method. 7

$$A = \begin{bmatrix} 2 & 5 & 1 \\ 5 & -2 & 3 \\ 1 & 3 & 10 \end{bmatrix}$$

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b) Solve the following differential equation for $y(0.4)$ using Heun's method. 8

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 6x ; \text{ with } y(0) = 0 \text{ and } y'(0) = 1 \text{ (take } h=0.2).$$

6. a) Use Euler's method to solve the following equation for $y(1)$ using $t_i \approx 0.25$. 7

$$\frac{dy}{dx} = x + y + xy ; \quad y(0) = 1$$

b) Solve the Poisson equation $\nabla^2 f = -10(x^2 + y^2 + 10)$ over the square with $0 \leq x \leq 3; 0 \leq y \leq 3$ and $f = 0$ on boundary. Use $h = 1$. 8

2×5

7. Write short notes on: (Any two)

a) Initial Value problems and Boundary value problems

b) Algorithm for secant method

c) Schmidt method for one dimensional heat equation

National Academy of Science and Technology

(Affiliated to Pokhara University)

Dhangadhi, Kailali

Pre- University Examination

Level: Bachelor

Semester: IV_Spring

Year : 2024

Programme: BE Computer

Full Marks: 100

Course: Numerical Methods

Pass Marks: 45

Time : 3hrs.

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 the questions.

1. a) Using false position method, find a root of the equation

$$x \log_{10} x = 1.2 \text{ correct to four decimal places.} \quad [7]$$

- b) Derive a formula to find the reciprocal of a number N ($\neq 0$) using Newton's method. Hence, find the reciprocal of 17 correct to four decimal places. [8]

2. a) Using suitable interpolation formula, estimate the number of workers getting wages between Rs. 100 and Rs. 150 on the basis of the following data: [7]

Wages Rs.	0-100	100-200	200-300	300-400
No. of workers	9	30	35	42

- b) Fit a curve of the form $y = ax^b$ using the data [8]

x	2	4	6	8	10
y	1.4	2	2.4	2.6	2.7

3. a) Solve the following system of equations using Gauss elimination method. [8]

$$10x - 7y + 3z + 5u = 6;$$

$$-6x + 8y - z - 4u = 5;$$

$$3x + y + 4z + 11u = 2;$$

$$5x - 9y - 2z + 4u = 7.$$

- b) Solve the following system of equations using Guass-Seidel method: [7]

$$x + 6y - 10z = -3; \quad 10x - 5y - 2z = 3; \quad 4x - 10y + 3z = -3.$$

4. a) Decompose the matrix using Choleskey's factorization method. [7]

$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 8 & 22 \\ 3 & 22 & 82 \end{pmatrix}$$

b) Evaluate the integral $\int_0^{\frac{\pi}{2}} \log(1+x) dx$ using Gaussian integration formula for n=2 and n=3. [8]

5. a) Using R-K 4th order method, solve $\frac{dy}{dx} = x + y^2$ with y(0)=1 in the interval $0 \leq x \leq 0.5$ taking step size h = 0.25. [7]

b) Using Heun's method, solve $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$ with y(0) = 1 and y'(0) = 0. Estimate y(1) taking step size h = 0.5. [8]

6. a) Solve the equation $u_{xx} + u_{yy} = -100(x^2+y^2+100)$ over the square domain $0 \leq x \leq 3$ and $0 \leq y \leq 3$ with $u(0, y) = u(x, 0) = 0$, $u(3, y) = u(x, 3) = 100$ and mesh length h=1. [8]

b) Write an algorithm for the implementation of bisection method. [7]

7. Attempt (Any two) [2 x 5 = 10]

i) Find f'(x) and f''(x) at x=1 with h=0.1 using central difference formula, where $f(x) = \ln(1+x)$.

ii) Find the largest eigen value and corresponding eigen vector of the square matrix using power method.

$$\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$$

iii) Write short notes on types of numerical errors with example.

POKHARA UNIVERSITY
SCHOOL OF ENGINEERING

Level: Bachelor

Final Internal Assessment

Full marks: 100

Programme: BE computer (New) 2024

Pass marks: 45

Course: Numerical Method

Time: 3hrs

Candidates are required to give their answers in their own words as far as practicable.

The figure in the margin indicates full marks.

Attempt all the questions.

1. a) Find a real root of the equation $xe^x = \cos x$ using 8
 i. one of the bracketing methods
 ii. one of the open methods

- b) Find the square root of 0.75 by writing $f(x) = x^2 - 0.75$ and solving the equation $x = x^2 + x - 0.75$ by the method of fixed-point iteration. Assume an initial value of $x_0 = -0.8$. Also try it with an initial value of $x_0 = 0.8$. Comment on the results. 7

2. a) From the following table, estimate the number of students obtaining marks between 60 and 65. 8

Marks	30-40	40-50	50-60	60-70	70-80
No. of sts	31	42	51	35	31

- b) Fit a parabolic curve for the following set of data also find $f(2)$. 7

x	0.5	1	1.5	4.5	6.5	7.5
f(x)	2.5	2.7	3.5	6.5	8.4	9.5

3. a) Using Romberg integration method, evaluate the integral $\int_0^1 \frac{dx}{1+x^2}$, correct up to 4 decimal places taking the initial sub-interval size as $h = \frac{b-a}{2}$. 8

- b) Evaluate $I = \int_0^{\frac{\pi}{2}} \sin x dx$ using two-term and three term gauss legendre formula. 7

4. a) Use Gauss Jacobi iteration method to solve:

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

$$3x + 5y + 2z = 15$$

$$2x + y + 4z = 8$$

7

b) Solve the following set of equation by decomposition method.

8

$$10x + y + z = 12$$

$$2x + 10y + z = 13$$

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

5. a) Find the largest Eigen-value and the corresponding Eigen-vector of the following square matrix using power method.

7

$$\begin{bmatrix} 3 & 1 & 4 \\ 1 & 2 & 3 \\ 4 & 3 & 5 \end{bmatrix}$$

b) Use Heun's method to solve $y' = \frac{2y}{x}$, $y(1) = 2$.

8

Take step size = 0.25 and estimate $y(2)$.

6. a) Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 6$ to find $y(0.4)$, given that $y(0) = 0$, $y'(0) = 1$ with $h = 0.2$ by using RK- 4th order method.

7

b) Torsion on a square bar of size 9cm*9cm subject to twisting is governed by: $\nabla^2 u = -4$, with Dirichlet boundary condition of $u(x, y) = 0$ and $h = 1$. Calculate the steady state temperatures at interior points. Assume a grid size of 3cm*3cm. Iterate until the minimum difference at any point is correct to two decimal places by applying Gauss-seidel method.

8

7. Write short notes on: (Any Two)

2*5

- a) Errors in Numerical Calculation.
- b) Algorithm of secant method.
- c) Cubic Spline Interpolation.
- d) Shooting Method.

GOOD LUCK

Nepal Engineering College
Final Assessment

Level:	Bachelor	Year:	2024
Programme:	BCT	Full Marks:	100
Year/Part:	II/II	Pass Marks:	45
Subject:	Numerical Methods	Time:	3 hrs

- ✓ 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 the questions.
1. a. Find the root of $x \log x - \sin x = 2$ correct upto 4 decimal places using Bisection Method. ✓ [7]
 1. b. What is Convergence and rate of convergence in Numerical Computation? Solve $x^3 - x - 11 = 0$ correct upto 4 decimal places using fixed point iteration method. [8]
 2. a. What is a cubic spline? Use cubic spline interpolation to evaluate $f(1.5)$ from following data: [7]

x	1	2	3	4
$y=f(x)$	1	5	11	8
 2. b. WAP in C/C++ for Lagrange's Interpolation. Using Divided Difference Interpolation technique, evaluate $y(7)$ from following data. ✓ [8]

x	2	3	6	9	10
$y=f(x)$	11	22	31	12	9
 3. a. Derive the expression for first derivative and second derivative using Newton's Forward Interpolation. [7]
 3. b. WAP in C/C++ for evaluating integral value using Simpson's 1/3 rule. Evaluate the integral $\int_0^6 \frac{\sin x}{1+x} dx$ using Simpson's 3/8 rule. [8]
 4. a. Solve the following system of linear equation using Gauss Elimination with Partial Pivoting.

$$a + 2b + 3c - d = 10$$

$$2a + 3b - 3c - d = 1$$

$$2a - b + 2c + 3d = 7$$

$$3a + 2b - 4c + 3d = 2$$
 4. b. Solve the following system of linear equation using LU Factorization method. [8]

$$2x + 4y - 6z = 8$$

$$x + 3y + z = 10$$

$$2x - 4y - 2z = -12$$

5. a. Find the largest Eigen value and corresponding Eigen vector for following matrix.

$$\begin{bmatrix} 2 & 5 & 1 \\ 5 & -2 & 3 \\ 1 & 3 & 10 \end{bmatrix}$$

[7]

- b. Solve the following differential equation using RK-2 method

$$y'' - 4y' + 4y = e^{3x}, y(0) = 0, y'(0) = -2 \text{ at } x=2 \text{ taking step-size } = 1.$$

[8]

6. a. Solve the following BVP using shooting method

$$y'' + xy' + y = 3x^2 + 2, y(0) = 0, y(1) = 1 \text{ and } h = 0.25$$

[7]

- b. Solve the equation $U_{xx} + U_{yy} = -10(x^2+y^2+10)$ over the square mesh with side $x=0=y$, $x=3=y$ with $u=0$ on boundary and mesh length=1.

[8]

7. Solve following questions. [2*5=10]

- a. WAP in C/C++ to solve Ordinary differential equation considering two equations using RK-4 Method.

- b. Explain the applications of Numerical Methods in Computer Science and Engineering.

NEPAL COLLEGE OF INFORMATION TECHNOLOGY
Assessment-Spring

Level: Bachelor
 Programme: BE-CE/SE
 Course: Numerical Methods

Year : 2024
 Full Marks: 100
 Pass Marks: 45
 Time : 3hrs.

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 the questions.

1(a) Solve: $x^6 - x^4 - x^3 - 1 = 0$ by Secant method correct to four decimal places. [8]

(b) Solve: $x \log_{10} x = 2$ by Newton-Rahson method correct to four significant digits. [7]

2(a) Solve: $\cos x \cosh x + 1 = 0$ [7]

(b) The following table gives the viscosity of an oil as a function of temperature. Find viscosity of oil when T=135 by using Newton's interpolating polynomial. [8]

T	100	130	160	190
Viscosity	10.8	8.1	5.5	4.8

3(a) Fit function of the form $y = ax^2 + \frac{b}{x}$ to the following observations

x	1	2	3	4	
y	-1.51	0.99	8.88	7.66	

(b) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin x}{x} dx$ by Simpson's and Trapezoid rule's taking number of Intervals n=6 [8]

4 (a) Evaluate $\int_{0.2}^{1.5} e^{-x^2} dx$ by Gaussian two and three-point formula. [7]

(b) Solve:

$$3x + 2y + z = 10$$

$$2x + 3y + 2z = 14$$

$$x + 2y + 3z = 14$$

By matrix factorization method.

[8]

5 (a) Find largest eigen value and corresponding eigen vector of the matrix

$$\begin{bmatrix} 3 & -1 & 0 \\ -2 & 4 & -3 \\ 0 & -1 & 1 \end{bmatrix} \quad [7]$$

(b) Solve: $0.5 \frac{d^2y}{dx^2} + 6 \frac{dy}{dx} + 50y = 24 \sin(x)$, $y(0) = 1$, $y'(0) = 2$ for $y(0.2)$ and $y'(0.2)$

By Heun's method taking $h=0.1$ [8]

6(a) Solve: $\frac{dy}{dx} = \sin(x) + y$, $y(0) = 2$ for $y(1)$ by fourth order Runge-Kutta method taking $h=0.5$ [7]

(b) Solve: $\nabla^2 u = -400$ over the square mesh with sides $x=0$, $y=0$, $x=4$, $y=4$ with $u=0$ on the Boundary, [8]

7. Write short notes on: (any two) [5*2]

(a) Parabolic Partial differential equation

(b) Error in Numerical computing.

(c) Cubic spline interpolating polynomial



Pokhara University
Everest Engineering College
Final Internal Assessment
Spring - 2024

Level: Bachelor

F.M. 100

Program: BE CMP

P.M. 45

Faculty: Science & Technology

Time: 3hrs

Subject: Numerical Methods (New) (4th Semester)

Attempt all the questions.

- 1 a) Find the root of the equation $x \ln(x) - 1.2 = 0$ using Secant Method correct up to 3 decimal places.
b) Using a root bracketing method find the roots of the equation $\cos(x) - 3x + 1 = 0$ correct up to three decimal places.
- 2 a) Fit a curve of the form $y = 1/(a+bx)$ by using the method of least square with the following data points.

x	1	2	3	4	5
y	3.33	2.20	1.52	1.00	0.91

- b) From the following table, Estimate the number of student who obtained marks between 40 and 45.

Marks	20-30	30-40	40-50	50-60
No of student	31	42	51	35

- a) Integrate the given integral $I = \int_0^{\pi} \frac{\cos(x)}{\sqrt{1+\sin(x)}} dx$ using Romberg Integration.

- b) Evaluate $I = \int_{-2}^2 \frac{1}{(1+x^2)} dx$ for n=6 using Trapezoidal Rule, Simpson's 1/3 Rule and Simpson's 3/8 rule. State which method yields better result.

- 4 a. Solve the following set of equation using LU Factorization Method.
- $$6x + y + z = 20$$
- $$x + 4y - z = 6$$
- $$x - y + 5z = 7$$
- b. Determine the highest Eigen value and its Corresponding Eigen Vector for the following matrix using Power Method.

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$

- 5 a) Find the Solution of the given linear equation using Gauss Seidal Method:

$$x + 2y + z = 8$$

$$2x + 3y + 4z = 20$$

$$4x + 3y + 2z = 16$$

- b. Solve the following differential equation within $0 \leq x \leq 0.3$ using RK-4TH order Method.

$$10 \frac{dy}{dx} = x^2 + y^2, y(0) = 1 \text{ with } h = 0.1$$

- 6 a.) Solve the differential equation $\frac{dy}{dx} = x + y$ using appropriate method within $0 \leq x \leq 0.2$ with initial condition $y(0) = 1$ and $h=0.1$.
- b. Solve the differential equation $\frac{d^2y}{dx^2} = y + x \frac{dy}{dx}, y(0) = 1, y'(0) = 0$ using Rk-2 method for $y(0.2) = 1, y'(0.2) = 0$ for $h = 0.1$
- 7 Write short notes on: (Any two)
- Errors in Numerical Method
 - Ill Conditioned System
 - Algorithm for NR method

"Best Wishes"

CLASSMATE
Date _____

21) 9x1

GANDAKI COLLEGE OF ENGINEERING AND SCIENCE
INTERNAL ASSESSMENT

Level: Bachelor Semester: 4th Year : 2024
 Programme: BE Computer/Software Full Marks: 100
 Course: Numerical Methods Pass Marks: 45
 Time : 3 hrs.

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 the questions.

1. a) What are the drawbacks of Newton Raphson Method? Solve the following equation $f(x) = xe^x - \cos x$ by Newton Raphson Method upto 4 decimal places. (2+6)
- b) Using secant method, find a positive real roots of the equation $x^3 - 3x + 1 = 0$, correct to 4 decimal places. 7

2. a) From the given data evaluate $f(2.5)$ by using Lagrange method. 8

x	1	2	4	5	7
F(x)	1	1.414	1.732	2.00	2.6

OR

- a) What is interpolation ? Find the value of $f(1.2)$ using appropriate interpolation technique.

x	1	1.4	1.8	2.2
F(x)	50	70	100	120

- b) Use the suitable method to fit a curve $y = ae^{bx}$ for the following data.

x	-2	-1	0	1	2	3	4
y	38	6	0	-5	-41	130	300

3. a) Compute the following using Simpson's 1/3 rule for $n= 8$ with an accuracy to five digit. 8

$$\int_{1}^{5} e^{-x^2} dx$$

$$a^n b^{2n} \cdot a^1 b^9 x^1$$

a 5

b) Evaluate the following using Gaussian three point Integration formula:

$$\int_2^4 (x^4 + 1) dx$$

4. a) Solve the following system of Linear equations using partial pivoting method.

$$x + y + z = 4, x + 4y + 3z = 8, x + 6y + 2z = 6$$

8

- b) Solve the following system of equations using Gauss Jacobi's method.

$$3x + 2y + z = 10, 2x + 3y + 2z = 14, x + 2y + 3z = 14$$

7

5. a) From the following differential equation estimate the value of $y(1)$ using RK 4th order.

8

$$dy/dx + 2x^2 y = 4 \text{ with } y(0) = 1 \text{ take } h=0.5$$

- b) Find the dominant eigen value and corresponding eigen vectors of the

matrix below using Power method. $\begin{pmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$.

7

6. a) Solve the Poisson equation $\nabla^2 f = -10(x^2 + y^2 + 10)$ over the square with $0 \leq x \leq 3; 0 \leq y \leq 3$ and $f = 0$ on boundary. Use $h = 1$.

8

- b) Solve the following differential equation for $y(0.4)$ using Heun's method.

7

$$d^2y/dx^2 + 2dy/dx - 3y = 6x; \text{ with } y(0) = 0 \text{ and } y'(0) = 1 \text{ (take } h=0.2).$$

7. Write short notes on: (Any two)

10

- a) Initial Value problems and Boundary value problems

- b) Algorithm for Matrix factorization method

- c) Schimidit method for Heat equation.

Final Internal Exam

Level: Bachelor

Programme: BE Computer 4th sem / Electrical 4th sem Year: 2024
Course: Numerical Methods Full Marks: 100 Time: 3 hrs

Attempt all questions.

Q>1(a) Find a real root of the $x^3 + x^2 + x + 7 = 0$ with error 0.0001 using bisection method. (8)

Q>1(b) Find the root of the equation $x^3 + x^2 - 1 = 0$ correct to 6 decimal place using fixed point iteration method. (7)

Q>2(a) Find the square root of 18 using NR method correct to 3 decimal place. (8)

Q>2(b) A third degree polynomial passes through (0,1), (1,-1), (2,-1) and (3,2). Find its value at $x = 4$ using forward difference interpolation. (7)

Q>3(a) Find the distance moved by a particle and its acceleration at the end of 4 seconds if the time versus velocity data is as follows: (8)

Time(t)	0	1	3	4
Velocity (v)	21	15	12	10

Q>3(b) Fit the exponential curve $y = ae^{bx}$ to the following data (7)

x	2	4	6	8	10
y	25	38	56	84	104

Q>4(a) Using Gaussian 2 point and 3 point quadrature formula, evaluate $\int (\tan^{-1} \frac{y}{x}) dx$ with lower limit 0 and upper limit 1. (8)

Q>4(b) Solve the following set of equation using LU factorization method (7)

$$x+2y+3z=5$$

$$2x+8y+22z=6$$

$$3x+22y+82z=-10$$

Q>5(a) Find the largest eigen value and corresponding eigen vector using power method (8)

$$A = \begin{pmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{pmatrix}$$

Q>5(b) Solve the first order IVP by RK-1: $y' = x+y$, $y(0)=0$ at $x=1$ taking $h=0.2$. (7)

Q>6(a) Solve the following boundary value problem by shooting method $y'' = 6x^4 - 4$, $y(0)=2$, $y(1)=5$ by applying RK-2 method. (8)

Q>6(b) Solve the equation $\nabla^2 u = -81xy$, $0 < x < 1$, $0 < y < 1$ with $h=1/3$, $u(0,y)=u(x,0)=0$ & $u(1,y)=u(x,1)=100$ (7)

Q>7 Write short notes on: (any two) (5*2=10)

(i) Gauss Jacobi method

(ii) Errors in Numerical Methods

(iii) Interpolation

MADAN BHANDARI COLLEGE OF ENGINEERING

URLABARI-6, MORANG

Level: Bachelor

Year: 2081

Programme: B.E Computer

Full Marks: 100

Course: Numerical Methods

Pass Marks: 45

Time: 3 hrs

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margins indicate full marks.

Attempt all the questions.

- 1) a) Using Bisection Method, find the root of the equation $4x^3 - 2x - 6 = 0$ up to three decimal places. [7]

OR

- b. Define error. Explain its types with sources of error in numerical computation.
- b. What are the working rules of fixed point iteration method? Using iteration method?

Find the root of the equation $x^3 + x^2 - 1 = 0$ correct to four decimal places.

[1+7]

- 2) a. Using Secant Method, find the root of the equation $x^3 - 2x - 5 = 0$ on the interval [2, 3] correct to three decimal places. [8]

- b. Find by Newton's method, the real root of the equation $3x = \cos x + 1$, correct to four decimal points. [7]

- 3) a. What is interpolation? Find the value of $f(1.2)$ using appropriate interpolation technique. [8]

x	1	1.4	1.8	2.2
$f(x)$	50	70	100	120

- b. Using Simpson's $\frac{1}{3}$ rule, evaluate $\int_0^{0.6} e^{-x^2} dx$ by taking $n = 6$ [7]

- 4) a. Evaluate the following using Gaussian three point Integration formula:

$$\int_0^1 \frac{dx}{1+x} \quad h = 0.1 / 0.2 \quad [7]$$

- b. Evaluate the integral $\int_0^{0.5} \left(\frac{x}{\sin x} \right) dx$ by using Romberg's method, correct to 3 decimal points. [8]

- 5) a. Solve by factorization method of the given equations [8]

$$\begin{aligned} 3x + 2y + 7z &= 4, \\ 2x + 3y + z &= 5, \\ 3x + 4y + z &= 7 \end{aligned}$$

b) Solve by Jacobi Iteration method of given equation:

[7]

$$\begin{aligned}20x + y - 2z &= 17, \\3x + 20y - z &= -18, \\2x - 3y + 20z &= 25\end{aligned}$$

6) a) Solve the following equation by Gauss-Seidel method

[8]

$$\begin{aligned}27x + 6y - z &= 85, \\x + y + 54z &= 120, \\6x + 15y + 2z &= 72\end{aligned}$$

OR

Solve by Gauss elimination method of given systems of equations:

$$\begin{aligned}2x - y + 3z &= 9, \\x + y + z &= 6, \\x - y + z &= 2\end{aligned}$$

b) Find the largest Eigen value and corresponding Eigen vector of given matrix using power method.

[7]

$$A = \begin{bmatrix} 2 & 5 & 1 \\ 5 & -2 & 3 \\ 1 & 3 & 10 \end{bmatrix}$$

7. Write short notes on: (Any two)

[2x5]

- a) Algorithm of fixed point iteration method
- b) Newton's backward difference interpolation formula
- c) ILL-conditioned of system of linear equations

Good Luck

POKHARA ENGINEERING COLLEGE
INTERNAL ASSESSMENT

Level: Bachelor
 Programme: BE Computer
 Course: Numerical Method

Semester – Spring Year : 2024
 Full Marks: 100
 Pass Marks: 45
 Time : 3hrs.

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 the questions.

1. a) Use the Newton's Raphson method to find a root of the function. 7
 Correct up to 4 decimal places.

$$f(x) = x^3 - 4x^2 + x + 6$$

- b) Apply Secant method to find the root of the equation. Correct up to 8
 4 decimal places.

$$x \sin x - 1 = 0$$

2. a) Find the Lagrange interpolation polynomial to fit the following 8
 data.

i	0	1	2	3
x_i	0.1736	0.3420	0.5000	0.6428
$e^x - 1$	0	1.7183	6.3891	19.0855

Use the polynomial to estimate the value of $e^{1.5}$.

- b) Given the data points

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

Fit a power function model of the form

$$y = ax^b$$

3. a) Use Romborg Integration to evaluate 8

$$\int_0^{3\pi/2} e^x \sin x \, dx$$

b) Solve the system of equation

7

$$3x_1 + 2x_2 + x_3 = 10$$

$$2x_1 + 3x_2 + 2x_3 = 14$$

$$1x_1 + 2x_2 + 3x_3 = 14$$

by using Doolittle LU decomposition method.

4 a) Obtain the solution of following system using Gauss-Seidel iteration method. 8

$$2x_1 + x_2 + x_3 = 5$$

$$3x_1 + 5x_2 + 2x_3 = 15$$

$$2x_1 + x_2 + 4x_3 = 8$$

b) Using Gauss-elimination with partial pivoting, solve the following set of equations 7

$$2x_1 + x_2 + x_3 - 2x_4 = 0$$

$$4x_1 + 0 \cdot x_2 + 2x_3 + x_4 = 8$$

$$3x_1 + 2x_2 + 2x_3 = 7$$

$$x_1 + 3x_2 + 2x_3 = 3$$

5 a) Solve the following equation for $y(0.2)$ 8

$$\frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - 3y = 6x$$

Given $y(0) = 0$, $y'(0) = 1$. Use RK method (2nd Order).

b) Use the classical RK method (4th order) to estimate $y(0.5)$ of the following equations with $h = 0.25$ 7

$$y'(x) = x + y, \quad y(0) = 1$$

6 a) Solve numerically the wave equation 8

$$f_{tt}(x,t) = 4 f_{xx}(x,t), \quad 0 \leq x \leq 5$$

with the boundary conditions:

$f(0, t) = 0$ and $f(5, t) = 0$ and initial values:

$$f(x, 0) = f(x) = x(5-x), \quad f_t(x, 0) = g(x) = 0$$

b) Solve the Poisson equation 7

$$\Delta^2 f = 2x^2 y^2$$

over the square domain $0 \leq x \leq 3$ and $0 \leq y \leq 3$ with $f = 0$ on the boundary and $h = 1$

Universal Engineering & Science College
Affiliated to Pokhara University
Chakupat, Lalitpur

403

Level: Bachelor **Semester: IV** **Year: 2024**
Programme : BE Computer **Time: 3 hours** **Full Marks: 100**
Course: Numericals Methods(new) **Pass Marks: 45**

Pre-Board Examination - 2081 (Spring 2023)

Candidates are requested to give their answers in their own words as far as practicable. The figure in the margin indicates full marks.

Attempt all the questions:

1. a) The equation $x \tan x = 1$ occurs in theory of vibrations. Find one of the positive real roots by using bisection method correct to at least three decimal places. 8

b) Find the square root of 7 using Newton Raphson method correct upto 4 decimal digit. 7

2. a) The following table given the percentage of criminals for different age groups. Using lagrange interpolation formula find the percentage of criminals under the age of 35. 8

Under age	25	30	40	50
% of criminals	52	67.3	84.1	94.4

- b) The voltage V across a capacitor at a time T seconds is given by the following table.

T	0	2	4	6	8
v	150	63	28	12	5.6

Use the principle of least squares to fit the curve of the form. $V = \alpha e^{\beta T}$ to the data.

3. a) Evaluate the integral $I = \int_0^{\frac{\pi}{2}} (\sin x) dx$ For n=6. Compare the result in both conditions for simpsons 1/3 rule and 3/8 rule. 7
- b) Evaluate the integral $\int_0^{10} \exp\left(\frac{-1}{1+x^2}\right) dx$ using the 2 and 3 point Gaussian quadrature formula. 8
4. a) Determine the largest eigen value and the corresponding eigen vector of the matrix using power method . 8
- $$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$
- b) Solve the following set of equation using Do little factorization method. 7
- $$3x+2y+z=10$$
- $$2x+3y+2z=14$$
- $$x+2y+3z=14$$
5. a) Solve the equation by Relaxationn method 8
- $$9x-y+2z=9, x+2y-2z=15, 2x-2y-13z=-17$$
- b) Applying runge kutta fourth order method to find an approximate value of y when X=0.3 given that: $y' = 2.5y + e^{0.3x}$ with an initial value $y(0)=1$, taking h =0.3. 7
6. a)solve the following differential equation within $0 \leq x \leq 0.5$ using Rk 4th order method $10d^2y/dx^2 + 2dy/dx - 3y = 5, y(0)=0, y'(0)=0$. Take h =0.25 8
- b) Solve Poisson's equation $U_{xx} + U_{yy} = 243(x^2+y^2)$ over a square domain $0 \leq x \leq 1, 0 \leq y \leq 1$ with step size h =1/3 with u =100 on the boundary. 7
7. Write short notes on:(Any two) 2*5=10

- a) ill conditioned system and well conditioned system
- b)cubic splines
- c)an algorithm for secant method

UNITED TECHNICAL COLLEGE

Semester- Spring

Level : Bachelor	Year : 2024
Program : BE Computer	Full Marks : 100
Course : Numerical Methods	P% Marks : 45
	Time : 3 hrs

Candidates are required to give their answers in their own words as far as practicable.

Attempt all the questions.

- 1 a What are the limitation of N-R method? Derive the formula for Secant Method. 8
 b Find the real equation $x^3 + x^2 - 1 = 0$ by the fix point iteration method correct to four decimal places.
- 2 a Find the distance moved by a particle and its acceleration at the end of 4 seconds, if the time versus velocity data is as follows. 8

t:	0	1	3	4
v:	21	15	12	12

- b Using the method of least squares, fit the curves $ax^2 + \frac{b}{x}$ to the following data. 7

x	1	2	3	4
y	1.51	0.99	8.88	7.66

- 3 a Find the value of $\cos(1.74)$ from the following table. 8

x	1.7	1.74	1.78	1.82	1.86
y	0.9916	0.9857	0.9781	0.9691	0.9584

- b The velocity v (km/min) of a moped which starts from rest, is given at 7 fixed intervals of time t (min) as follows

t:	2	4	6	8	10	12	14	16	18	20
v:	10	18	25	29	32	20	11	5	2	0

- 4 a Solve by Relaxation Method, the equations: 8

$$9x - 2y + z = 50; x + 5y - 3z = 18; -2x + 2y + 7z = 19$$

- b What is Ill conditioned method? Explain the impacts of ill conditioned 7 method with suitable numerical example.

- 5 a Use the Runge –Kutta 4th order method to estimate $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$ 8

- b Following equation by Picard's method $y'(x) = x^2 + y^2$, $y(0) = 0$ and 7 estimate $y(0.1)$, $y(0.2)$ and $y(1)$.

- 6 a Explain Shooting method with suitable example. 8

- b Solve the Poisson's equation $\nabla^2 f = (2+x^2)y$ over the square domain of 7 $0 \leq x \leq 3$ and $0 \leq y \leq 3$ with $f = 0$ on the boundary and $h = 1$

- 7 Write Short Notes on: (Any two) 10

- a Lagrange's Interpolation
- b Algorithm of Simpson's 3/8 Method
- c Algorithm of Gauss Jordan Method

Term Test I

Date:	2081/02/29	Full Marks	50
Level	BE	Time	
Programme	BCE		

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. What are the advantages and limitations of Newton Raphson method? Find the positive real root of the non-linear equation $xe^x = \cos(x)$ correct upto three decimal places using one of the bracketing methods. [3+7]
 2. Explain in brief the numerical errors with examples. Find the real root of the non-linear equation $f(x) = x^2 - x - 1$ using Newton Raphson method such that the absolute error is less than 10^{-3} . [4+6]
 3. What are the advantages and limitations of Lagrange interpolation? Using Newton divided difference interpolation find $f(12)$. [3+7]
- | | | | | | | |
|------|----|-----|-----|-----|------|------|
| x | 4 | 5 | 7 | 10 | 11 | 13 |
| f(x) | 48 | 100 | 294 | 900 | 1210 | 2028 |
4. The temperature of a metal strip was measured at various time intervals during heating and the values are given in the table below. [7]

time, t(min)	1	2	3	4
Temperature, T(Celsius)	70	83	100	124

 If the relationship between the temperature T and time t is of form $T = be^{t/4} + a$
 Estimate the temperature at $t = 6$ mins.

5. Evaluate

$$I = \int_0^6 \frac{1}{x^2+1} dx$$

Using trapezoidal, Simpson1/3 rule and Simpson 3/8 rule. Also compare them with exact integral value. [7]

OR

Use Gauss Legendre two point and three point formula to find the approximate integral value and compare with exact value.

$$I = \int_1^2 \frac{1}{x} dx$$

6. The table below shows the values of the distance travelled by a car at various time intervals during the initial running

Time, t(min)	5	6	7	8	9
Distance travelled, s(t) (km)	10	14.5	19.5	25.5	32

Estimate the velocity and acceleration at time $t=5$ min. [6]

OR

Solve the system of linear equations using Gauss elimination method with partial pivoting.

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

Date:	2081/03/07	Full Marks	50
Level	BE	Time	
Programme	BCE		
Semester	IV	1.5 hrs	

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Find the largest Eigen value and its corresponding Eigenvector for the following matrix. [8]

$$\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 2 \\ 1 & 2 & 2 \end{bmatrix}$$

2. Solve $\frac{d^2y}{dx^2} + \frac{2dy}{dx} + 6y = x$, with $y(0) = 0$, $y'(0) = 1$ for $y(0.2)$ taking $h = 0.2$ by RK4 method. [8]

3. Solve the following set of equations by using Gauss Jordon method. [8]

✓
$$\begin{aligned} 3x + 2y + 7z &= 4 \\ 2x + 3y + z &= 5 \\ 3x + 4y + z &= 7 \end{aligned}$$

4. Using shooting method solve the equation $\frac{d^2y}{dx^2} = 6x$, $y(1) = 2$, $y(2) = 9$ in the interval $(1, 2)$. [10]

5. Solve the equation $\Delta^2 u = -2(x^2 + y^2 + 1)$ over square plane with sides $x = 0, y = 0, x = 2$ and $y = 2$ with $u = 0$ on the boundaries and the mesh length $h = K = 1$. [8]

6. Solve the following system of linear equation using Gauss Seidel method. [8]

✓
$$\begin{aligned} 2x_1 + x_2 &= 4 \\ x_1 + 4x_2 + x_3 &= 12 \\ x_2 + 4x_3 &= 14 \end{aligned}$$