

POKHARA UNIVERSITY

Level: Bachelor

Semester – Spring

Year : 2006

Programme: BE

Full Marks: 100

Course: Numerical Methods

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) Find the real root of the equation $x^3 - 4x + 1 = 0$ that lies between 1 and 4, correct to three decimal places by using the Newton-Raphson method. 8

- b) Use fixed point iteration method to evaluate root of the equation $x^2 - x - 1 = 0$, correct up to 3-decimal places. 7

2. a) The velocity distribution of the fluid near a flat surface is given below:- 8

X(cm)	0.1	0.3	0.5	0.7	0.9
V(cms)	0.72	1.81	2.73	3.47	3.98

X is the distance from the surface using a suitable interpolation formula, obtain the velocity at $x=0.2$

- b) Use the data linearization method and determine the exponential fit of $y = C e^{Ax}$ for the following data: 7

X:	0	1	2	3	4
Y:	1.5	2.5	3.5	5.0	7.5

3. a) Evaluate the following integral 10

$$\int_0^{\frac{\pi}{2}} \sin x \, dx$$

Using

1. Trapezoidal Rule

2. Simpson's $\frac{1}{3}$ rule

3. Simpson's $\frac{3}{8}$

Comment on the result.

- b) Using secant method, find the root of the equation $x^6 - x^4 - x^3 - 1 = 0$. Correct upto 2-significant digit. 5

4. a) Monthly faculty salary in three departments of an institute is given below. Assuming that the salary for a particular category is same in all the departments, calculate the salary of each category of faculty. Use any suitable method. 7

Department	<u>Number of faculty</u>			Total in thousands.
	Prof.	Asst.prof.	Lect.	
A	2	2	4	60
B	3	1	2	50
C	1	4	3	60

- b) Use L -U factorization method to solve the following system of equations. 8
- $$x + y + z = 1$$
- $$3x + y - 3z = 5$$
- $$x - 2y - 5z = 10$$
5. a) Solve $y' = y + e^x$, $y(0) = 0$ for $y(0.2)$ and $y(0.4)$ by RK-4th order method. 7
- b) Use Heun's method to solve $y'' - xy + 4y = 0$; $y(0) = 3$; $y'(0) = 0$ at $x = 0.2$. Take $h = 0.1$ 8
6. a) In a square bar with dimension of 3 inch \times 3 inch, torsion function, ϕ , can be obtained from the following P.D.E: $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = -2$ 10
- where $\phi = 0$ on the outer boundary of the bar's cross-section. Subdivide the region into nine equal squares to form a mesh and find the values of ϕ in the interior nodes.
- b) Find the largest eigen value using power method current up to 2-significant digit. 5
- $$\begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & 1 \\ 1 & 0 & 2 \end{bmatrix}$$
7. Write shorts notes on (**Any Two**) : 5×2
- Ill-conditioned systems
 - Shooting method for solving boundary value problem
 - Cubic spline

POKHARA UNIVERSITY

Level: Bachelor Semester – Fall Year : 2009
 Programme: BE Full Marks : 100
 Course: Numerical Methods 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. Calculate the root of given equation using Bisection method; correct to three decimal points. $f(x) = \sin x - 2x + 1$. 8
- b. Find the root of equation $x^2 - 3x + 2 = 0$, correct to four decimal digits, using NR method. 7
2. a. Find the polynomial using Langrange's method; also calculate the absolute and relative error at $x=2.7$. 7

x	3.2	2.7	1.0	4.8
f(x)	22.0	17.8	14.2	38.3

- b. The heat of water H (ft) and the quantity of water Q (ft³) flowing per second are related by the law $Q = CH^\alpha$. Find out the best fit values for coefficients C and α for the following data: 8

H	5	10	15	20	25	30
Q	20	150	360	800	1500	2200

3. a. Integrate the given integral. 8

$\int_1^3 \cos x dx$, Using composite trapezoidal, Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule (use equal interval for all method).

- b. Using three point Gauss Legendre formula, evaluate $\int_{0.5}^{1.5} e^{-x^2} dx$. 7

4. a. Using Gauss Elimination method, solve the following system of linear equation. 8

$$\begin{array}{rclclclcl}
 10x & - & 7y & + & 3z & + & 5u & = & 6 \\
 -6x & + & 8y & - & Z & - & 4u & = & 5 \\
 3x & + & y & + & 4z & + & 11u & = & 2 \\
 5x & - & 9y & - & 2z & + & 4u & = & 7
 \end{array}$$

- b. Find the largest eigen value and corresponding eigen vector by power method. 7

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

5. a. Find the value of x at 2.0, using Heun's Method. 7
 $y' = x + y^2$; $y(1) = -8$, step size $h = 0.5$.
- b. Solve:
 $y'' + 2y' + 6y = x$ using RK-4th Method. Where $y(0) = 0$, $y'(0) = 0$ are the initial condition and find it for $y(0.2)$ taking $h = 0.2$ 8
6. a. A square metal sheet of side 30cm is floating in water such a way that two sides are in held 90° and another two sides are in 10° celcius. Calculate the interior temperature of the grid of size 10cm. solve the necessary equation using Gauss Seidal method. 10
- b. Find the square root of 17 using Fixed point iteration Method. 5
7. Write short notes on **(Any Two)**: 5×2
 - a. Chowleskys' LU Decomposition Method
 - b. Least Square Approximation
 - c. Initial and Boundary Value Condition

POKHARA UNIVERSITY

Level: Bachelor

Semester – Spring

Year : 2009

Programme: BE

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) Use False-position method to find the root of the following equation, correct upto two decimal places: 8

$$x^3 - 4x^2 + x + 6 = 0$$

- b) Find the root of the equation $f(x) = x \sin x + \cos x$ using Newton-Raphson method, correct up to three decimal places. 7

2. a) The velocity distribution of the fluid near a flat surface is given by the table below: 8

X (cm)	0.1	0.3	0.5	0.7	0.9
V (cm/s)	0.72	1.81	2.73	3.47	3.98

Where x is the distance from the surface. Using a suitable interpolation method, obtain the velocity at $x=2.5$

- b) Use regression method to fit the geometrical curve $y = ab^x$ to the data given below and obtain the value of y at $x=5.5$ 7

X	0	1	2	3	4	5	6	7
Y	10	21	35	59	92	200	400	610

3. a) Evaluate the following integral using Simpson's 3/8 Rule: 8

$$\int_1^2 (x^3 + 1) dx, \text{ using } n = 3.$$

- b) Evaluate the integral $\int_{-1}^1 e^x dx$ using two-point Gauss Legendre method. 7

4. a) Solve the following system of equation by Gauss-Seidel method (upto 3 iterations only) 8

$$28x + 4y - z = 32$$

$$x + 3y + 10z = 24$$

$$2x + 17y + 4z = 35$$

- b) Solve the following system of equation by Jacobi-Iteration method 7

$$3x + 4y + 15z = 54.8$$

$$x + 12y + 3z = 39.66$$

$$10x + y - 2z = 7.74$$

5. a) Use the Rk4 method to estimate $y(0.5)$ of the following equations with $h = 0.25$ 7

$$\frac{dy}{dx} = x + y, y(0) = 1$$

- b) Solve the second order differential equation 8

$y'' - x^2 y' - 2xy = 0$ for $y(0.1)$ and $y'(0.1)$, given that $y(0) = 1$, $y'(0) = 0$ using Heun's method Take step size $h = 0.1$

6. a) Solve the elliptic equation $U_{xx} + U_{yy} = 0$ for the following square mesh with boundary values as shown in the figure. Iterate until the maximum difference between two successive values at any point is less than 0.001. 8

- b) Determine the largest eigen value and corresponding eigen vector of the following matrix. 7

$$\begin{bmatrix} 3 & -1 & 1 \\ -2 & 4 & -3 \\ 0 & -1 & 1 \end{bmatrix}$$

7. Write short notes on: (**Any Two**) 2×5

- Gaussian Quadrature method
- Lagrange's Interpolation method
- Errors in Numerical calculation

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE

Semester – Fall

Year : 2010

Full Marks : 100

Pass Mark : 45

Time : 3 hrs

Course: Numerical Method

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 a root of the equation $x \sin x + \cos x = 0$ using Newton's Method so that relative error is less than 0.1%. 7
- b. Find a real root of the equation $x^3 - 2x - 5 = 0$ correct to three decimal places using secant method. 8
2. a. Find Newton's forward difference interpolating polynomial for the following 8

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.00	2.28

data. Use the obtained formula to estimate the value of $f(0.24)$.

- b. Fit an exponential equation of the form $y = ae^{bx}$ using the least square method from the following data. 7

x	1	2	3	4	5	6
y	1.65	2.70	4.50	7.35	12.2	15

3. a. Find the approximate value of $y = \int_0^{\pi} \sin x dx$, using 8
 - i. Trapezoidal Rule
 - ii. Simpson's 1/3 rule by dividing the range of integration into 6 equal parts.

- b. Evaluate the integral $I = \int_0^{10} \exp\left(\frac{-1}{1+x^2}\right) dx$, using Gauss quadrature 7
formula with $n = 2$ and $n = 3$.

4. a. Solve the following system of linear equations using Gauss Elimination Method. Use partial pivoting whenever necessary. 8

$$\begin{aligned} b+3c+2d &= 19 \\ 3b+2c+2d &= 20 \\ a+4b+2d &= 17 \\ -2a+2b+c+d &= 9 \end{aligned}$$

- b. Use LU decomposition method and solve 7

$$\begin{aligned} 5x_1 - 2x_2 + x_3 &= 4 \\ 7x_1 + x_2 - 5x_3 &= 8 \\ 3x_1 + 7x_2 + 4x_3 &= 10 \end{aligned}$$

5. a. Solve the differential equation for $y(0.25)$ using RK 4th order method. 7

$$10 \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 6x = 0$$
, with $y(0) = 1$ and $y'(0) = 0$. (take $h = 0.25$).

- b. Solve the differential equation $y' = x + y$ using appropriate method within $0 \leq x \leq 0.2$ with $y(0) = 1$. 8

6. a. Solve the Poisson equation, $\nabla^2 f = 2x^2 y^2$ over the square domain $0 \leq x \leq 3$ and $0 \leq y \leq 3$ with $f = 0$ on the boundary with $h = 1$. Show the necessary steps for solving simultaneous equations by any of the method known to you. 10
- b. Evaluate the square root of 3 using the equation $x^2 - 3 = 0$ by applying the fixed point iteration algorithm correct to three decimal places. 5

7. Write short notes (**Any Two**): 2×5
 - a. pivoting
 - b. algorithm to use bisection method
 - c. cubic spline interpolation

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Numerical Methods

Semester – Fall

Year : 2011
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) Find the root of the equation $x \sin x + \cos x = 0$ with accuracy 0.008, using False Position method. 8

- b) Using Secant method find a root of the equation $x - e^x + 2 = 0$ correct to three decimal places. 7

2. a) Prove that the Newton Raphson method is quadratic convergent. 7

- b) Estimate the value of $\sin \theta$ at $\theta = 25$ using Newton-Gregory forward difference formula with the help of the following table: 8

θ	10	20	30	40	50
$\sin \theta$	0.1736	0.3420	0.5000	0.6428	0.7660

3. a) Determine the constants a and b by the method of least square such that $y = ae^{bx}$ fits the following data: 7

$x :$	2	4	6	8	10
$y :$	4.077	11.084	30.128	81.897	222.62

- b) Evaluate the integral $I = \int_0^{\frac{\pi}{2}} \sin x dx$. Compare the result in both conditions for Simpson's 1/3 and 3/8 rule. 8

4. a) Solving the following system of Linear equations using L-U factorisation method. 8

$$\begin{aligned} 5x - 2y + z &= 4, \\ 7x + y - 5z &= 8, \\ 3x + 7y + 4z &= 10. \end{aligned}$$

- b) Using Gauss-Seidel iteration method solve: 7
- $$2x - 7y - 10z = -17,$$
- $$5x + y + 3z = 14$$
- $$x + 10y + 9z = 7$$

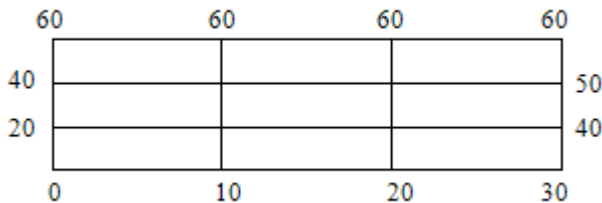
5. a) Solve the following differential equation within $0 \leq x \leq 0.5$ using RK 4th order method. $10 \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx} \right)^2 + 6x = 0$, with $y(0) = 1$ and $y'(0) = 0$. (take $h=0.25$) 8

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

6. a) Use Power method to find the largest Eigen value and corresponding Eigen vector for the following matrix. 7

$$\begin{pmatrix} 4 & 6 & 0 \\ 0 & 5 & 3 \\ 2 & 0 & 3 \end{pmatrix}$$

- b) Solve the Laplace's equation $U_{xx} + U_{yy} = 0$ in the domain of the figure given below: 8



7. Write short notes on **any two**: 2×5
- Romberg integration
 - Cubic spline interpolation
 - Laplacian equation

POKHARA UNIVERSITY

Level: Bachelor Semester – Fall Year : 2012
 Programme: BE 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) Find the roots of the equation by using Newton Raphson method. 7
 $f(x) = x - 1.5 \sin x - 2.5 = 0$
- b) Find the root of the equation $xe^x = \cos x$ using the false position method, correct to 3 decimal places. 8
2. a) Find a real root of $2x - \log_{10} x = 7$ correct to four decimal places using fixed point iteration method. 7
- b) The following table gives the population of a town during the last six census. Estimate using Newton's interpolation formula, the increase in population during the period 1946 and 1948 8

Year	1911	1921	1931	1941	1951	1961
Population (in 000)	12	13	20	27	39	52

3. a) The pressure and volume of a gas are related by the equation $PV^\gamma = C$, γ and C being constants. Fit this equation to the following set of observations. 7

P(kg/cm ²)	0.5	1.0	1.5	2.0	2.5	3.0
V (litres)	1.62	1.00	0.75	0.62	0.52	0.46

OR

Find the missing values of the following table 7

x	0	1	2	3	4	5	6
$F(x)$	-4	-2	-	-	220	546	1148

By Trapezoid and Simpson's rules

- b) Evaluate $\int_0^3 x^3 \sin(x^2) e^{x-3}$ 8
4. a) Break the following matrix into $[L]$ and $[L^T]$, where $[L]$ is a lower 7

triangular matrix and $[L^T]$ is transpose of $[L]$

$$\begin{bmatrix} 3 & 2 & 1 & : & 10 \\ 2 & 3 & 2 & : & 14 \\ 1 & 2 & 3 & : & 14 \end{bmatrix}$$

- b) Determine the largest eigenvalue and the corresponding eigenvector of the matrix: $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ using the power method.

8

5. a) Find the inverse of the matrix by using Gauss Jordan method.

7

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

- b) The mathematical model of an electrical circuit is given by

$$0.5 \frac{d^2 Q}{dt^2} + \frac{6dQ}{dt} + 50Q = 24 \sin 10t \text{ with } Q(0)=0 \text{ and } Q'(0)=0,$$

8

then find $Q(0.2)$ and $Q'(0.2)$ by fourth order Runge-Kutta method

then find $Q(0.2)$ and $Q'(0.2)$ by fourth order Runge-Kutta method

6. a) Using Euler's method. Find an approximation value of y

7

corresponding to $x = 1.04$ given $\frac{dy}{dx} = xy^{\frac{1}{2}}$ and $y = 1$ when $x = 1$.

- b) Give the values of $u(x,y)$ on the boundary of the square given in figure, evaluate $u(x,y)$ satisfying Laplace equation $\nabla^2 u = 0$ at the pivoted points of this figure

8

1000		1000		1000	1000
2000		u_1		u_2	500
2000		u_4		u_3	0
1000	500	0			

7. Write short notes on **any two**:

2×5

- a) Romberg Integration Method
- b) Shooting method
- c) Laplacian equation

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Numerical Methods

Semester – Spring

Year : 2012
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) Find at least one root of $x^3 - 2x - 5 = 0$ with accuracy 0.008% using Bisection method. 8
- b) Find a root of the equation $3x + \sin x - e^x = 0$ using secant method so that the relative error is less than 0.01%. 7
2. a) Given the data points as below- 8

i	0	1	2	3
X_i	1	2	3	4
$F(X_i)$	0.5000	0.3333	0.2500	0.2000

Estimate $F(2.5)$ by applying Cubic Spline technique.

- b) The velocity distribution of the fluid near a flat surface is given below : 7
- | | | | | | |
|-----|------|------|------|------|------|
| x : | 0.1 | 0.3 | 0.5 | 0.7 | 0.9 |
| v : | 0.72 | 1.81 | 2.73 | 3.47 | 3.98 |

Using suitable interpolation formula obtain the velocity at $x = 0.2$ and 0.4 .

3. a) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x^2}$ using Gauss quadrature formula with $n = 2$ and $n = 3$. 8
- b) Evaluate $\int_0^{0.6} x e^x$ using trapezoidal rule, simpson's $\frac{1}{3}$ rule and simpson's $\frac{3}{8}$ rule. Also state which method yields better result. 8
4. a) Solving the following system of Linear equations using L-U factorisation method. 8

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

$$5x + y - 5z = 8$$

$$3x + 7y + 4z = 11$$

7

b) Using Gauss –elimination method solve the equations:

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

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

$$x - y + z = 0$$

5. a) Solve the following differential equation within $0 \leq x \leq 0.5$ using 8

RK 4th order method. $5 \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx} \right)^2 + 3x = 0$, with $y(0)=1$ and $y'(0) = 0$. (take $h=0.25$)

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

6. a) Using Rung-Kutta method of fourth order, solve 8

$$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2} \text{ with initial condition } y(0)=1 \text{ at } x=0.2.$$

b) Find the largest eigenvalue λ_1 and the corresponding eigen vector V_1 of the matrix. 7

$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix} \text{ Using power method}$$

7. Write short notes on **any two**:

2×5

- Write the algorithm for the implementation of bisection method.
- Error in Numerical method
- Shooting method .

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Numerical Method

Semester: Fall

Year : 2013
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) Find a positive root of the equation $f(x) = \cos x - 3x + 1$ correct up to 3 decimal places using Bisection Method. 7
b) Calculate the root of non-linear equation $3x = \cos x + 1$ using Secant Method. 8
2. a) Find a real root of the equation: $x \log_{10} x = 1.2$ by using Newton-Raphson (NR) method such that the root must have error less than 0.0001%. 7
b) Use appropriate method of interpolation to get $\sin \theta$ at 45° from the given table 8

θ	10	20	30	40	50
$\sin \theta$	0.1736	0.3420	0.5000	0.6428	0.7660

3. a) From the following data 7

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

Fit a power function model of the form $y = ax^b$
- b) Evaluate the integral $I = \int_0^{\pi/2} \sqrt{\sin x} dx$ compare the result in both condition for Simpson 1/3 and 3/8 rule. 8
4. a) Find the inverse of the given matrix by applying Gauss Elimination Method (GEM) with partial pivoting technique. 8

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

- b) Solve the following system of equations by applying Gauss-Seidel 7

iterative method. Carry-out the interactions upto 6th stage.

$$28x+4y-z=32$$

$$X+3y+10z=24$$

$$2x+17y+4z=35$$

5. a) The voltage 'V' across a capacitor at a time 'T' seconds is given by the following table. Use the principle of least squares to fit the curve of the form: $V = \alpha e^{\beta T}$ to the data. 7

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

- b) Solve: $dy/dx=y-2x/y$, $y(0)=1$ in the range $0 \leq x \leq 0.2$ by using (1) Euler's method and (2) Heun's method. Comment on the results. Take $h=0.2$. 8

6. a) Using Runge Kutta method of order 4, solve the equation: 7

$$\frac{d^2 y}{dx^2} = 6xy^2 + y, y(0) = 1 \text{ and } y'(0) = 0 \text{ to find } y(0.2) \text{ and } y'(0.2). \text{ take } h=0.2.$$

- b) The steady-state two dimensional heat flow in a metal plate of size 30x30cm is defined by $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$. Two adjacent sides are placed at 100°C and other side at 0°C. Find the temperature at inner points, assuming the grid size of 10x10cm. 8

7. Write short notes on: (Any two) 2×5

- Romberg Integration.
- Laplacian Equation.
- Advantage of pivoting over Gauss Elimination method.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Numerical Method

Semester: Fall

Year : 2014
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) The flux equation of an iron core electric circuit is given by : 8
 $f(\Phi) = 10 - 2.1\Phi - 0.01\Phi^3$. The steady state value of flux is obtained by solving the equation, $f(\Phi) = 0$. By using any close-end method, estimate the steady state value of “ Φ ” correct to 3 decimal places.
- b) Evaluate one of the real roots of the given equation: $x.e^x - \cos(x) = 0$ by NR- method correct to at least 4 decimal places. 7
2. a) Find the missing term in the following table using suitable interpolation 7

X	0	1	2	3	4
Y	1	3	9	?	81

- b) The following table gives the heights, $x(\text{cm})$ and weights, $y(\text{kg})$ of five persons. 8

x	175	165	160	155	145
y	68	58	55	52	48

Assuming the “linear relationship” between x and y , obtain the regression line (x on y). Also obtain ‘ x ’ value for $y=40$.

3. a) The following table gives the displacement, $x(\text{cms})$ of an object at various of time, $t(\text{seconds})$. Find the velocity and acceleration of the object at $t=1.6$ sec. Using suitable interpolation method. 8

T	1.0	1.2	1.4	1.6	1.8
X	9.0	9.5	10.2	11.0	13.2

- b) Find the real root of the equation $X \log_{10} X - 1.2 = 0$ correct to four 7

places of decimal using Bracketing method.

4. a) Solve the following system of equations by applying Gauss Elimination Method(GEM) with partial pivoting technique. And also determine the determinant value. 8

$$\begin{aligned} 2x+2y+z &= 6 \\ 4x+2y+3z &= 4 \\ x-y+z &= 0 \end{aligned}$$

- b) Find the largest eigen value and the corresponding eigen vector correct upto 3 decimal places using power method for the matrix 7

$$A = \begin{pmatrix} 2 & -10 \\ -1 & 2 \\ 0 & -1 \end{pmatrix}$$

5. a) Solve the following system by using Gauss Seidel method: 7
- $$10x - 5y - 2z = 3; x + 6y - 10z = -3; 4x - 10y + 3z = -3.$$

- b) Given: $\frac{dy}{dx} = \frac{2x+e^x}{x^2+x e^x}$; $y(1)=0$. Solve for y at $x=1.04$, by using Euler's method(take $h=0.01$). 8

6. a) Solve: $\frac{dy}{dx} = 1+xz, \frac{dz}{dx} = -xy$ for $y(0.6)$ and $z(0.6)$ given that $y=0, z=1$ at $x=0$ by using Heun's method. Assume, $h=0.3$. 7

- b) Torsion on a square bar of size 9cm*9 cm 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
- Monotonic and oscillatory divergence in fixed point iteration method
 - An algorithm for Lagrange's interpolation polynomial
 - Relaxation method.