

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2024

Programme: BE

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) Write down the drawbacks of NR-method. Find a real root of the equation: $x^2 - 3x + 2 = 0$ by using NR- method in the neighbourhood of $x = 0$ correct to five significant digits. 8
- b) What is the difference between the convergence and divergence of a non-linear equation? Prove the oscillatory divergence and monotone divergence of the function: $f(x) = x^2 - 18$ by using Fixed point iterative method. 7
2. a) State an algorithm and convergence of second method. 7
- b) Estimate the value of $\sin\theta$ at $\theta = 25$ using newtons forward interpolation. 8

θ	10	20	30	40	50
$\sin\theta$	0.1736	0.3420	0.5	0.6428	0.7660

3. a) The growth of bacteria(N) in a culture after t hours is given by the following table 7

Timte t(hr)	0	1	2	3	4
Bacteria(N)	32	47	65	92	132

If the relationship between bacteria N and time t is of the form $N=ab^t$. Using least square approximation estimate the N at $t = 5$ hr.

- b) Integrate the given integral $\int_0^{\frac{\pi}{2}} \frac{\cos x}{\sqrt{1+\sin x}} dx$ using Gauss Quadrature Formula for N=2 and N=3. 8
4. a) Find the inverse of matrix using Gauss Jordan Method. 7

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

- b) Find the largest Eigen value and corresponding Eigen vector of the matrix. 8

$$A = \begin{bmatrix} 1 & 4 & 4 \\ 4 & 1 & 8 \\ 4 & 8 & 1 \end{bmatrix} \text{ using Power Method.}$$

5. a) Solve the following system of equations by using relaxation method 8
correct to two decimal places.

$$9x - y + 2z = 9$$

$$x + 10y - 2z = 15$$

$$2x - 2y - 13z = -17$$

- b) Use Taylor series method to solve the ordinary differential equation: 7
 $dy/dx = x^2 + y^2$ for $x = 0.5$ subject to the initial condition: $y(0) = 1$.

6. a) Solve: $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y$ for $x = 1.5$, given that $y = z = 1$ at $x = 1$ 8
by using Euler's method (take $h = 0.1$).
b) Solve Poisson's equation $u_{xx} + u_{yy} = 243(x^2 + y^2)$ over a square domain 7
 $0 \leq x \leq 1$, $0 \leq y \leq 1$ with step size $h = 1/3$ with $u = 100$ on the boundary.

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

- a) Newton's differentiation formulas
- b) Overview of PDEs
- c) Shooting method