

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Numerical Methods

Semester: Fall

Year : 2024  
Full Marks : 100  
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

$\theta$	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

Time 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 correct to two decimal places. 8
- $$9x - y + 2z = 9$$
- $$x + 10y - 2z = 15$$
- $$2x - 2y - 13z = -17$$
- b) Use Taylor series method to solve the ordinary differential equation:  $dy/dx = x^2 + y^2$  for  $x = 0.5$  subject to the initial condition:  $y(0) = 1$ . 7
6. a) Solve:  $\frac{dy}{dx} = x + z$ ,  $\frac{dz}{dx} = x - y$  for  $x = 1.5$ , given that  $y = z = 1$  at  $x = 1$  by using Euler's method (take  $h = 0.1$ ). 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
- Newton's differentiation formulas
  - Overview of PDEs
  - Shooting method