

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Numerical Methods

Semester: Fall

Year : 2021
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 $x^3 + x^2 - 3x - 3 = 0$ by secant method up to 8th iteration. Assume that the error should be less than 10^{-4} . 7

- b) Find the root of the equation $\log x - \cos x = 0$ correct to three decimal placed by using N-R method. 8

2. a) Define interpolation. From the following table, estimate the number of students who passed marks between 40 and 45: 8

Marks	: 30-40	40-50	50-60	60-70	70-80
No. of students :	30	40	50	38	31

- b) Fit cubic polynomial equations to the given data set and find the value of $f(3.7)$ and $f'(7.5)$. 7

X	2	4	7	9
f(X)	1	2	1	2

3. a) Integrate the following function by using Trapezoidal Rule, Simpson's 8

$$\frac{1}{3} \text{ rule and Simpson } 3/8 \text{ rule. Take } n = 6. \int_0^{\pi/2} \sin x \, dx$$

- b) Integrate the given integral $\int_0^{\pi/2} \frac{\cos x}{\sqrt{1 + \sin x}} \, dx$ 7

Using Gauss quadrature Formula for $n=2$ and $n=3$

4. a) Find the inverse of the matrix, using Gauss Jordan method. 8

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

- b) Find the largest Eigen-value and the corresponding Eigen-vector of the following square matrix using Power method. 7

$$\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & 4 \end{bmatrix}$$

5. a) Solve the following set of equations by using LU Crout method 7

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

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

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

- b) Apply R-K-4 method to solve $y(0.2)$ for the given equation 8

$$\frac{d^2y}{dx^2} + x \frac{dy}{dx} - y \text{ given that } y=1 \text{ and } \frac{dy}{dx} = 0 \text{ when } x=0.$$

6. a) In a square bar with dimension of 3 inch \times 3 inch, torsion function, ϕ , 8

can be obtained from the following P.D.E: $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = -2$ 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) Consider second order initial value problem $y'' - 4y' + 2y = e^t \sin(t)$ with $y(0) = 0.4$ and $y'(0) = -0.6$, using Heun's find value of $y(0.2)$ and $y'(0.2)$. 7

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

a) Taylor's series for solving ODE

b) Ill-Conditioned System

c) Classify the partial differential equation $U_{xx} + 2U_{xy} + U_{yy} = 0$