POKHARA ENGINEERINGN COLLEGE
INTERNAL ASSESSMENT

Level: Bachelor   Semester – Spring   Year : 2024
Programme: BE Computer   Full Marks: 100
Course: Numerical Method   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. Correct up to 4 decimal places.   7

   $f(x) = x^3 – 4x^2 + x + 6$

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

   $x\sin x - 1 = 0$

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

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   7

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

   Fit a power function model of the form

   $$y = ax^b$$

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

   $$2x_1 + x_2 + x_3 - 2x_4 = 0$$
   $$4x_1 \quad\quad + 2x_3 + x_4 = 8$$
   $$3x_1 + 2x_2 + 2x_3 \quad\quad = 7$$
   $$x_1 + 3x_2 + 2x_3 \quad\quad = 3$$

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

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

   with the boundary conditions:

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

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

   b) Solve the Poisson equation   7

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

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

7. Write Short notes on 2×5
   a) Bisection method
   b) Cubic spline interpolation
   c) Higher order derivatives.