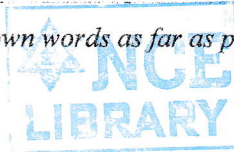


TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Chaitra

Exam.	Regular (New Course)		
Level	BE	Full Marks	60
Programme	BCE	Pass Marks	24
Year / Part	II / I	Time	3 hrs.

Subject: - Numerical Methods (ENSH 202)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks..
- ✓ Assume suitable data if necessary.



- Find a real root of $e^{0.5x+3} + \cos(0.4x) - 50 = 0$ precise to 4 significant figures using the bisection method.
- Write Jacobian matrix for the following system of non-linear equations and use Newton-Raphson method to approximate a solution correct to two decimal places taking $(x_0, y_0) = (2, 1)$ as initial guess values.

$$\begin{aligned} x^3 - y^2 &= 8 \\ x^2 + y^3 &= 6 \end{aligned}$$

- Solve the following system of linear equations using Do-Little's Factorization method.

$$\begin{bmatrix} 2 & 5 & 4 \\ 3 & 4 & 5 \\ 5 & 4 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 24 \\ 28 \\ 32 \end{bmatrix}$$

- Find dominant eigen value and corresponding vector of the given matrix using the power method.

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

- Construct divided difference table from the following data and use Newton's divided difference interpolation technique to approximate $y(9)$.

x	0	2	5	7	8	10
y	4.72	7.1	5.72	5.7	7.04	14.22

- Using the least square method, fit the following data to a curve of the form $y = ae^{bx}$.

x	2	4	6	8	10
y	4.1	11.2	30.2	81.9	204.6

- Evaluate the following integral using Gauss-Legendre 3-point formula and compare the result with exact value of the integral.

$$\int_0^4 \left(\cos\left(\frac{\pi x}{2}\right) + 5 \right) dx$$

- Derive the expressions to evaluate first and second order derivatives from a set of tabulated data using Newton's forward interpolation formula. Also derive the expressions for the initial point.
- Write a python program to solve an initial value problem involving a first order ordinary differential equation using Runge-Kutta fourth order method. The program should also show the results graphically.

- Using finite difference method, solve the following boundary value problem for three internal nodes.

$$y'' - 5y' + 4y = 5x, \quad y(2) = 4, \quad y(4) = 5$$

11. Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for a square mesh with the following boundary conditions using the finite difference method employing Gauss-Seidal iteration method to solve the equations.

$$0 \leq x \leq 1, \quad 0 \leq y \leq 1,$$

$$\Delta x = \Delta y = h = 1/3,$$

$$u(x, 0) = 360x, \quad u(x, 1) = 240(1 - x),$$

$$u(0, y) = 240y, \quad u(1, y) = 360(1 - y)$$

12. Derive the recurrence relation for solving one dimensional heat equation using Bender-Schmidt method and use it to solve the following problem for five time steps taking $\Delta x = h = 1$.

$$u_t = 0.5 u_{xx}, \quad u(0, t) = u(4, t) = 0, \quad u(x, 0) = 2x(4 - x)$$
