TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING

Examination Control Division

2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BME, BAME, BIE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Numerical Methods *(SH603)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define error and write its different types with examples. If x = 1.350253 is rounded off to Four significant digits, find absolute and relative errors. [4]

2. Write an algorithm to find a real root of a non linear equation using secant method. [6]

3. What are limitations of Newton-Raphson method? Using Newton-Raphson method, find a root of equation $x\sin x + \cos x = 0$ which is near to $x = \pi$. [2+4]

4. Solve the following system of linear equation using Gauss-Seidal method, correct to 3 decimal places. [8]

$$2x_1 + 6x_3 - 3x_4 = 31$$
$$6x_1 + 2x_4 = 14$$
$$-3x_1 + 5x_2 = 9$$
$$2x_1 + x_2 - 5x_3 + 9x_4 = -9$$

5. Obtain the dominant eigen value and its corresponding eigen vector of following matrix using Power Method. [8]

$$\begin{bmatrix} 1 & 4 & 4 \\ 4 & 1 & 8 \\ 4 & 8 & 1 \end{bmatrix}$$

6. Fit the curve of the form $y = a\log_e x + b$ to the following data sets. [8]

x	2	3	4	5	6	7
y	5.45	6.26	6.84	7.29	7.66	7.96

7. Approximate y(2) and y(10) using appropriate interpolation formula from the following data: [8]

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

8. Derive Newton-Cotes general quadrature formula for integration and use it to obtain Simpson's $-\frac{1}{3}$ rule of integration. [6]

9. Evaluate $\int_0^1 \frac{\tan^{-1} x}{x}$ using Gaussian 3 point formula. [4]

10. Solve the following boundary value problem using shooting method [10]
$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x$, with y(1) = 1 and y(2) = 5; Taking h = 0.25

11. Write a pseudo-code to solve an initial value problem of first order using Runge - Kutta 4 method. [4]

12. Derive recurrence formula for solving one dimensional heat equation $U_t = c^2U_{xx}$. Using it solve the heat equation $U_t = 0.5\,U_{xx}$, $0 \le x \le 5$, $0 \le t \le 4$ with boundary conditions $U(x, 0) = xe^x(5 - x)$, $U(0, t) = 0$ and $U(5, t) = 0$; taking h = 1. [4+4]

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