03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashadh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Numerical Methods

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any Five questions. Question No. 6 is compulsory.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

[T:16]

1. a) Find at least one root of $x^3 - 2x - 5 = 0$ with the accuracy of 0.08%, using Bisection method. [8]

   b) Find an approximate root of $x \log_{10} x - 1.2 = 0$ using secant method upto three decimal places of accuracy. [8]

2. a) Use a suitable method to fit an exponential curve $y = ae^{bx}$ for the following data: [8]

X	1	2	3	4	5
Y	1.65	2.7	4.5	7.35	12.2

   b) The followings are the measurement of t (time) made on a curve recorded by an oscillograph representing a change in the conditions of an electric current (I). [8]

t (time)	1.2	2.0	2.5	3.0
I	1.36	0.58	0.34	0.20

   Find the value of I when t = 1.6 with appropriate Newton's Gregory Interpolation method.

3. a) Evaluate $I = \int_0^2 \frac{(x^2 + 2x + 1)}{1 + (x+1)^4} dx$ using Gauss two point and three point formula. Also, compare results obtained from both the methods. [8]

   b) Find the largest Eigen value of the matrix $A = \begin{bmatrix} 2 & -2 & 4 \\ 2 & 3 & 2 \\ -1 & 1 & 1 \end{bmatrix}$ using power method. [8]

4. a) Solve the system of equations given using the Gauss elimination method with partial pivoting. [8]

$$2x_1 + x_2 + x_3 - 2x_4 = -10$$
$$4x_1 + 2x_3 + x_4 = 8$$
$$3x_1 + 2x_2 + 2x_3 = 7$$
$$x_1 + 3x_2 + 2x_3 - x_4 = -5$$

   b) Solve the following differential equation within $0 \le x \le 0.4$ using RK 4th order method. $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 6x$, with $y(0) = 0$ and $y'(0) = 1$. (take $h = 0.2$) [8]

5. a) A rod is rotating in a plane. The following table gives the angle θ(radian) through which the rod has turned for various values of the time t seconds. [8]

t	0	0.2	0.4	0.6	0.8	1.0	1.2
θ	0	0.12	0.49	1.12	2.02	3.20	4.67

   Calculate the angular velocity and angular acceleration of the rod, when t = 0.1 second.

   b) Solve the Poisson equation $\nabla^2 f = 2x^2y^2$, over the square domain of $0 \le x \le 3$ and $0 \le y \le 3$ with $h = k = 1$. Consider $f = 0$ at all its boundaries, $x = 0$, $y = 0$, $x = 3$ and $y = 3$. [8]

6. Develop algorithm, flowchart and program coding to interpolate at any points within a given set of data using Lagrange's interpolation method. [16]