Exam.Code:0940
Sub. Code: 6710

2053
B.E. (Mechanical Engineering)
Fourth Semester
MEC-404: Numerical Analysis

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each section. Use of simple calculator is allowed. All questions carry equal marks.

x-x-x

1. (a) Consider the number 52.43, which is correct to four significant figures. Find absolute error, relative error and percentage error.

(b) State Newton's formula to find a root of $f(x) = 0$. Why this method is also known as method of tangents? Write down its merits and demerits.

(c) What is the Lagrange's formula to find y, if $(x_0, y_0), (x_1, y_1), (x_2, y_2)$ are given?

(d) Write down the Euler's and modified Euler's method to solve:

$\frac{dy}{dx} = f(x, y), y(x_0) = y_0$. Explain the difference between them.

(e) Approximate $4x^3 + 2x^2$ using Chebyshev polynomial.

SECTION-A

2. (a) Find the number of term of the exponential series such that their sum gives sum of e^x correct to nine decimal places at $x = 1$.

(b) Find a root of the equation $x - \cos x = 0$ by using the Bisection method correct to three decimal places.Find the number of iterations required to achieve this such accuracy.

3. (a) Find a positive root of the equation $3x - \cos x - 1 = 0$by Newton method.

(b) Define forward, backward and shift operators. Derive the relation between them. Find the missing values in the following data using them:

x:	0	5	10	15	20	25
$f(x)$:	6	10	–	17	–	31

4. (a) Using Newton's divided difference formula, evaluate $f(8)$ and $f(15)$ from the following data:

x:	4	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	2028

(b) Find the value of x if $\sqrt[3]{x} = 3.756$ given the following data:

x	50	52	54	56
f(x)	3.684	3.732	3.779	3.825

P.T.O.

SECTION-B

5. (a) Solve the following equations by Gauss elimination method:

$$x + 4y - z = -5;\quad x + y - 6z = -12;\ 3x - y - z = 4.$$

(b) Find the smallest eigenvalue of the matrix $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ by using inverse power method.

6. (a) Compute $\int_0^1 \frac{x}{x^3+10}\,dx$ with 9 ordinates by Trapezoidal and Simpson's one-third rule.

(b) Given $\frac{dy}{dx} = 3x + y^2$, where $y(1) = 1.2$. Use Runge-Kutta method of second order to find approximate value of $y(1.1)$ correct to three decimal places.

7. (a) Using the finite difference method, find $f(0.25), f(0.5)$ and $f(0.75)$ satisfying the differential equation: $\frac{d^2y}{dx^2+y} = x$ subject to $y(0) = 0, y(1) = 2$.

(b) Economize the series given by $\sinh x = x + \frac{x^3}{6} + \frac{x^5}{120} + \frac{x^7}{5040} + - - -$ on $[-1, 1]$, allowing for a tolerance of 0.0005.

x-x-x