(37)

Exam.Code:0940
Sub. Code: 7049

1059

B.E. (Mechanical Engineering) Fourth Semester

MEC-404: Numerical Analysis

Max. Marks: 50

e allowed: 3 Hours

TE: *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.*

x-x-x

1 (a) Explain fixed point method. What is the condition for the convergence of fixed point iteration method? Find its order of convergence. $(5\times 2=10)$

(b) State Newton's forward and backward interpolation formulas.

(c) What is the use of power method? Explain.

(d) State Romberg's integration formula to find the value of $I=\int_a^b f(x)dx$ for first two intervals. Why it is better than trapezoidal formula?

(e) Obtain the finite difference scheme for the differential equation: $2y''(x)+y(x)=5$.

SECTION-A

II. (a) Write a note on error propagation and numerical instability. Find the number of terms of the exponential series such that their sum gives the value of e^x correct to six decimal places for all values of x in $0\le x\le 1$.

(b) Prove that the Regula-falsi method has linear order of convergence whereas secant method is super-linearly convergent. Explain, why?

III. (a) Find the quadratic factor of $f(x)=x^3-2x^2+x-2$ by Lin-Bairstow's method.

(b) Using Newton divided difference formula, find $f(x)$ as a polynomial in powers of $(x-3)$:

x:	5	11	27	34	41
$f(x)$:	23	899	17315	15600	68510

IV. (a) How Lagrange's formula can be used to express the rational function as a sum of partial fractions. Express $f(x)=\dfrac{x^2+x-3}{x^3-2x^2-x+2}$ as a sum of partial fractions.

(b) Explain inverse interpolation. Values of x and e^x are given below:

P.T.O.

$(1.4, 4.0552), (1.5, 4.4817), (1.6, 4.9530), (1.7, 5.4739)$. Find x when $e^x = 4.7115$, using the method of successive approximations.

SECTION-B

V. (a) Solve the following system of linear equations using Gauss-Seidel method:

$$x + 4y + z = 6,\ x + y + 4z = 6,\ 4x + y + z = 6.$$

(b) Reduce the matrix to the tri-diagonal form by Householder's method:

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}.$$

VI. (a) State Gerschgorin and Brauer theorems. Estimate the eigenvalues of the matrix and plot them: $A = \begin{bmatrix} 5 & 1 & 1 \\ 0 & 6 & 1 \\ 1 & 0 & -5 \end{bmatrix}$.

(b) Compute $I = \int_{-1}^{1} \frac{1}{x^2 + 1}\, dx$ using trapezium and Simpson's one-third rules by taking eight equal intervals.

VII. (a) Solve the boundary value problem using finite difference method : $\frac{d^2y}{dx^2} + y + x = 0, 0 < x < 1, y(0) = y(1) = 0.$

(b) Find the economized power series for $\cos x = 1 - \frac{x^2}{\angle 2} + \frac{x^4}{\angle 4} - -$ for $0 \le x \le 1$ with a tolerance of $\varepsilon = 0.02$. $(4 + 4 + 2)$

(c) Find the best lower order approximation to cubic polynomial: $5x^3 + 4x^2 + 7$ using Chebyshev's polynomials.

x-x-x