1019

Bachelor of Engineering (Mechanical Engg.)

4th Semester

MEC – 404: Numerical Analysis

Time allowed: 3 Hours

Max. Marks: 50

Note: Attempt _five_ questions in all, including Question No. 1 which is compulsory and selecting two questions each from Unit I - II. Use of simple calculator is allowed.

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I. Attempt the following questions:-

a) If X=0.4000 is correct to four significant digits, find the relative error in it. Also explain the significance of significant digits.

b) Define rate of convergence of an iterative method. Find the same for fixed point iteration.

c) Give the relationship between the divided differences and forward differences. What is the order of the approximation $f^1(x) \approx \frac{1}{h} \Delta f(x)$.

d) When do we use the power method? Does it give the sign of the largest value?

e) Write the Euler's and modified Euler's methods for solving the first order initial value problem. Also give their geometrical interpretation. (5×2)

UNIT – I

II. a) Explain how absolute error changes according to subtraction, multiplication and division.

b) It is given that C = 15300 ± 500. Find the maximum value of error in C^3.

c) Find the value of angle 'θ', when amplitude of sine wave becomes half of its peak value. (4,2,4)

III. a) Find the correct root to four decimal places of the equation: $x e^x = \cos x$.

b) The following data, represents the function $f(x) = \cos(x+1)$:

x:	0.0	0.2	0.4	0.6
f(x):	0.5403	0.3624	0.1700	-0.0292

Estimate the value of $f(0.5)$ using the Newton's backward difference interpolation. Also compare with the exact result. (5,5)

IV. a) Apply Hermite's formula to find a cubic polynomial which meets the following specifications:-

	x_k	y_k	y_k^1
x^1	0	0	0
x^2	1	1	1

b) Apply Lagrange's formula inversely to find the value of x when y=6, given the following table:-

x =	168	120	72	63
y =	3	7	9	10

(5,5)

P.T.O.

UNIT – II

V.   a)   Apply Gauss-Jordan method to find the inverse of:-

$$A = \begin{bmatrix} 50 & 107 & 36 \\ 25 & 54 & 20 \\ 31 & 66 & 21 \end{bmatrix}$$

b)   Solve the following system by Gauss-Seidel iteration method:-
$$-3x + 22y + 2z = 47, \ 5x + y + 20z = 67 \ and \ 45x + 2y + 3z = 58$$

(5.5)

VI.   a)   Find the largest eigen value and associated eigen vector for the matrix:-
$$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$

b)   Evaluate $I = \int_0^6 \frac{dx}{1+x^2}$ using Romberg's method of integration.   (5.5)

VII.   a)   Solve the boundary value problem:-
$$xy^{11} + y = 0, y(1) = 1, y(2) = 2 \ \text{by second order finite difference with}$$
$h=0.25$

b)   Find least square lim e for $f(t) = t^2$, over interval $(0,1)$.   (5.5)

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