*Roll No.* .............................

# OLE-24262

## B. Tech. 5th Sem. (MAE)

## Examination – April, 2021

### APPLIED NUMERICAL TECHNIQUES AND COMPUTING

**Paper : ME-311-F**

***Time : Three Hours ]*** ***[ Maximum Marks : 100***

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*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

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***Note :*** Question No. **1** is ***compulsory***. Attempt total ***five*** questions with selecting ***one*** question form each Section. All questions carry equal marks.

**1.** (a) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant figures and find its absolute error. We have $\sqrt{3} = 1.732, \sqrt{5} = 2.236, \sqrt{7} = 2.646$.

(b) Define forward differences and backward differences.

(c) Discuss initial value problems and B.V.P's.

(d) State Newton's backward Interpolation formula.

(e) Describe Numerical differentiation and Numerical integration.

(f) Write the finite difference approximations to partial derivatives in x and y directions

(g) Find by Taylor's series method, the value of $y$ at $x = 0.1$ and $x = 0.2$ from $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$.

(h) Express $1 + x - x^4$ as a sum of Chebyshev polynomials.

## SECTION – A

**2.** (a) Given that :

$a = 10.00 \pm 0.05$
$b = 0.0356 \pm 0.0002$
$c = 15300 \pm 100$
$d = 6200 \pm 100$

Find the maximum value of the absolute error in

(a) $a + b + c + d$

(b) $c3$

(b) If $R = 10x^3y^2z^2$ and errors in x, y, z are 0.03, 0.001, 0.02 respectively at $x = 3$, $y = 1$, $z = 2$. Calculate the absolute error, percentage error and relative error in evaluating R.

**3.** (a) Determine $f(x)$ as a polynomial in x for the following data :

| | | | | | |
|---|---|---|---|---|---|
| x : | –4 | –1 | 0 | 2 | 5 |
| f(x) : | 1245 | 33 | 5 | 9 | 1335 |

by using Divided Diff. Table. Hence Evaluate $f(4)$

(b) Fit a parabola, by the method of least squares, to the following data :

| | | | | | |
|---|---|---|---|---|---|
| x : | 1 | 2 | 3 | 4 | 5 |
| y : | 5 | 12 | 26 | 60 | 97 |

## SECTION – B

**4.** (a) Find f '(8) from the following data :

| | | | | | |
|---|---|---|---|---|---|
| x : | 3 | 5 | 11 | 27 | 34 |
| (f)x : | –13 | 23 | 899 | 17315 | 35606 |

(b) Use Simpson's $\frac{1}{3}$ rd rule to find $\int_0^{0.6} e^{-x^2}\,dx$ by taking seven ordinates.

**5.** (a) Find a real root of the equation $3x = \cos x + 1$ by Bisection Method correct to four decimal places.

(b) Using Newton-Raphson formula, find a root of the equation $x\sin(x) + \cos(x) = 0$ up to three decimal places.

## SECTION – C

**6.** (a) Solve the system

$$2x + 4y + z = 3$$
$$3x + 2y - 2z = -2$$
$$x - y + z = 6$$

by using Gauss Jordan method

(b) Solve the equations :

$$10x - 2y - 3z = 205;$$
$$-2x + 10y - 2z = 154;$$
$$-2x - y + 10z = 120$$

by using iterative method

**7.** 7 Transform the matrix to tri-diagonal form by using Householder's method

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

Also find the Eigen values and corresponding eigen vectors.

## SECTION – D

**8.** (a) Using Runge- Kutta method, compute y(0.2) and y (0.4) from

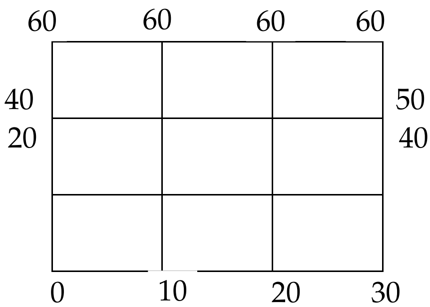
$$\frac{dy}{dx} = 3x + \frac{1}{2}y,\ y(0) = 1$$

(b) Give $\dfrac{dy}{dx} = x^2(1+y)$

$$y(1) = 1,\ y(1.1) = 1.233,\ y(1.2) = 1.548,\ y(1.3) = 1.979$$

Evaluate y(1.4) by using Milne's Method.

**9.** (a) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mess with boundary values as show n




(b) Determine the largest eigen value and the corresponding eigen vector of the matrix.

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