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TMA–502

B. TECH CSE (THIRD SEMESTER)
END SEMESTER
EXAMINATION, Jan., 2023
COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) Explain need of Normalized Floating Point Number Representation. Take an appropriate example to explain underflow

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and overflow condition of errors in normalized floating-point Addition, Subtraction, Multiplication and Division. (CO1)

(b) With the help of graphical representations explain all the steps involved in Newton Raphson Method along with the occurrence of fail condition. Solve the given equation using Newton Raphson Method : (CO1)

$$x.\sin x + \cos x = 0$$

(c) Explain the concept of strictly Diagonal Dominant Matrix. Solve the following system of equations using Gauss Seidel Iterative Method correct up to 3 decimal place. (CO1)

$$2x_1 - 3x_2 = -7$$

$$x_1 + 3x_2 - 10x_3 = 9$$

$$3x_1 + x_3 = 13$$

2. (a) The following table gives the scores secured by 100 students in the Numerical Analysis subject : (CO2)

Range of scores	Number of students
30—40	25
40—50	35
50—60	22
60—70	11
70—80	7

Use Newton's forward difference interpolation formula to find :

(i) The number of students who got scores more than 55.

(ii) The number of students who secured scores in the range between 36 & 45.

(b) If $f(x)$ is a polynomial and given that : (CO2)

$f(4) = 270$, $f(5) = 648$, $\Delta f(5) = 682$, $\Delta^3 f(4) = 132$

Find the value of $f(5.8)$ using Gauss's backward formula.

(c) Given the following table, using interpolation with unequal interval find $f(x)$ as a polynomial in powers of $(x-5)$: (CO2)

x	$f(x)$
0	4
2	26
3	58
4	112
7	466
9	922

3. (a) A tank is discharging water through an orifice at a depth of x meter below the surface of the water whose area is A m_2. Following are the values of x for the corresponding values of A. (CO3)

A	x
1.257	1.5
1.39	1.65
1.52	1.8
1.65	1.95
1.81	2.1

1.962	2.25
2.123	2.4
2.295	2.55
2.462	2.7
2.65	2.85
2.827	3

Using the formula (0.018) $T = \int_{1.5}^{3.0} \frac{A}{\sqrt{x}} dx$,

Calculate T, the time (in second) for the level of the water to drop from 3.0 m to 1.5 m above the orifice.

(b) Evaluate the given integral, step size $= \frac{6}{7}$: $\int_0^6 \frac{x^2+2}{x^2+1} dx$ (CO3)

(c) Do comparative analysis of all the numerical methods for solving integral equation in terms of speed and reliability. Also write the formula of each one and discuss no. of sub-interval required for each. (CO3)

4. (a) Given that $\frac{dy}{dx} = \log_{10}(x+y)$ with the initial condition that y = 1 when $x = 0$. Find y for $x = 0.2$ and $x = 0.5$ using Euler's modified formula. (CO4)

(b) Given $\frac{dy}{dx} = xy$ with $y(1) = 5$. Using the Fourth Order Runge-Kutta Method, find the solution in the interval (1, 1.5) using step size $h = 0.1$. (CO4)

(c) Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$, And $y(0.1)$, $y(0.1) = 1.06$, $y(0.2) = 1.12$, $y(0.3) = 1.21$. (CO4)

Evaluate $y(0.5)$ by Milne's Predictor-Corrector Method.

5. (a) Explain some benefits of using Graphical representation of frequency distribution; also discuss Histograms and Frequency curve graphical representation for frequency distribution with example. (CO5)

(b) Given the points : (– 1, 3) (0, 1), (1, 2), (3, 9) (CO5)

(i) Find the least-squares parabola $f(x) = ax^2 + bx + c$ for the points.

(ii) Use $f(x)$ to estimate all x so that $f(x) = 10$.

(c) A farmer collected data on the annual rainfall, x cm, and the annual yield of peas, p tones per acre. The data for annual rainfall was coded using $V = \frac{x-5}{10}$ the following statistics were found. (CO5)

$S_{vv} = 5.753$, $S_{PV} = 1.688$, $S_{PP} = 1.168$, $\overline{P} = 3.22$, $\overline{V} = 4.42$

(i) Find the equation of the regression line of p on v in the form $p = a + bv$.

(ii) Using your regression line estimate the annual yield of peas per acre when the annual rainfall is 85 cm.