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TMA–502

B. TECH. (CSE) (FIFTH SEMESTER) END SEMESTER EXAMINATION, Dec., 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) Find a real, which lies between 2 and 3 of the equation $x\log_{10}x-1.2=0$ using the method of bisection. (CO1)

(b) By using fixed point iteration method, find a real root of $2x-\cos x-3=0$ correct to three decimal places. (CO1)

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(c) Solve the following equations by Gauss-Seidel method upto 4 iterations : (CO1)

$$x + y + 54z = 110$$
$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$

2. (a) Find the Lagrange interpolating polynomial of degree 2 approximating the function $y = \ln x$ defined by the following table of values. Hence determine the value of ln 2.7. (CO2)

x	$y = \ln x$
2	0.69315
2.5	0.91629
3	1.09861

(b) The population of a city as follows : (CO2)

Year (x)	Population in lakhs (y)
1941	20
1951	24
1961	29
1971	36
1981	46
1991	51

Estimate the population during the period 1946 to 1976.

(c) Prove the following relations : (CO2)

(i) $E = \Delta + 1$

(ii) $E = e^{hD}$

(iii) $\Delta - \nabla = \delta^2$

(iv) $\Delta\nabla = \Delta - \nabla$

3. (a) Using Newton's divided difference formula, find $f'(10)$ and $f''(10)$ from the following table : (CO3)

x	$f(x)$
3	–13
5	23
11	899
27	17315
34	35606

(b) Determine the solution of one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ with boundary condition $u(0,t) = u(1,t) = 0,\ t > 0$ and initial condition $u(x,0) = x$ by using finite difference method. (CO3)

(c) Using Euler's Modified method find the solution of the equation $\frac{dy}{dx} = x + \sqrt{y}$, with initial condition $y = 1$ at $x = 0$, for the range $0 \le x \le 0.6$ in steps of 0.2. (CO3)

4. (a) Fit a straight line to the following data : (CO4)

x	y
6	5
7	5
7	4
8	5
8	4
8	3
9	4
9	3
10	3

(b) Explain curve fitting and its significance. Also fit a second degree parabola to the following data : (CO4)

x	y
1989	352
1990	356
1991	357
1992	358
1993	360
1994	361
1995	361
1996	360
1997	359

(c) What is Cubic Spline Interpolation ? Calculate Cubic Splines for the given data and find $y(0.5)$: (CO4)

X	0	1	2
Y	–5	–4	3

5. (a) Explain Correlation and Correlation Coefficient. (CO5)

The following marks have has obtained by a class of students in statistics :

Paper I	Paper II
80	81
45	56
55	50
56	48
58	60
60	62
65	64
68	65
70	70
75	74
85	90

Compute the coefficient of correlation for the above data and find the lines of regression.

(b) For 10 observations on price (x) and supply (y), the following data were obtained (in appropriate units) : (CO5)

$\Sigma x = 130$, $\Sigma y = 220$, $\Sigma x^2 = 2288$, $\Sigma y^2 = 5506$, and $\Sigma xy = 3467$

Obtain the two lines of regression and estimate and estimate the supply when the price is 16 units.

(c) Obtain a regression place by using multiple linear regression to fit the data given below : (CO5)

X	Y	Z
1	12	0
2	18	1
3	24	2
4	30	3