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221TME100022303

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester M.Tech Degree Regular and Supplementary Examination December 2023 (2022 scheme)

Discipline: MECHANICAL ENGINEERING

Course Code & Name: 221TME100 COMPUTATIONAL METHODS FOR ENGINEERS

Max. Marks: 60 Duration: 2.5 Hours

PART A

Answer all questions. Each question carries 5 marks Marks

1 Explain significant figures and truncation error. An approximate value of π is given by 3.1428571 and its true value is 3.1415926. Find the absolute and relative errors. (5)

2 By the method of Least squares, find the straight line that best fit the following data (5)

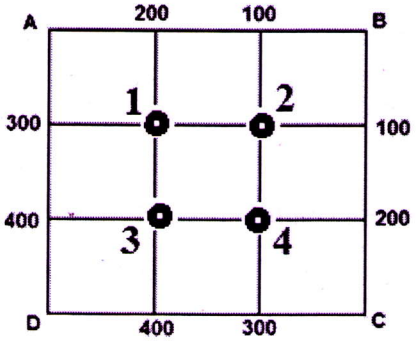
x	1	2	3	4	5
$y = f(x)$	14	27	40	55	64

3 A function $y = f(x)$ is given by the following table. Estimate *the first and second derivatives at 2 (i.e. f '(2) and f ''(2)) using a forward difference scheme. .* (5)

x	0	1	2	3	4
$y = f(x)$	176	185	194	207	228

4 Solve $dy/dx = x + y$, $y(0) = 1$ with $h = 0.2$ at $x = 1$ by Euler's method (5)

5 Solve the elliptic equation $Uxx + Uyy = 0$ for the following square mesh with boundary values as shown below using Liebmann method (5)



PART B

Answer any 5 questions. Each question carries 7 marks

6 Find a real root of the equation $x^3 - x - 11 = 0$ using bisection method, correct to three decimal places. (7)

7 Solve the following system of equations by Gauss-Jordan method. (7)

$5x - 2y + 3z = 18$

$x + 7y - 3z = -22$

$2x - y + 6z = 22$

8 By the method of least squares, find a second order variation that best fits the data (7)

x	0	1	2	3	4
y	1	5	10	22	38

Hence, estimate y (1.5).

9 Evaluate (7)

$$\int_0^1 \frac{dx}{1+x^2}$$

by two point and three point Gassian quadrature formula. Weights and abscissae for two point are {1,1} and {-0.57735, 0.57735} respectively. Weights and abscissae for three point are {0.55555, 0.88889, 0.55555} and {-0.77460, 0.00000, 0.77460} respectively.

10 Solve (7)

$$\frac{dy}{dx} = \frac{1}{x+y}$$

with $x_0 = 0$, $y_0 = 2$ at $x = 0.4$ taking $h = 0.2$ by Runge-Kutta fourth order method

11 Use Lagrange's interpolation to find the value of y at $x = 6$ from the following data. (7)

x	3	7	9	10
y	168	120	72	63

12 Solve by Bender-Schmidt's method $U_t = 5U_{xx}$ with conditions $U(0,t)$ 0 , $U(5,t) = 60$ and $U(x,0) = 20x$ for $0 < x \leq 3$, $U(x,0) = 60$ for $3 < x \leq 5$ for 5 time steps having $h = 1$. (7)

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