No. of Printed Pages : **2**

Sl. No.

21MAT3E2AL

M.Sc. III Semester Degree Examination, April/May - 2023

MATHEMATICS

Computational Techniques

Time : 3 Hours Maximum Marks : 70

Note : *Answer* ***any five*** *questions with Question No.* ***1 compulsory****. Each question carry* ***equal*** *marks.*

1. (a) Briefly explain the concept of Geometrical interpretation and error analysis of the trapezoidal rule of the order h^2. **7**

(b) Evaluate $\int_0^{\infty} \frac{e^{-x}}{1+x^2}\,dx$. Using Guass-Laguerre two-point and three-point formula. **7**

2. (a) Define initial value problem. Discuss the Taylor-series method to find the numerical solution of the differential equation $\frac{dy}{dx} = f(x, y)$ at the initial condition $y(x_0) = y_0$. **7**

(b) Using modified Euler's method. Obtain the solution of Differential equation $\frac{dy}{dt} = y + e^x$, with the initial condition $y(0) = 0$ for $x = 0.2$ and $x = 0.4$. **7**

3. (a) Derive the Milne's predictor formula for the solution of the initial value problem $y' = f(y)$; $y(x_0) = y_0$. **7**

(b) Use the linear shooting method to compute the solution of the following boundary value problem $y'' = y$, $y(0) = 0$ and $y(1) = 1$. **7**

4. (a) Solve $4u_{xx} = u_{tt}$, given $u(0, t) = 0$, $u(4, t) = 0$, $u(x, 0) = 0$ and $u(x, 0) = x(4 - x)$. Take $h = 1$. Find the solution upto 4 steps in t-direction. Using Bender-Schmidt Scheme. **7**

(b) Derive the five point formula for solving Laplace equation using finite differences. **7**

P.T.O.

5. (a) Fit the line $y = a + bx$, using the following data by least square method. **7**

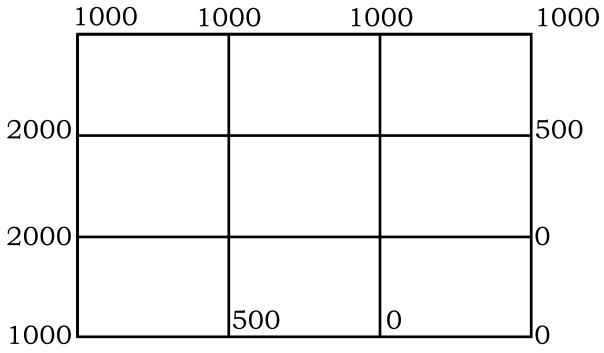
x_i	0	1	2	3	4
y_i	1	1.8	3.3	4.5	6.3

(b) Briefly explain the method of curve fitting by a sum of exponentials. **7**

6. (a) Using Galerkin method to solve the following BVP described by the differential equation **7**
$u'' + u + x = 0$, $0 < x < 1$ subject to the boundary conditions $u(0) = 0$, $u'(1) = 0$.

(b) Using Runge-kutta method find $y(0.2)$ for the equation $\frac{dy}{dx} = x + y$ and **7**
$y(0) = 1$ taking $h = 0.1$

7. (a) Given the values of $u(x, y)$ on the boundary of the square in the following figure, evaluate the function $u(x, y)$ satisfying the Laplace equation $\nabla^2 u = 0$ at the pivotal points of this figure by Jacobi's method. **7**



(b) Explain method of fit a line by least squares. **7**

8. (a) Discuss the classification of second order partial differential equation and give one example in each case. **5**

(b) Briefly explain the stability of Runge-Kutta method. **5**

(c) What is Regression analysis ? And explain it's types. **4**

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