No. of Printed Pages : **3**

21MAT3E2AL

Sl. No.

M.Sc. III Semester Degree Examination, April/May - 2024

MATHEMATICS

Computational Techniques

(NEP)

Time : 3 Hours   Maximum Marks : 70

Note : *Answer **any five** of the following questions with Question No. **1 (Q.1)** is **Compulsory**. Each question carries **equal** marks.*

1. (a) With the usual notation derive the Newton-cotes formula and hence derive Simpsons one third formula. **5**

(b) A tank is discharging water through on orifice at a depth of 'x' metres below the surface of the water whose area is 'Am^2'. The following are the table of 'x' for corresponding value of 'A'. **5**

A	1.257	1.39	1.52	1.65	1.809	1.962	2.123	2.295	2.462	2.65	2.827
x	1.50	1.69	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00

Using the formula (0.018) $T = \int_{1.5}^{3} \frac{A}{\sqrt{x}} dx$,

Calculate 'T' the time in seconds for the level of the water to drop 3.0 m to 1.5 m above the orifice.

(c) Evaluate the approximate value of the integral $\int_{2}^{4} \frac{e^x}{\sin x + x} dx$ by using. **4**

(i) Gauss-Chebyshev three point formula

(ii) Gauss-Legendre three point formula

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

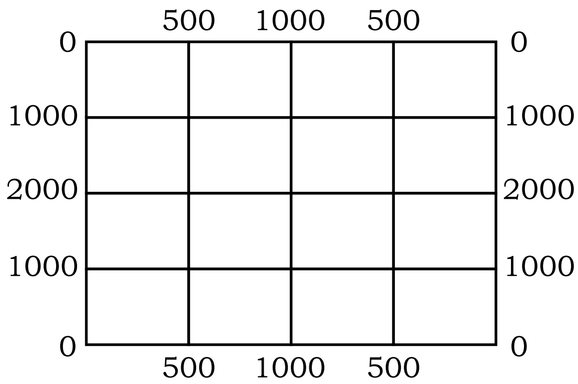
(b) Using Modified Euler's method. Compute $y(0.2)$ from $\frac{dy}{dx} = x + y$; $y(1) = 2$ taking step size $h = 0.1$. Compare the results obtained by this method with the results obtained by analytical method. **7**

3. (a) Discuss the Milne's Predictor-Corrector method to find the numerical solution of the differential equation. **10**

$$\frac{dy}{dx} = f(x, y);\ y(x_0) = y_0$$

(b) Using Galerkin Method solve the following BVP described by the differential equation $u'' + u + x = 0$, $0 < x < 1$ subjected to the boundary conditions $u(0) = u(1) = 0$. **4**

4. (a) Solve the Elliptic equation $u_{xx} + u_{yy} = 0$ for the square mesh of the figure with boundary value as shown. **7**



(b) Solve the PDE $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subjected to the boundary condition. **7**

$u(x, 0) = \sin \pi x$, $0 \le x \le 1$; $u(0, t) = u(1, t) = 0$. Carry out computation's for two levels, taking $h = 1/3$ and $k = 1/36$.

5. (a) Fit the least square for the curve $y = ax^3$ with the following data and hence estimate 'y' at $x = 6$ **7**

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

(b) Explain the non-linear regression with an example. **7**

6. Using Euler's method. Find the value of $y(0.1)$, $y(0.2)$ and $y(0.3)$ for $\frac{dy}{dx} = xy + y^2$; $y(0) = 1$. **14**

Hence find the value of $y(0.3)$ by using Adams-Bashforth-Moulton method.

7. (a) Explain the Liebmann's iteration process for solving Laplace equation. **7**

(b) Fit the normal equations and hence find the best fit value of x, y and z in the Least square sence from the following equations. **7**

$x+2y+z=1;$

$2x+y+z=4;$

$-x+y+2z=4;$

$4x+2y-5z=-7.$

8. (a) Explain the stability of Runge-Kutta method. **5**

(b) Explain the shooting technique for numerical solution of the BVP for ordinary differential equation. **5**

(c) Discuss the classification of Partial differential equation. **4**

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