(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2022 ONLY)

22UMS306

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : NOVEMBER-2023

COURSE NAME: B.Sc.-MATHEMATICS **MAXIMUM MARKS: 50**

SEMESTER: III **TIME : 3 HOURS**

PART - III

NUMERICAL TECHNIQUES

SECTION – A (10 X 1 = 10 MARKS)

ANSWER ALLTHE FOLLOWING QUESTIONS. (K1)

MULTIPLE CHOICE QUESTIONS.

1. Which of the following is an iterative method?
   a) Gauss elimination b) Gauss Jacobi c) Gauss Jordan d) None

2. In Gregory – Newton Forward Difference Formula, p =__________.
   a) $\frac{x-x_0}{h}$ b) $\frac{x+x_0}{h}$ c) $\frac{x}{h}$ d) $\frac{x_0}{h}$

3. Newton's forward difference formula for the first derivative is $\left(\frac{dy}{dx}\right)_{x=x_0} =$ ________.
   a) $\frac{1}{h}\left(\Delta y_0 + \frac{1}{2}\Delta^2 y_0 + \frac{1}{3}\Delta^3 y_0 + \ldots\right)$ b) $\frac{1}{h}\left(\Delta y_0 - \frac{1}{2}\Delta^2 y_0 + \frac{1}{3}\Delta^3 y_0 - \ldots\right)$
   c) $\frac{1}{h}\left(\Delta^2 y_0 - \Delta^3 y_0 + \frac{11}{12}\Delta^4 y_0 - \ldots\right)$ d) $\frac{1}{h^2}\left(\Delta y_0 + \Delta^2 y_0 + \frac{11}{12}\Delta^4 y_0 + \ldots\right)$

4. Euler's method is ___________.
   a) $y_{m+1} = y_m - h\,f(x_m, y_m)$ b) $y_{m+1} = h\,f(x_m, y_m)$
   c) $y_{m+1} = y_m + hf(x_m, y_m)$ d) $y_{m+1} = f(x_m, y_m)$

5. Laplace equation is _____________.
   a) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ b) $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial y^2} = 0$ c) $\frac{\partial u}{\partial x^2} + \frac{\partial u}{\partial y^2} = 0$ d) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. Write a note on Gauss elimination method.
7. Write Newton's forward interpolation formula.
8. Write Trapezoidal rule.
9. Write second order Runge - Kutta Method.
10. State Libermann's iterative formula.

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Solve by Gauss elimination method the equations.

$$2x + y + 4z = 12$$
$$8x - 3y + 2z = 20$$
$$4x + 11y - z = 33$$

(OR)

b) Write the comparison of Gauss Elimination method and Gauss Seidal Iteration methods.

12. a) The following data are from the steam table:

Tempurature °C	140	150	160	170	180
Pressure kg f/cm^2	3.685	4.854	6.302	8.076	10.225

Using the newton's formula find the pressure of the steam for a temperature of 142°.

(OR)

b) Find out the divided difference of y_x, given that

x	**1**	**2**	**4**	**7**	**12**
y	**22**	**30**	**82**	**106**	**206**

13. a) Find the forward difference table for the following data.

x	0.60	0.65	0.70	0.75
y	0.6221	0.6155	0.6138	0.6170

(OR)

b) Using the trapezoidal rule, evaluate $\int_{0.6}^{2} y\, dx$ from the following table:

x	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
y	1.23	1.58	2.03	4.32	6.25	9.36	10.23	12.45

14. a) Apply the local Taylor series method to find the value of $y(1.1)$ correct to three decimal places given that $y' = xy^{1/2}, y(1) = 1$ taking the first three terms of the Taylor series Expansion.

(OR)

b) Given $y' = -y$ and $y(0) = 1$, determine the values of y at x = (0.01)(0.01)(0.03) by Euler's Method.

15. a) Write the standard five-point formula and the diagonal five-point formula.

(OR)

b) Explain the solution of Laplace's equation by iteration.

SECTION – C (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

16. a) Find By Gauss Elimination, the inverse of the matrix $\begin{bmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{bmatrix}$ (K4)

(OR)

b) Solve by Gauss – Seidal Method of Iteration the Equations (K4)

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

17.a) The following data gives the melting point of an alloy of Lead and Zinc, where t is the temperature in deg-C and p is the percentage of Lead in the alloy.

p	**40**	**50**	**60**	**70**	**80**	**90**
t	**184**	**204**	**226**	**250**	**276**	**304**

Using Newton's interpolation formula, find the melting point of the alloy containing 84 percent of lead. (K5)

(OR)

b) By means of Newton's Divided Difference Formula, find the value of f(8) given (K5)

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

18. a) From the following table of values of x and y, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x=1.05(K4)

x	**1.00**	**1.05**	**1.10**	**1.15**	**1.20**	**1.25**	**1.30**
y	**1.00000**	**1.02470**	**1.04881**	**1.07238**	**1.09544**	**1.11803**	**1.14017**

(OR)

b) Use Romberg's method to compute $\int_0^1 \frac{1}{1+x^2}\, dx$ correct to 4 decimal places. (K4)

19.a) Solve the equation $\frac{dy}{dx} = 1 - y$ with the initial condition x = 0, y = 0 using Euler's Improved method and tabulate the solutions at x = .1, .2, .3, .4 . (K4)

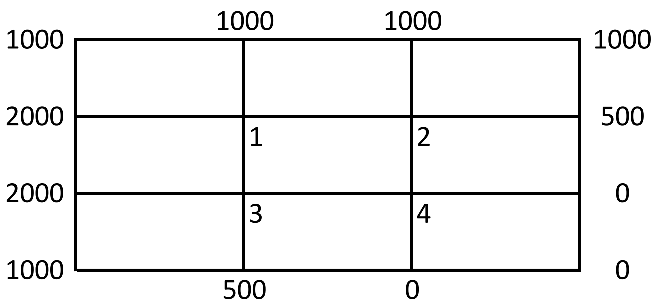
(OR)

b) Prove that the solution for the equation $\frac{dy}{dx} = y, y(0) = 1$ yields $y_n = (1 + h + \frac{1}{2}h^2)^m$, using second order Runge Kutta Method. (K4)

20. a) Solve the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$, the square with sides x = 0 = y, x = 3 = y with u=0 on the boundary and mesh length =1. (K5)

(OR)

b) Given the values of u(x,y) on the boundary of the square given in the figure, evaluate the function u(x, y) satisfying Laplace's equation $\nabla^2 u = 0$ at the pivotal points of this figure. (K5)



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