KUMARAGURU
college of technology
character is life

B.TECH DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Fourth Semester

BIOTECHNOLOGY

U18MAT4102: Numerical Methods

COURSE OUTCOMES

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems

CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables

CO3: Find the trend information from discrete data set through numerical differentiation.

CO4: Estimate integrals from discrete data through numerical methods

CO5: Predict the system dynamic behavior through solution of ODEs modeling the system

CO6: Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. Can we apply iteration method to find the root of the equation 2x=cosx+3 in $\left[0, \frac{\pi}{2}\right]$? Justify?   CO1 [K$_1$]

2. What is Newton's algorithm to solve the equations $x^2 = 12$ CO1 [K$_1$]

3. Use Lagrange's formula, to find the quadratic polynomial through (0,0),(1,1) and (2,4)   CO2 [K$_1$]

4. What is the principle of least square?   CO2 [K$_1$]

5. Compare Trapezoidal rule and Simpson's 1/3rd rule.   CO3 [K$_4$]

6. Define Simpson's 3/8th rule.   CO4 [K$_1$]

7. By Euler's method, find y(1.1) given $y' = x + y, y(1) = 0$.   CO5 [K$_1$]

8. Find y(0.02) using improved Euler's method, given $y' = x^2 + y, y(0) = 1$.   CO5 [K$_1$]

9. What is the order of error for solving Laplace and Poisson's equations by finite difference method?   CO6 [K$_1$]

10. Define the Bender Schmidt's difference scheme in general form.   CO6 [K$_1$]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Solve the system of equations 4x+2y+z=14, x+5y-z=10, x+y+8z=20 using **8** CO1 [K₃]
Gauss-Seidal iteration method.

   b) Find numerically largest eigen value of $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ using power method. **8** CO1 [K₁]

12. a) From the following table of half-yearly premium for policies maturing at **8** CO2 [K₅]
different ages, estimate the premium for policies maturing at age 46 and 63

Age x:	45	50	55	60	65
Premium y:	114.84	96.16	83.32	74.48	68.48

   b) Use the Newton divided difference formula to find f(1.5) from the following **8** CO2 [K₁]
table

x:	1	1.3	1.6	1.9	2.2
y:	0.7651977	0.6200860	0.4554022	0.2818186	0.1103623

13. a) Find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ at x=1.1 for the following data. **8** CO3 [K₁]

x:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
f(x):	7.989	8.403	8.781	9.129	9.451	9.750	10.031

   b) Use the Newton divided difference formula to find $f''(3)$ from the following **8** CO3 [K₁]
table

x:	0	1	2	4	5	6
y:	1	14	15	5	6	19

14. a) The velocity v(km/min) of a moped which starts from rest, is given at fixed **6** CO4 [K₃]
intervals of time t(min) as follows. Identify approximate distance covered in 12
minutes, by using Trapezoidal rule.

x:	0	2	4	6	8	10	12
y:	0	10	18	25	29	32	20

b)   Solve $\int\limits_{1}^{2}\int\limits_{1}^{2}\dfrac{dxdy}{x+y}$ by using Simpson's 1/3 rule, taking $\Delta x = \Delta y = 0.25$ **10**   CO4   [K3]

15. a)   Solve the initial value problem $\dfrac{dy}{dx} = x - y^2$, y(0)=1 ,y(0.1)=0.9917,   **8**   CO5   [K3]

y(0.2)=0.8494 find (i) y(0.3) and using R.K.fourth order method, (ii) y(0.4) using Milne's predictor corrector method.

b)   Solve the initial value problem $\dfrac{dy}{dx} = x^2 + y^2, y(0) = 1$, find y(0.1) and y(0.2) using   **8**   CO5   [K3]

Taylor's series method .

16. a)   Using Crank-Nicolson's method solve $u_{xx} = u_t,$ $0 < x < 1, t > 0$ given   **8**   CO6   [K3]

that $u(0,t) = 0, u(4,t) = 0$ and $u(x,0) = \dfrac{x}{3}(16 - x^3).$ Compute $u_{ij}; i = 1,2,3,4$ and $j = 1,2$

b)   Solve $u_{xx} + u_{yy} = 0$ numerically for the following mesh with boundary   **8**   CO6   [K3]

conditions as shown below:

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