Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (Regular), JULY 2022

(2021 Scheme)

Course Code: **21MD204-A**

Course Name: **Numerical Methods**

Max. Marks: **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Find a real root between 3 and 4 of $2x - \log_{10} x = 7$ correct to four decimal places using iteration method. [Choose $x_0 = 3.6$]
2. Solve the following system of equations by Gauss Seidel method

$$3x + y = 11$$
$$2x + 5y = 16$$

3. Using linear interpolation, find T, at $t = 4$.

Time t seconds	Temperature T^0C
1	10
3	15
5	20

4. Use Trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering 5 subintervals.
5. Given $\frac{dy}{dx} = 1 - y$ with $y = 0$ for $x = 0$. Find y approximately for $x = 0.1$ by Euler's method.
6. Write down the formulas for the fourth order Runge – Kutta method.
7. What is the classification of the equation $(1 + x^2)u_{xx} + (5 + 2x^2)u_{xt} + (4 + x^2)u_{tt} = 0$.
8. What is the classification of the equation $y^2u_{xx} - 2xyu_{xy} + x^2u_{yy} + 2u_x - 3u = 0$.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Find a real root of the equation $x^3 - 4x - 9 = 0$ correct to four decimal places by Regula – Falsi method. (6)

OR

10. Using Newton Raphson Method, find a real root of the equation $x^3 - 3x - 5 = 0$ correct to four decimal places. (6)

MODULE II

11. Use gauss elimination to solve the system (6)

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

OR

12. Solve using relaxation method (6)

$$5x + 2y + z = -12$$
$$-x + 4y + 2z = 20$$
$$2x - 3y + 10z = 3$$

MODULE III

13. Using Newton's forward formula, find $f(1.6)$ from the following table. (6)

x	1	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

OR

14. Find the curve of best fit of the type $y = ae^{bx}$ to the following data by the method of least squares: (6)

x	1	5	7	9	12
y	10	15	12	15	21

MODULE IV

15. The table given below reveals the velocity v of a body during the time t specified. Find its acceleration at $t = 1.1$ (6)

t	1.0	1.1	1.2	1.3	1.4
v	43.1	47.7	52.1	56.4	60.8

OR

16. A train is moving at the speed of 30 m/sec. Suddenly breaks are applied. The speed of the train per second after t seconds is given by (6)

Time (t)	0	5	10	15	20	25	30	35	40	45
Speed (v)	30	24	19	16	13	11	10	8	7	5

Apply Trapezoidal rule and Simpson's three – eighth rule to determine the distance moved by the train in 45 seconds.

MODULE V

17. Given that $\frac{dy}{dx} = \log_{10}(x + y)$ with the initial condition that $y = 1$ when $x = 0$. Find y for $x = 0.2$ and $x = 0.5$ using Euler's modified formula. (6)

OR

18. Given $\frac{dy}{dx} = y - x, y(0) = 2$. Find $y(0.1)$ and $y(0.2)$ correct to four decimal places using Runge – Kutta Method. (6)

MODULE VI

19. Find the dominant eigen value of $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and the corresponding eigen vector. (6)

OR

20. Solve the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = 0 = y, x = 3 = y$ with $u = 0$ on the boundary and mesh length $= 1$. (6)

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