ISLAMIAH COLLEGE(AUTONOMOUS)

LAB MANUAL

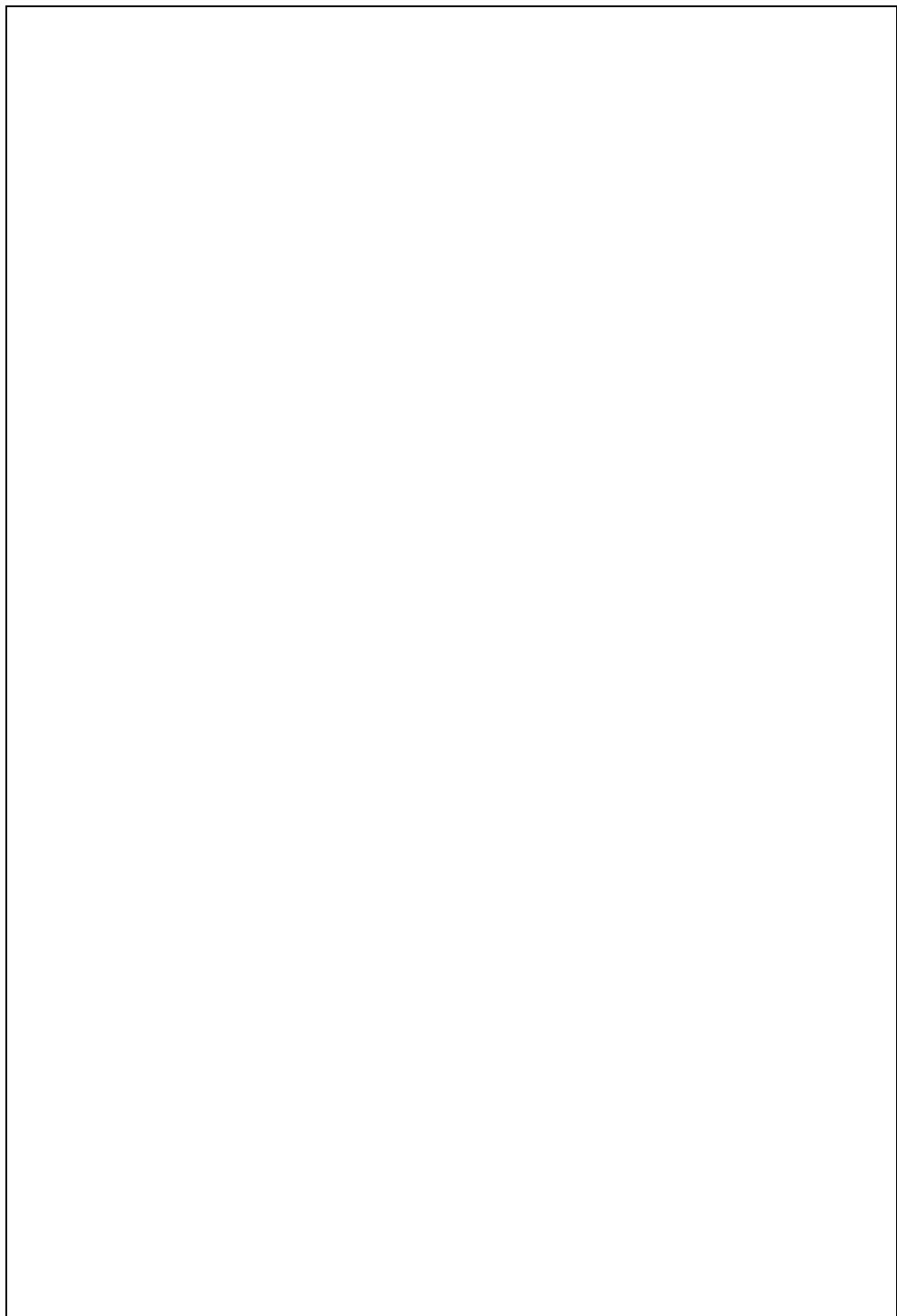**PROBLEM SOLVING TECHNIQUES – II**

U8MSAP21

For the Candidates admitted from the academic year 2018 – 2019

By

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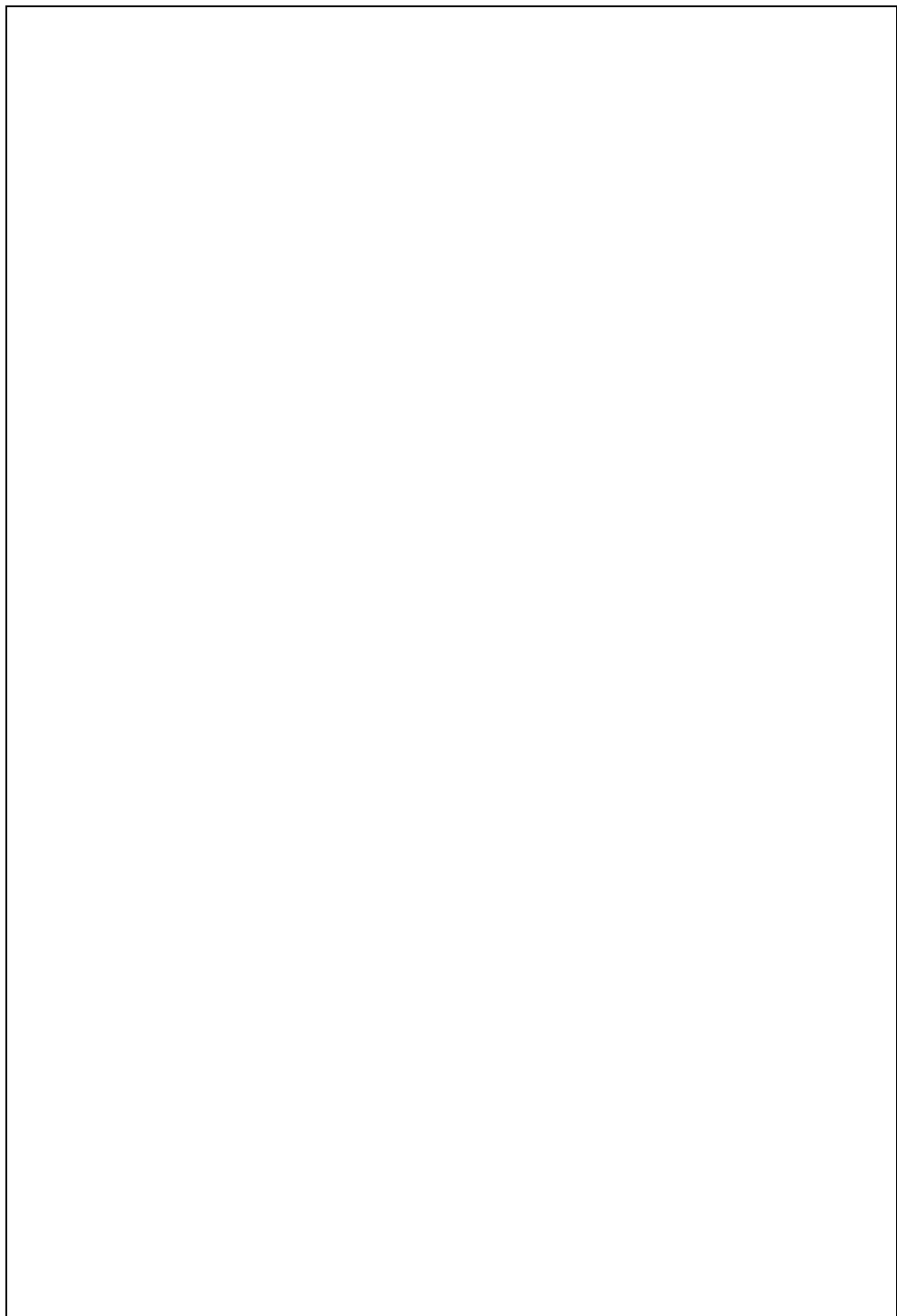**VANIYAMBADI – 635 752**

U8MSAP21   Problem Solving Techniques – II

2 Hours / Week

List of Exercises

1. Numerical Differentiation.

2. Numerical Integration.

3. Numerical Solutions to Ordinary Differential Equations.

4. Testing Consistency of System of Equations.

5. Applications of Integrations to Area and Volume.

Ex. No. 1 Numerical Differentiation

Date:

1. Calculate $f'(x)$ at $x = 1$ and $h = 10^{-4}$ where $f(x) = \tan^{-1} x$, and also find the error using backward difference formula.

    Command:

    Output:

2. Calculate $f'(x)$ at $x = 1$ and $h = 1$ where $f(x) = \tan^{-1} x$, and also find the error using backward difference formula.

    Command:

    Output:

3. Calculate $f'(x)$ at $x = 1$ and $h = 10^{-2}$ where $f(x) = \tan^{-1} x$, and also find the error using central difference formula.

    Command:

    Output:

4. Calculate $f\ '(x)$ at $x = 1$ and $h = 2$ where $f(x) = \sin^{-1} x$, and also find the error using backward difference formula.

    Command:

    Output:

5. Calculate $f\ '(x)$ at $x = 1$ and $h = 10^{-3}$ where $f(x) = \tan^{-1} x$, and also compute the error using forward difference formula.

    Command:

    Output:

6. Calculate $f\ '(x)$ at $x = 1$ and $h = 10^{-5}$ where $f(x) = \cos^{-1} x$, and also find the error using backward difference formula.

    Command:

    Output:

7. Calculate $f'(x)$ at $x = 1$ and $h = 10^{-4}$ where $f(x) = \tan^{-1} x$, and also compute the error using forward difference formula.

Command:

Output:

8. Calculate $f'(x)$ at $x = 1$ and $h = 2$ where $f(x) = \tan^{-1} x$, and also find the error using backward difference formula.

Command:

Output:

9. Calculate $f'(x)$ at $x = 1$ and $h = 5$ where $f(x) = \tan^{-1} x$, and also find the error using central difference formula.

Command:

Output:

10. Calculate $f\ '(x)$ at $x = 1$ and $h = 2$ where $f(x) = \tan^{-1} x$, and also find the error using backward difference formula.

Command:

Output:

Ex. No. 2 Numerical Integration

Date:

1. Compute $\int_0^5 \sin x \, dx$.

   Command:

   Output:

2. Compute $\int_1^2 e^{-x^2} dx$.

   Command:

   Output:

3. Compute $\int_0^4 \cos x \, dx$.

   Command:

   Output:

4. Compute $\int_0^2 \frac{1}{2x^3 - 2x + 5} \, dx$

Command:

Output:

5. Compute $\int_1^2 e^{-x^3} dx$.

Command:

Output:

6. Compute $\int_0^5 \frac{1}{2x^3 + 2x + 5} \, dx$

Command:

Output:

7. Compute $\int_1^5 e^{x^5} dx$.

Command:

Output:

8. Compute $\int_0^5 \frac{1}{2x^3 + 2x + 2} \, dx$

Command:

Output:

9. Compute $\int_0^\pi \sin x \, dx$.

Command:

Output:

10. Compute $\int_0^2 \cos x \, dx$.

Command:

Output:

Ex. No. 3 Numerical Solutions to Ordinary Differential Equations.

Date:

1. Solve the differential equation $\frac{dy}{dt} = ty$.

   Command:

   Output:

2. Solve the differential equation $\frac{dy}{dt} = ty$ with the initial condition y (0) = 2.

   Command:

   Output:

3. Solve $(D^2 + 5D + 4)y = 0$.

   Command:

   Output:

4. Solve $(D^2 - 9)y = 0$.

   Command:

   Output:

5. Solve the differential equation $\frac{dy}{dx} + 4\,y(x) = e^{-x}; y(0) = 1$.

   Command:

   Output:

6. Solve $(D^2 + n^2)y = 0$.

   Command:

   Output:

7. Solve Compute $\int_1^5 e^{-x^2}dx$.

   Command:

   Output:

8. Solve $(D^2 + D + 1)y = e^x$.

   Command:

   Output:

9. Solve $\frac{dy}{dx} + ax = 0$.

   Command:

   Output:

10. Solve $\frac{d^2y}{dt^2} + n^2x = 0$.

    Command:

    Output:

Ex. No. 4 Testing Consistency of System of Equations.

Date:

1. Examine the consistency of the equation

$$x + y + z = 1,$$

$$3x + 4y + 5z = 1,$$

$$2x + 3y + 4z = 1.$$

Command:

Output:

2. Find whether the following equations are consistent

$$x + 2y + 2z = 2$$

$$3x - 2y - z = 5$$

$$2x - 5y + 3z = -4$$

$$x + 4y + 6z = 0$$

Command:

Output:

3. Find whether the following equations are consistent

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$x + 3y + 5z = 14$$

Command:

Output:

4. Find whether the following equations are consistent

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$x + 2y + \lambda z = \mu$$

Command:

Output:

5. Examine the consistency of the equations

$$x + y + z = 6,$$

$$x - y + 2z = 5,$$

$$3x + y + z = 8,$$

$$2x - 2y + 3z = 7.$$

Command:

Output:

6. Discuss the consistency of the following system of equations.

$$4x + 3y + 6z = 25$$

$$x + 5y + 7z = 13$$

$$2x + 9y + z = 1$$

Command:

Output:

7. Test the consistency of system of equations

$$a + b + c = 3$$

$$3a - 5b + 2c = 8$$

$$5a - 3b + 4c = 14.$$

Command:

Output:

8. Show that the following equations are not consistent.

$$2x + 6y + 11 = 0$$

$$6x + 20y - 6z + 3 = 0.$$

$$6y - 18z + 1 = 0.$$

Command:

Output:

9. Show that the following equations are consistent.

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

$$3x + 6y + 2z = 10$$

$$2x + 9y - z = 12.$$

Command:

Output:

10. Test the consistency of system of equations

$$a - 4b + 7c = 14$$

$$3a + 8b - 2c = 13$$

$$7a - 8b + 26c = 5.$$

Command:

Output:

Ex. No. 5 Applications of Integrations to Area and Volume.

Date

1. Calculate the area enclosed between the x-axis, and the curve
    $y = x^3 - 2x + 5$ and the ordinates $x = 1$ and $x = 2$.

    Command:

    Output:

2. Find the area under the curve: $f(x) = x^2 \cos(x)$ for $-4 \leq x \leq 9$.

    Command:

    Output:

3. Find the area under the curve: $f(x) = x^2 \sin(x)$ for $-4 \leq x \leq 3$.

    Command:

    Output:

4. Find the area under the curve: $f(x) = x\cos(x)$ for $0 \leq x \leq \pi$.

Command:

Output:

5. Find the area under the curve: $f(x) = x\sin(x)$ for $0 \leq x \leq \frac{\pi}{2}$.

Command:

Output:

6. Calculate the volume of cone if the height is 12 cm and the radius is 7 cm.

Command:

Output:

7. Calculate the volume of cone if the height is 10 cm and the radius is 8 cm.

Command:

Output:

8. Calculate the volume of cylinder if the height is 16 cm and the radius is 4 cm.

    Command:

    Output:

9. Calculate the volume of sphere if the radius is 7 cm.

    Command:

    Output:

10. Calculate the volume of sphere if the radius is 10 cm.

    Command:

    Output: