**COURSE OUTLINE**

1. Introduction to Differential Equations

- Linear dependence

- Classification of Ordinary Differential Equations

\* Order

\* Degree

\* Linearity.

2. First Order ODEs

- Types and Techniques of solution of first order ODE’s

\* Integration Methods

- Direct Integration

- Separation of Variables

- Integrating Factor

\* Substitution Methods

- Homogeneous 1st order equations

- Bernoullis’s Equations

- Exact Differential Equations

- Numerical methods for solving ODEs

\* Euler’s Method

\* Improved Euler’s Method

\* Runge-Kutta Method

\* Picard’s iterative method

- Physical applications of first order ODE.

3. Theory and solutions of higher order linear equations; physical applications.

4. Ordinary differential equations with constant coefficients

- Methods of undetermined coefficients

- Variation of parameters

- D-Operator.

5. Linear Differential Equations with Variable coefficients.

6. Cauchy-Euler’s equations

7. Systems of linear operations

8. Properties of linear operations

9. Series solution

8. First order non-linear equations

- Autonomous

- Equidimensional

- Scale-invariant