

17HS005 DIFFERENTIAL EQUATIONS

Course Description and Objectives:

The main purpose of the course is to introduce students to the theory and methods of ordinary and partial differential equations. Students should be able to implement the methods taught in the course to work associated problems, including proving results of suitable accessibility. This course is designed to prepare students to solve problems arising from many applications such as mathematical models of physical or engineering processes.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1	Explore some of the basic theory of linear ODEs, recognize basic types of linear ODEs
2	Recognize ODEs, PDEs and system of considered equation concepts that are encountered in the real world, understand.
3	Defining different sets of generalized coordinates for a given mechanical system and the use of canonical transformations.
4	Identify the physical situations formulate mathematical models using pdes.
5	Students are introduced to modern concepts and methodologies.

Skills:

1. Extract information from equations to interpret the reality.
2. Extract information from partial differential equations to interpret the reality.
3. Know the various types of methods and their limitations

UNIT – I (12 Hours), Differential Equations of first order and first degree :

Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; Integrating Factors; Change of Variables.

UNIT – II (12 Hours), Orthogonal Trajectories.

Differential Equations of first order but not of the first degree :

Equations solvable for p ; Equations solvable for y ; Equations solvable for x ; Equations that do not contain x (or y); Equations of the first degree in x and y – Clairaut's Equation.

UNIT – III (12 Hours), Higher order linear differential equations-I :

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.

General Solution of $f(D)y=0$

General Solution of $f(D)y=Q$ when Q is a function of x .

$\frac{1}{f(D)}$ is Expressed as partial fractions.

P.I. of $f(D)y = Q$ when $Q = be^{ax}$

P.I. of $f(D)y = Q$ when Q is $b \sin ax$ or $b \cos ax$.

UNIT – IV (12 Hours), Higher order linear differential equations-II :

Solution of the non-homogeneous linear differential equations with constant coefficients.

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$

P.I. of $f(D)y = Q$ when $Q = xV$

P.I. of $f(D)y = Q$ when $Q = x^mV$

UNIT –V (12 Hours), Higher order linear differential equations-III :

Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation.

Reference Books:

1. Differential Equations and Their Applications by Zafar Ahsan, Prentice-Hall of India Learning Pvt. Ltd. New Delhi, Second edition.
2. A text book of mathematics for BA/BSc Vol 1 by N. Krishna Murthy & others, S. Chand & Co., New Delhi.
3. Ordinary and Partial Differential Equations Raisinghania, S. Chand & Co., New Delhi.
4. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha, Universities press.

Suggested Activities:

Seminar/ Quiz/ Assignments/ Project on Application of Differential Equations in Real life