TRINITY COLLEGE FOR WOMEN NAMAKKAL
Department of Mathematics

ORDINARY DIFFERENTIAL EQUATION
23PMA03– **ODD SEMESTER**

AN INTRODUCTION ON ODE

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Introduction to Ordinary Differential Equations (ODE)

Recall basic definitions of ODE,

*order

*linearity

*initial conditions

*solution

Classify ODE based on(order, linearity, conditions)

Classify the solution methods

CLASSIFICATION OF ODE:

ODE can be classified in different ways

Order

- **First order ODE**
- **Second order ODE**
- **N^{th} order ODE**

Linearity

- **Linear ODE**
- **Nonlinear ODE**

Auxiliary conditions

Initial value problems

Boundary value problems

SOLUTIONS:

Analytical Solutions to ODE are available for linear ODE and special classes of nonlinear differential equations.

Numerical method are used to obtain a graph or a table of the unknown function

We focus on solving first order linear ODE and second order linear ODE and Euler equation.

FIRST ORDER LINEAR DIFFERENTIAL EQUATIONS:

Def: A first order differential equation is said to be *linear* if it can be written

$$y' + p(x)y = g(x)$$

Second Order Linear Differential Equations:

The general equation can be expressed in the form

$$ay''+by'+cy = g(x)$$

where a, b and c are constant coefficients

Let the dependent variable y be replaced by the sum of the two new variables: y = u + v

Therefore

$$\left[au''+bu'+cu\right]+\left[av''+bv'+cv\right]=g(x)$$

If v is a particular solution of the original differential equation.

$$\left[au''+bu'+cu\right]=0$$

PURPOSE

The general solution of the linear differential equation will be the sum of a "*complementary function*" and a "*particular solution*".

THE COMPLEMENTARY FUNCTION (SOLUTION OF THE HOMOGENEOUS EQUATION):

$$ay''+by'+cy=0$$

Let the solution assumed to be: $y=e^{rx}$

$$\frac{dy}{dx}=re^{rx}$$

$$\frac{d^2y}{dx^2}=r^2e^{rx}$$

$$e^{rx}(ar^2+br+c)=0$$

characteristic equation →

- Real, distinct roots
- Double roots
- Complex roots

THANK YOU

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