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SYLLABUS

1) Differential Equations and applications.
2) Matrix Algebra
3) Linear Algebra.
4) Numerical Methods - I
5) Numerical Methods - II

FOR MORE DETAILS REFER COURSE CONTENTS.

Differential Equations

A differential equation is an equation that relates one or more functions and their derivatives.

eg $\frac{dy}{dx} = f(x)$ $\frac{dy}{dx} = g(x, y)$

$$(1-x)\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = 0$$

ORDINARY DIFFERENTIAL EQUATIONS

A differential equation containing one or more functions of one independent variable and the derivatives of those functions.

eg: $x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = 0$

TYPES OF D.E:

i) ODE

ii) PDE (Partial differential equation)

$z = f(x, y)$

independent variables.

GENERAL FORM OF AN ODE

The n^{th} order ODE is given as,

$F(x, y, y' \ldots\ldots y^n) = 0$

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LINEAR ODE

An n^{th} order ODE is said to be linear if it can be written as:

$$(*) \longrightarrow a_0(x)y^n + a_1(x)y^{n-1} + a_2(x)y^{n-2} \ldots\ldots a_n(x)y = R(x)$$

Where $a_j(x)$ for $0 \le j \le n$ are called the coefficients of the equations

In $(*)$, if $R(x)=0$, then $(*)$ is called a homogenous linear differential equation.

In $(*)$, if $R(x) \neq 0$, then $(*)$ is called a non homogenous linear differential equation.

GEOMETRICAL MEANING OF FIRST ORDER, FIRST DEGREE DIFFERENTIAL EQUATION.

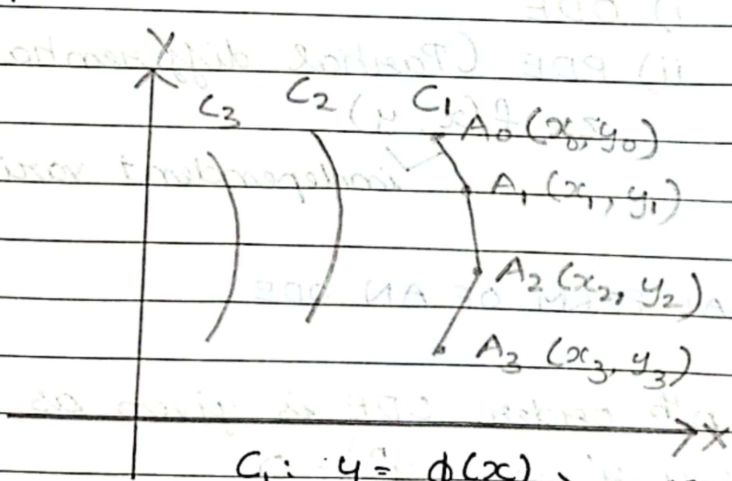
Let $f\left(x, y, \frac{dy}{dx}\right) = 0$ be the d.e of 1st order, 1st degree.

Let:

$$m_0 = \frac{dy_0}{dx_0}$$

$$m_1 = \frac{dy_1}{dx_1}$$

$$m_2 = \frac{dy_2}{dx_2}$$



$C_1 : y = \phi(x)$
$C_2 : y = \psi(x)$ → smooth curves

~~The~~ This is the solution of the given d.e

$$y = k_1\phi(x) + k_2\psi(x)$$

FORMATION OF A DIFFERENTIAL EQUATION.

→ by eliminating arbitrary constants.
(order of d.e = no of arbitrary constants)

Eg: Q. $y = e^x (A\cos x + B\sin x)$

Ans.

$$\frac{dy}{dx} = e^x(A\cos x + B\sin x) + e^x(-A\sin x + B\cos x)$$

$$\frac{dy}{dx} = y + e^x(-A\sin x + B\cos x)$$

$$\frac{d^2y}{dx^2} = \frac{dy}{dx} + e^x(-A\sin x + B\cos x) + e^x(-A\cos x - B\sin x)$$

$$\frac{d^2y}{dx^2} = \frac{dy}{dx} + e^x(-A\sin x + B\cos x) - y$$

$$\frac{d^2y}{dx^2} = \frac{dy}{dx} + \frac{dy}{dx} - y - y.$$

$$\frac{d^2y}{dx^2} = 2\left(\frac{dy}{dx} - y\right)$$