Assignment Topic: i. Linear Differential Equation

ii. Bernoulli Equation

**Linear Differential Equation:**

The linear differential equation is of the form

**dy/dx + Py = Q**

where P and Q are numeric constants or functions in x. It consists of a y and a derivative of y. The differential is a **first-order** differentiation and is called the first-order linear differential equation.

To solve this equation, multiply both the sides by the Integrating Factor, I.F = .

So,

**dy/dx + Py = Q**

or,  . dy/dx + P y = Q.

or, d/dx(y. ) = Q

Integrating both sides, with respect to x the following expression is obtained..

or, y.=∫(Q. *.dx)*

or, y =

The above expression is the general solution of the linear differential equation.

**Examples on Linear Differential Equation:**

Example 1: Find the general solution of the differential equation

xdy -(y + 2x2).dx = 0

Solution: The give differential equation is

xdy - (y + 2x2).dx = 0.

This can be simplified to represent the following linear differential equation.

dy/dx - y/x = 2x

Comparing this with the differential equation dy/dx + Py = Q we have the values of P = -1/x and the value of Q = 2x. Hence, we have the integration factor as

IF =

or, IF =

or, IF =

Further, the solution of the differential equation is as follows.

=

=

=

2x2 + xc

Answer: linear differential equation is 2x2 + xc.

**Bernoulli Equation:**

A equation written in the form

+ P y = Q yn

Is called Bernoulli Equation.

Note: But First notice that if 𝑛=0 or 𝑛=1 then the equation is linear and we already know how to solve it in these cases.

Otherwise,

Working Rule:

1. Divide the equation by yn

+ P y = Q yn

y-n + P y(1-n) = Q

1. Put y1-n  = v then (1-n) y-n =
2. Now convert it into + (1-n) Pv = (1-n)Q
3. This equation is a Linear Equation.

Now, we have to solve this eqn.

Here, the I.F. =

So, +P (1-n) v = (1-n)Q

Or, ( = (1-n)Q

Or, ( = + C

Which is the required equation.

Example:

Solve this equation-

x + y = y2logx

or, + y = y2logx

or, y-2 + y-1 = logx

let, y-1 = v

or, -1y-1-1 =

or, -1y-2 =

Now,

y-2 + y-1 = logx

or,- *+=*  logx

or,  *- = -*  logx

here, the I.F = == = = = x-1 =

So, v = +c

Or, = +c

Or, = +c [ v = ]

Thus, The solution is , = +c (answer)