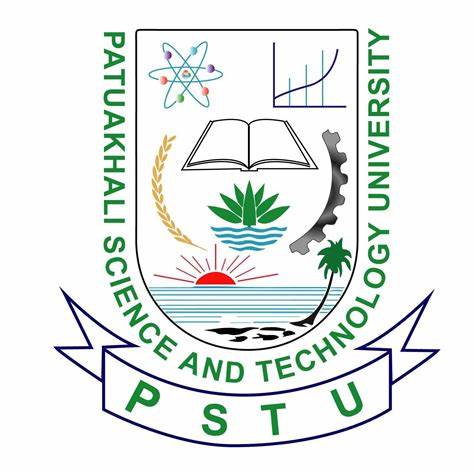
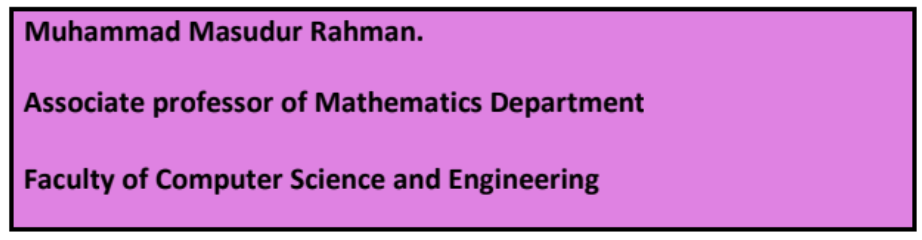
**PATUAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY**



Course Code: MAT-211

**SUBMITTED TO:**

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**Definition**

1. **What is differential equation? Give an example.**

**Ans:** A differential equation is an equation that relates one or more functions and their derivatives. It describes how a function changes over time or space.

Here's an example of a simple differential equation:

This equation states that the rate of change of y with respect to x is equal to 2x. To solve this differential equation, you would integrate both sides with respect to x:

= dx

⇒ y = x2 + C;

Where C is the constant of integration.

1. **What is order in differential equations? What is degree?**

**Ans:** In the context of differential equations, the order refers to the highest order derivative present in the equation.

For example:

is a first-order differential equation because it involves only the first derivative .

Degree: In the context of differential equations, the degree refers to the highest power of the variable in the equation.

For Example:

+ 3 + 2y = 0 is a second order differential equations.

1. **What is the general solution of differential equations?**

**Ans:** The general solution of a differential equation is a solution that includes all possible solutions of the equation. It usually contains arbitrary constants that need to be determined using additional conditions, such as initial conditions or boundary conditions, to obtain a unique solution.

For example:

= 2x

The general solution to this differential equation is:

y = x2 + C

where C is an arbitrary constant.

1. **What is the particular solution of differential equation?**

**Ans:** A particular solution of a differential equation is a specific solution that satisfies both the differential equation and any additional conditions that are provided.

Let's illustrate with an example:

Consider the first-order ordinary differential equation:

= 2x

The general solution to this differential equation is:

y = x2 + C

To find a particular solution, we need additional information. Let's say we have the initial condition y(0)=1. We can use this condition to determine the value of the constant C.

y(0) = 02 + C = 1

so, C = 1

Therefore, the particular solution to the differential equation with the given initial condition is:

y = x2 + 1

**Formula:**

if, then we can simplify it writing

.

if, then we can simplify it writing

dy = f(x)dx.

**Problem 01:**

**Solve:**

Or,

Or, ey + c = ex + c

That’s the answer.

**Problem 02:**

**Solve:**

Or,

Or, y =

Or, y = tan-1) +c

That’s the answer.

**Problem 03:** =

A first order and first-degree differential equation can be written as **f (x, y) d x + g (x, y) d y = 0** or d y d x = f (x, y) g (x, y) or d y d x = ϕ (x, y), where f (x, y) and g (x, y) are the functions of x and y.

Given differential equation is =

Or,

on, integrating,

or, +c

or,

or,

or,

∴ = c(constant)

This is the require solution

**Problem 04:** = (4x+y+1)2

Given equation is, = (4x+y+1)2… … … (1)

Let, 4x+y+1=z then 4+ =

or =- 4 … … ... (2)

From 1 & 2 equation we get,

- 4 = z2

= 4+z2

+z2 = dx

Integrating both sides we get,

½ tan-1 = x+

Tan-1= 2x+c

= tan (2x+c)

4x+y+1 = 2 tan(2x+c)

(Answer)

**Problem 05:** (x - y)2  =a2

(x - y)2  =a2

Expand the left Side:

(x2 -2xy+y2) =a2

Now, let’s differentiate both sides with respect x:

(x2 -2xy+y2)  (x2 -2xy+y2)  =0

Using the product rule & the chain rule, we get:

2x=0

We have,

This simplifies to:

Integration once:

C1

Integration again,

Y= C1x +C2

Where c1 and c2 are constants of integration.

(Answer)

**Problem 06:** (x + y)2  =a2

(x + y)2  =a2

Expand the left Side:

(x2 +2xy+y2) =a2

Now, let’s differentiate both sides with respect x:

(x2 + 2xy+y2)  (x2 +2xy+y2)  =0

Using the product rule & the chain rule, we get:

2x=0

We have,

This simplifies to:

Integration once:

C1

Integration again,

Y= C1x +C2

Where c1 and c2 are constants of integration.

**Problem 07**:

Given equation is

(x2 + y²) dx = 2xy dy

...(1)

Let,

y =vx.

then

From (2) putting the values of dy/dx and y in (1) we get

or,

or,

or,

or,

Integration both sides

+ =0

or, In (v2-1) + lnx = Inc

or, In(v2- 1)x = Inc

or,(v2 - 1)x = c

or,

or, y2-x2=cx

**Problem 08:**

Let , y=vx

= v+ x ……………(2)

From equ (1) and (2) we get ,

V + x

V + x

x =

x =

=

V -

- (Ans)

**Homogenous Function**:

Homogeneous function is a function with multiplicative scaling behaving. The function f(x, y), if it can be expressed by writing x = kx, and y = ky to form a new function f(kx, ky) = kn f(x, y) such that the constant k can be taken as the nth power of the exponent, is called a homogeneous function.

An equation of the form in which f1(x, y) and f2(x, y) are homogenous functions of x and y of the same degree can be reduced to an equation in which variables are separated by putting y= vx ,

Example:

Solve: (x2+y2) dx + 2xy dy= 0

We have,

putting y= vx , the equation becomes

= =

or,

=

or, ,

Integrating

or, ln(1+3v2) =ln x

or, ln(1+3)= ln x (Answer)