# Electromagnetic waves

## Lecture 5

## Ampere's Law

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In electromagnetism, Ampère's circuital law relates the integrated magnetic field around a closed loop to the electric current passing through the loop.

- Ampere's law in magnetism plays an important role in the same way as Cousins' law in electricity Ampere's law is used to calculate the strength of the magnetic field caused by a current of high symmetry in addition to his ability to give a clearer perception and a more comprehensive understanding of the Biot -Savarts law .

## What is Ampere's Law?

According to Ampere's law, magnetic fields are related to the electric current produced in them. The law specifies the magnetic field that is associated with a given current or vice-versa, provided that the electric field doesn't change with time.

## Ampere's Law can be stated as:

"The magnetic field created by an electric current is proportional to the size of that electric current with a constant of proportionality equal to the permeability of free space."

- Maxwell extended this law with the inclusion of magnetic fields which arise without current by other causes. Thus, Ampere- Maxwell's law is one of the four Maxwell equations.
- The integral form of the law is as below:
  $\oint B ds = \mu_0 I$

Where :

$\mu_0$ is the permeability of free space and 'I' is current.

This law allows us to maintain a proper bridge to fulfil the gap between electricity and magnetism. It also provides the mathematical relation between magnetic fields and electric . Amperes law gives the way to calculate the magnetic field, produced due to the result of anelectric current moving through a wire of any shape.