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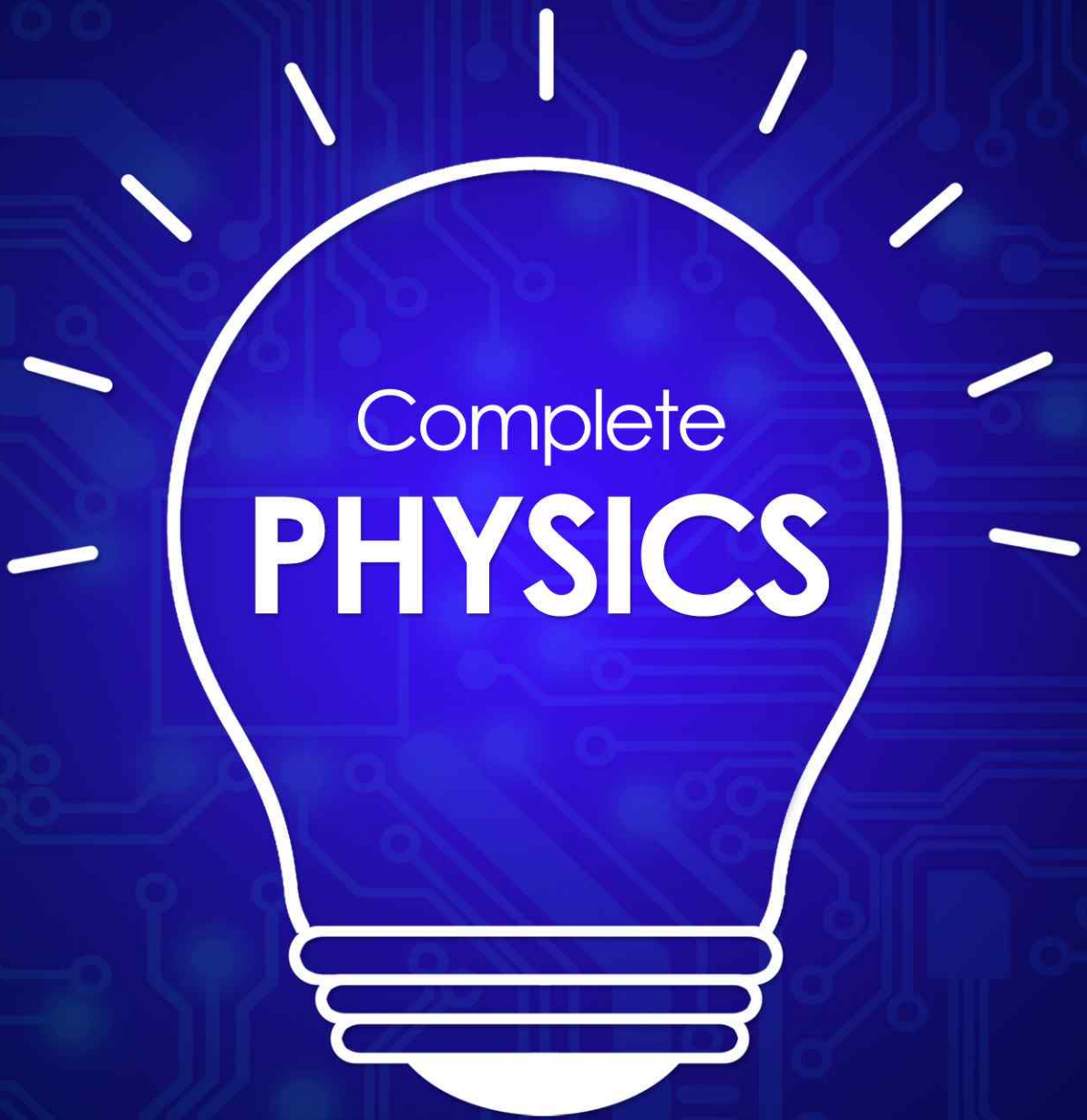

Complete PHYSICS

IIT-JEE · NEET · CBSE eBOOKS

CLASS 11&12th

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CLASS 12th

Electromagnetic Waves

01. Introduction

Basic Equations of Electricity and Magnetism

The whole concept of electricity and magnetism can be explained by the four basic equations we have deal so far.

(i) $\int E \times ds = \frac{Q}{\in_0}$ (Gauss law for electrostatic)

(ii) $\int B \times ds = 0$ (Gauss law for magnetism)

(iii) $\int B \times d\ell = \mu_0 i$ (Ampere's law for Magnetism)

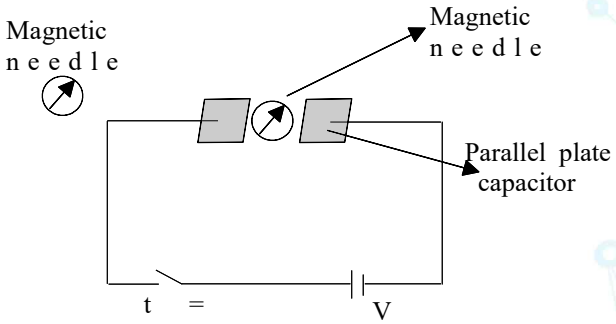
(iv) $\int E \times d\ell = 0$ (Ampere's law for electrostatic)

The above stated equation are true for non-time varying fields

02. Concept of Displacement Current (Modified Amper's Law)

Maxwell tried to generalis the concept of faradays law that if changing magnetic field can produce changing electric field then the reverse should also be true i.e. changing electric field must produce magnetic field.

To understand the concept of displacement current let us try to understand this experiment when the switch was closed at t = 0 both the needles deflected.



Deflection of needle (1) is under stood as M.F. is produced due to current flowing in the wire.

But why did needle 2 deflect? It is lying in between the two plates of capacitor where there is no current. This magnetic field between the plates is due to the changing electric field between the plates (During charging of capacitor). Hence maxwell conducted that changing electric field produces a magnetic field

For Needle (1) Amper's law

$$\int B \times d\ell = \mu_0 i_c \quad \text{..... (1)}$$

For needle (2) Amper's law

$$\int B \times d\ell = \mu_0 \in_0 \frac{d\phi_E}{dt} \quad \text{..... (2)}$$

Hence there are two methods of producing M.F.