# FARADAY'S LAW (OR MAXWELL-FARADAY)

FROM EXPERIMENTAL OBSERVATIONS, AND CONSIDERING THE INTEGRATION REGIONS CONSTANT,

$$\oint_C \bar{E} \cdot \hat{t}\, dc = -\frac{d}{dt} \int_S \bar{B} \cdot \hat{n}\, ds = -\frac{\partial}{\partial t} \Phi_B$$

OR

- CIRCULATION OF $\bar{E}$ FIELD ON A CLOSED CURVE
- MAGNETIC FLUX ACROSS AREA BOUNDED BY CURVE

RELATES FLUX OF $\bar{B}$ TO CIRCULATION OF $\bar{E}$

ALSO WRITTEN AS

$$\oint_C \bar{E} \cdot d\bar{l} = -\frac{\partial \Phi_B}{\partial t}$$

MAXWELL-FARADAY LAW (INTEGRAL FORM)

A CHANGING MAGNETIC FIELD INDUCES A CIRCULATING ELECTRIC FIELD (EMF).

SINCE THE INDUCED FIELD LINES WILL FORM CLOSED LOOPS, THESE FIELDS CAN DRIVE CHARGES AROUND CLOSED CIRCUITS, SO UNDER CERTAIN CIRCUMSTANCES, CAN GENERATE CURRENTS.

THE CIRCULATION OF THE INDUCED $\bar{E}$ FIELD IS THE ENERGY GIVEN TO EACH COULOMB OF CHARGE AS IT MOVES AROUND THE CIRCUIT.

## LENTZ LAW

CURRENTS INDUCED BY CHANGING MAGNETIC FLUX ALWAYS FLOW IN THE DIRECTION AS TO OPPOSE THE CHANGE IN FLUX.

APPLYING STOKES THEOREM TO THE INTEGRAL FORM, WE CAN OBTAIN

$$\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$$

MAXWELL-FARADAY DIFFERENTIAL FORM