ELECTROMAGNETISM PRINCIPLES SUMMARY

Gauss's Law (Electric)

$\oint E \cdot dA = Q / \varepsilon_0$

Relates the net electric flux through a closed surface to the enclosed net charge.

Gauss's Law (Magnetic)

$\oint B \cdot dA = 0$

Indicates that magnetic monopoles do not exist; magnetic field lines are continuous loops.

Faraday's Law

$\varepsilon = -d\Phi B / dt$

A changing magnetic field induces an electromotive force (EMF) and an electric field.

Ampère-Maxwell Law

$\oint B \cdot dl = \mu_0(I + \varepsilon_0 \, d\Phi E/dt)$

Magnetic fields are generated by electric currents and changing electric fields.

Lorentz Force Law

$F = q(E + v \times B)$

The total force exerted on a point charge due to electromagnetic fields.

Coulomb's Law

$F = k \, (q_1 q_2) / r^2$

Quantifies the electrostatic force of attraction or repulsion between two point charges.

Constants: $\varepsilon_0 \approx 8.854 \times 10^{-12}$ F/m | $\mu_0 \approx 4\pi \times 10^{-7}$ H/m | $c \approx 3.00 \times 10^8$ m/s