MAXWELL's EQUATIONS
(for time varying fields)

	Local Form	Integral Form
Gauss Theorem for the Electric Field	$\nabla \cdot \vec{\mathbf{E}} = \frac{\rho_v}{\varepsilon}$	$\iint_S \vec{\mathbf{E}} \cdot \hat{\mathbf{n}}\, d\sigma = \frac{Q}{\varepsilon}$
Gauss Theorem for the Magnetic Field	$\nabla \cdot \vec{\mathbf{B}} = 0$	$\iint_S \vec{\mathbf{B}} \cdot \hat{\mathbf{n}}\, d\sigma = 0$
Faraday's Law	$\nabla \times \vec{\mathbf{E}} = -\frac{\partial \vec{\mathbf{B}}}{\partial t}$	$\oint_C \vec{\mathbf{E}} \cdot \widehat{\mathbf{T}}\, ds = -\iint_\Sigma \frac{\partial \vec{\mathbf{B}}}{\partial t} \cdot \hat{\mathbf{n}}\, d\sigma$
Ampere's Circuital Law	$\nabla \times \vec{\mathbf{B}} = \mu \vec{\mathbf{J}} + \mu\varepsilon \frac{\partial \vec{\mathbf{E}}}{\partial t}$	$\oint_C \vec{\mathbf{B}} \cdot \widehat{\mathbf{T}}\, ds = \mu I + \mu\varepsilon \iint_\Sigma \frac{\partial \vec{\mathbf{E}}}{\partial t} \cdot \hat{\mathbf{n}}\, d\sigma$

$\vec{\mathbf{E}}$ = electric field;
$\vec{\mathbf{B}}$ = magnetic flux density (or magnetic induction);
ρ_v = volume charge density;
ε = absolute permittivity of the medium;
S = closed surface;
Q = total charge contained in the volume V bounded by the surface S;
$\hat{\mathbf{n}}$ = unit normal vector to the surface S (or Σ);
C = closed simple curve;
Σ = surface bounded by the closed simple curve C;
$\widehat{\mathbf{T}}$ = unit tangent vector to the curve C;
μ = absolute permeability of the medium;
$\vec{\mathbf{J}}$ = conduction current density;
I = total conduction current crossing the surface Σ.

Note that if $\vec{\mathbf{E}}$ and $\vec{\mathbf{B}}$ are **static** then Faraday's and Ampere's Laws become

$$\nabla \times \vec{\mathbf{E}} = 0 \qquad \Longleftrightarrow \qquad \oint_C \vec{\mathbf{E}} \cdot \widehat{\mathbf{T}}\, ds = 0,$$

$$\nabla \times \vec{\mathbf{B}} = \mu \vec{\mathbf{J}} \qquad \Longleftrightarrow \qquad \oint_C \vec{\mathbf{B}} \cdot \widehat{\mathbf{T}}\, ds = \mu I.$$