## Maxwell's Equations

Time-Varying Fields, simple media, \& stationary circuits:

Integral Form
Faraday's Law $\quad \oint_{c} \overline{\mathcal{E}} \cdot d \bar{l}=-\mu \frac{d}{d t} \int_{s} \overline{\mathcal{H}} \cdot d \bar{s}$
Ampere's Law

$$
\begin{aligned}
\oint_{c} \overline{\mathcal{H}} \cdot d \bar{l}=\sigma \int_{s} \overline{\mathcal{E}} \cdot d \bar{s} & +\varepsilon \frac{d}{d t} \int_{\mathrm{s}} \overline{\mathcal{E}} \cdot d \bar{s} \\
& +\int_{s} \overline{\mathcal{J}} \cdot d \bar{s}
\end{aligned}
$$

Gauss' Law

$$
\begin{aligned}
& \oint_{s} \overline{\mathcal{E}} \cdot d \bar{s}=\frac{1}{\varepsilon} \int_{V} \rho_{v} d V \\
& \oint_{s} \overline{\mathcal{H}} \cdot d \bar{s}=0
\end{aligned}
$$

Differential Form
$\bar{\nabla} \times \overline{\mathcal{E}}=-\mu \frac{\partial \overline{\mathcal{H}}}{\partial t}$
$\bar{\nabla} \times \overline{\mathcal{H}}=\sigma \overline{\mathcal{E}}+\varepsilon \frac{\partial \overline{\mathcal{E}}}{\partial t}+\overline{\mathcal{J}}$

$$
\begin{aligned}
& \bar{\nabla} \cdot \overline{\mathcal{E}}=\frac{\rho_{v}}{\varepsilon} \\
& \bar{\nabla} \cdot \overline{\mathcal{H}}=0
\end{aligned}
$$

