Summary of Coordinate Transformations

Cartesian to Cylindrical
Cylindrical to Cartesian

Cartesian to Spherical
Spherical to Cartesian

Divergence Theorum and Curl

Gradient - Scalar Field
Divergence - Vector Field

If $\nabla \cdot \vec{A} = 0$ then $\vec{A} =$ solenoidal vector fied (whatever goes in comes out)

Divergence Theorum

$$\int\limits_V \nabla \vec{A} \cdot dV = \oint\limits_S \vec{A} d\vec{S}$$

$$\int\limits_V \nabla \vec{D} \cdot dV = \oint\limits_S \vec{D} d\vec{S}$$

Circulation of $\vec{A}$ around countour C

$$\Delta \oint\limits_C \vec{A} d\vec{l}$$

*** Δ is underlined in Nguyen's notation. Look into this.

Curl

$$\nabla \times \vec{A} = \frac{1}{\Delta s} \lim_{\Delta s \to \emptyset} \oint\limits_S \vec{A} d\vec{l}$$

Stoke's Theorum

$$\int\limits_S \nabla \times \vec{A} \cdot d\vec{s} = \oint\limits_C \vec{A} \cdot d\vec{l}$$

Two Null Identitites

$$\nabla \times (\nabla V) \equiv 0$$

$$\nabla \cdot (\nabla \vec{A}) \equiv 0$$

Maxwell's Equations

$$\vec{E}(x, y, z, t), \vec{H}, \vec{D}, \vec{B}, \vec{J}, \varphi_v$$

Faraday

$$\nabla \times \vec{E} = \frac{-\delta \vec{B}}{\delta t}$$

Ampere

$$\nabla \times \vec{H} = \vec{J} + \frac{-\delta \vec{D}}{\delta t}$$

Gauss

$$\nabla \cdot \vec{D} = \varphi_v$$

No Magnetic Charges

$$\nabla \cdot \vec{B} = 0$$

Modified Ampere's Law

$$\frac{\delta \vec{D}}{\delta t}$$

Special Cases of Maxwell's Equations: Static $\vec{E}$ and $\vec{H}$

$$\vec{E}, \vec{H} = f(x, y, z) \neq f(t) \rightarrow \frac{\delta}{\delta t} = 0$$

Faraday

$$\nabla \times \vec{E} = 0 \qquad \oint_C \vec{E} \cdot \vec{dl} = 0$$

Ampere

$$\nabla \times \vec{H} = \vec{J} \qquad \oint_C \vec{H} \cdot \vec{dl} = I$$

Gauss

$$\nabla \times \vec{D} = \varphi_v \qquad \oint_C \vec{D} \cdot \vec{ds} = Q$$

No Magnetic Charges

$$\nabla \times \vec{B} = 0 \qquad \oint_C \vec{B} \cdot \vec{ds} = 0$$

Modified Ampere's Law

$$\frac{\delta \vec{D}}{\delta t}$$

*** AUTHOR'S NOTE - MAKE VAR/CONST KEY *** - stopped reference on page 49 lecture notes