Summary of PHYS 102

Name	Point Form	Integral Form
Gauss' law	$\nabla \cdot \mathbf{E} = \frac{1}{\epsilon_0}\rho$	$\oint_S \mathbf{E} \cdot d\mathbf{S} = \frac{1}{\epsilon_0}\int_V \rho \, dV = \frac{Q}{\epsilon_0}$
Gauss' law for magnetic fields	$\nabla \cdot \mathbf{B} = 0$	$\oint_S \mathbf{B} \cdot d\mathbf{S} = 0$
Faraday's law	$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$	$\oint \mathbf{E} \cdot d\mathbf{l} = -\frac{\partial}{\partial t}\int_S \mathbf{B} \cdot d\mathbf{S} = -\frac{d\Phi}{dt}$
Ampére's law	$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0\epsilon_0 \frac{\partial \mathbf{E}}{\partial t}$	$\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 \int \mathbf{J} \cdot d\mathbf{S} + \mu_0\epsilon_0 \frac{\partial}{\partial t}\int_S \mathbf{E} \cdot d\mathbf{S}$
Lorentz force equation	$\mathbf{F} = q(\mathbf{E} + \mathbf{u} \times \mathbf{B})$	
Current continuity condition	$\nabla \cdot \mathbf{J} = -\frac{\partial \rho_v}{\partial t}$	
Electric scalar potential	$\mathbf{E} = -\nabla V$	$V_{12} = -\int_1^2 \mathbf{E} \cdot d\mathbf{l}$
Coulomb's law	$\mathbf{F}_{12} = \frac{Q_1 Q_2}{4\pi\epsilon_0 r^2}\mathbf{a}_{R_{12}}$	
Biot-Savart's law	$d\mathbf{B} = \frac{\mu_0 I}{4\pi r^2} d\mathbf{l} \times \mathbf{a}_R$	
Electric flux		$\Psi = \frac{1}{\epsilon_0}\int_S \mathbf{E} \cdot d\mathbf{S}$
Magnetic flux		$\Phi = \int_S \mathbf{B} \cdot d\mathbf{S}$