Formula Sheet (3rd Midterm)

$V_{emf} = v\ell B$ (Motional emf); $\Phi = BA\cos\phi$ (Magnetic flux);

$V_{emf} = NAB\omega\sin\omega t$ (Emf induced in a rotating planar coil) where $\omega = 2\pi f$;

$V_{emf} = v(2\ell)B$ (Motional emf due to a rotating planar coil);

$V_{emf} = -N\dfrac{\Delta\Phi}{\Delta t}$ (Faraday's law); $V_{emf\_s} = -M\dfrac{\Delta I_p}{\Delta t}$ (Emf due to mutual inductance);

$V_{emf} = -L\dfrac{\Delta I}{\Delta t}$ (Emf due to self-inductance); $E = \frac{1}{2}LI^2$ (Energy stored in an inductor);

$\dfrac{V_s}{V_p} = \dfrac{N_s}{N_p}$, $\dfrac{I_s}{I_p} = \dfrac{N_p}{N_s}$ (Transformer equations); $c = f\lambda = \dfrac{1}{\sqrt{\varepsilon_0\mu_0}}$ (Speed of light);

$u = \dfrac{1}{2}\varepsilon_0 E^2 + \dfrac{1}{2\mu_0}B^2 = \varepsilon_0 E^2 = \dfrac{B^2}{\mu_0}$ (Total energy density);

$E = cB$ (Relation between E and B); $E_{rms} = \frac{1}{\sqrt{2}}E_0$, & $B_{rms} = \frac{1}{\sqrt{2}}B_0$ (Root mean square);

$S = \dfrac{P}{A} = cu$ (Intensity); $f_o = f_s\left(1 \pm \dfrac{v_{rel}}{c}\right)\begin{cases} - & \text{away} \\ + & \text{toward} \end{cases}$ (Doppler effect);

$\overline{S} = \overline{S}_0\cos^2\theta$ (Malus' law)

$n = \dfrac{c}{v}$ (Index of refraction); $n_1\sin\theta_1 = n_2\sin\theta_2$ (Snell's law); $\dfrac{n_2}{n_1} = \dfrac{d'}{d}$ (Apparent depth)

$\sin\theta_c = \dfrac{n_2}{n_1}$ $(n_1 > n_2)$ (Critical angle); $\tan\theta_B = \dfrac{n_2}{n_1}$ (Brewster's law);

$f = \frac{1}{2}R$ (Focal length of a concave mirror); $f = -\frac{1}{2}R$ (Focal length of a convex mirror);

$\dfrac{1}{d_o} + \dfrac{1}{d_i} = \dfrac{1}{f}$ (Mirror & lens equation);

$m = \dfrac{\text{Image height, } h_i}{\text{Object height, } h_o} = -\dfrac{d_i}{d_o}$ (Magnification equation for mirrors & lenses);

Extra formulas from the previous chapters

$F = q_0 vB\sin\theta$ (Lorentz force); $F = IB\ell\sin\theta$ (Ampere's force);

$V = IR$ (Ohm's law); $P = IV$ (Electric power);

Constants

$\varepsilon_0 = 8.85\times10^{-12}\text{C}^2/(\text{N}\cdot\text{m}^2)$ (Permittivity of free space);

$\mu_0 = 4\pi\times10^{-7}$ T·m/A (Permeability of free space);

$c = 3.00\times10^8$ m/s (Speed of light in vacuum).

Appendix

k (kilo)	$\times 10^3$	μ (micro)	$\times 10^{-6}$
m (milli)	$\times 10^{-3}$	n (nano)	$\times 10^{-9}$

Right- and Left-Hand Laws