PH-UY 2023 Final Exam Study Guide

Fluids

Key Concepts:
- Hydrostatic pressure: $P = P0 + \rho gh$
- Buoyant force: $F_B = \rho_{fluid} * g * V$
- Bernoulli's equation: $P + \frac{1}{2}\rho v^2 + \rho gy = const$
- Continuity equation: $A1v1 = A2v2$

Practice Topics:
- U-tube equilibrium
- Faucet stream narrowing
- Bernoulli & continuity problems

Electrostatics

Key Equations:
- $E = kQ/r^2$, $V = kQ/r$, $U = kq1q2/r$
- $\Delta V = -\int E \cdot d\blacksquare$, Gauss's Law: $\blacksquare E \cdot dA = Qin/\varepsilon 0$

Practice Topics:
- E-fields of charged objects
- Flux and Gauss's Law
- Potential & force between charges

Capacitors & Dielectrics

Key Equations:
- $C = \varepsilon 0 * A/d$, $U = \frac{1}{2}CV^2 = Q^2/2C$
- With dielectric: $C = \kappa C0$

Practice Topics:
- Capacitor circuits (series/parallel)
- Dielectric energy changes
- Capacitor charging

DC Circuits

Key Equations:
- Ohm's Law: $V = IR$, Power: $P = IV = I^2R$
- Resistance: $R = \rho L/A$

Practice Topics:
- Power & resistivity
- Mixed resistor networks
- RC time-dependent behavior

Magnetism

Key Equations:
- $F = qv \times B$, $F = I\blacksquare \times B$, $r = mv/qB$, $\tau = \mu \times B$
- B from long wire: $\mu 0I/2\pi r$, solenoid: $B = \mu 0nI$

Practice Topics:
- Fields from wires and loops
- Circular motion in B-field
- Magnetic force interactions

Induction & Faraday's Law

Key Equations:
- $\varepsilon = -d\Phi B/dt$, $\Phi B = B*A*\cos\theta$
- Motional emf: $\varepsilon = Blv$, Inductor: $V_L = L\, dI/dt$

Practice Topics:
- Moving bar emf
- Changing flux and coils
- RL circuit behavior

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AC & Oscillations

Key Equations:
- LC circuit: $T = 2\pi\sqrt{(LC)}$
- Generator emf: $\varepsilon max = NBA\omega$

Practice Topics:
- LC oscillation period
- Induced emf in rotating coils