PS228 Physics III – Exam 2 Material Summary

Chapter 25 Learning Objectives: Understand concept of current (I) and current density (J). Understand physical basis for resistivity and resistance, and how they are related. Understand Ohm's law in terms of potential difference and electric field in the conductor). Understand concept of electromotive force for ideal (r=0) and realistic ($r \neq 0$) sources (i.e., batteries, etc., with a source resistance). Understand simple circuits involving resistors and emf sources. Understand power and energy in circuits (i.e., $P=IV=V^2/R=I^2R$).

Lecture 10-11. Assignment #4.

25.1 – Current

Understand definitions of current, drift velocity, current density.

25.2 – Resistivity

Examples: Ohm's Law in vector and scalar forms, definitions of resistivity, relation to resistance.

25.3 – Resistance

Examples: Copper wire example, other conductors.

25.4 – Electromotive Force and Circuits

Examples: Wire examples, ideal/non-ideal sources, pencil lead examples.

25.5 – Power and Energy

Examples: Max power transfer, general examples with resistors, short circuits.

Chapter 26 Learning Objectives: Understand parallel and series combinations of resistors, and be able to calculate equivalent combinations. Understand Kirchhoff's Rules, and be able to apply them to determine potential differences across and currents through devices in a simple circuit.

Lecture 12. Problems: Assignment #5.

26.1 – Resistors in Series and Parallel

Examples: Pencil Lead example, circuit combinations, homework.

26.2 – Kirchhoff's Rules

Examples: Simple 2-Loop analysis problem, bridge circuit (also the homework problems!)

Chapter 27 Learning Objectives: Understand the geometry of magnetic fields and the concept of poles. Calculate force on moving charged particles due to magnetic fields. Understand magnetic flux, and Gauss's laws. Calculate particle motions (cyclotron frequency and radii) in magnetic fields. Understand how a velocity selector works. Calculate magnetic force on a current-carrying conductor.

Lecture 13-14. Assignment #5, #6.

27.1 – Magnetism

Understand "dipole" model of Earth's field (i.e., what is really "North" and "South").

27.2 – Magnetic Field and Force

Examples: Force on Proton or point charge.

27.3 – Magnetic Flux

Examples: Quick Conceptual Discussion (i.e., that it is zero for a closed surface!!!), no monopoles.

27.4 – Motion of Charged Particles

Examples: Proton launched from origin, radius of orbit, period of orbit, helical trajectories.

27.5 – Applications of Motion of Charged Particles

Examples: Velocity Selector / Mass Spectrometer (Conceptually).

27.6 – Magnetic Force on a Current-Carrying Conductor

Examples: Many, with forces on wires and dipoles.

27.7 – Force and Torque on a Current Loop

Examples: Torque and potential energy for dipole.

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Chapter 28 Learning Objectives: Calculate magnetic field due to a moving charge. Calculate magnetic field due to infinitesimal current elements and current-carrying wire segments. Calculate magnetic field due to very long current-carrying conductors. Obtain force between parallel conductors. Calculate magnetic field due to loops of current.

Lecture 15-16. Assignment #6.

28.1 – Magnetic Field of a Moving Charge

Examples: 28.1, comparison of electric and magnetic forces.

28.2 – Magnetic Field of a Current Element

*Understand as basis in terms of motion of charge, how to set up d**B**.*

28.3 – Magnetic Field of a Current-Carrying Wire

Examples: 28.3, 28.4; integrate and simplify to long conductor.

28.4 – Force Between Parallel Conductors

Homework, review demo, and Ch. 27 force calculation.

28.5 – Magnetic Field of a Circular Current Loop

Examples: 28.6. Biot-Savart calculations of fields due to loops (full and partial).