

TEST TWO Thursday Evening 7:30- 9:30 pm. The Friday class immediately following is canceled because of the evening exam.

What We Expect From You On The Exam

- (1) An understanding of how to calculate magnetic fields in highly symmetric situations using Ampere's Law, e.g. as in the Ampere's Law Problem Solving Session.
- (2) An understanding of how to use Faraday's Law in problems involving the generation of induced EMF's. You should be able to formulate quantitative answers to questions about energy considerations in Faraday's Law problems, e.g. the power going into ohmic dissipation comes from the decreasing kinetic energy of a rolling rod, etc.
- (3) An understanding of the nature of the motion of an electric charge in constant magnetic and electric fields, including in "crossed-fields," i.e. when \mathbf{E} is perpendicular to \mathbf{B} .
- (4) An understanding of how to calculate the magnetic fields of moving charges or current elements using the Biot-Savart law, e.g.

$$\vec{\mathbf{B}} = \frac{\mu_o}{4\pi} \frac{q \vec{\mathbf{v}} \times \hat{\mathbf{r}}}{r^2} \quad d\vec{\mathbf{B}} = \frac{\mu_o}{4\pi} \frac{I d\vec{\mathbf{s}} \times \hat{\mathbf{r}}}{r^2}$$

- (5) An understanding of how to calculate the forces and torques on a current element in an external magnetic field or on a charge moving in an external magnetic field, including the characteristics of cyclotron motion. That is, to understand and be able to apply the equations

$$\vec{\mathbf{F}} = q\vec{\mathbf{v}} \times \vec{\mathbf{B}} \quad d\vec{\mathbf{F}} = Id\vec{\mathbf{s}} \times \vec{\mathbf{B}}$$

- (6) An understanding of the magnetic moment vector of a current loop. A conceptual understanding of how the torque exerted on a magnetic dipole in an external field arises, and how to derive the expression for this torque ($\vec{\boldsymbol{\tau}} = \vec{\boldsymbol{\mu}} \times \vec{\mathbf{B}}$). Also, a conceptual understanding of how the force exerted on a magnetic dipole in a non-uniform external magnetic field arises.
- (7) To be able to answer qualitative conceptual questions that require no calculation. These will be concept questions similar to those in lecture, where you will be asked to make a choice out of a multiple set of choices.
- (8) An understanding of circuit theory: analyze multi-loop circuits involving only batteries and resistors.

To study for this exam we suggest that you review your problem sets, in-class problems, Friday problem solving sessions, PRS in-class questions, and relevant parts of the study guide and class notes.