

TEAR OFF SHEET

1033

NUMBER _____

PHYSICS 135bL

Professor Shakeshaft
Professor Nemeschansky

Spring 1998
Tuesday, March 31
5:00 p.m.

SECOND MIDTERM EXAMINATION

NAME (Printed) _____
Last First Initial

This is a closed book exam. No notes or other materials are allowed. Your signature represents that you understand these rules and that you agree neither to give nor receive help during this exam.

NAME (Signed) _____

SOCIAL SECURITY NUMBER _____

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1. _____

2. _____

3. _____

4. _____

TOTAL _____

1. (25 pts) A particle of mass 0.1 kg and charge 2 C is moving with speed 20 m/s in a horizontal circle of radius 0.25 m on a smooth table. The particle is attached to one end of a string (of length 0.25 m). The other end of the string is fixed (at the center of the circle). A uniform magnetic field of strength 2 T points vertically downwards. What is the tension in the string if

- (a) the particle moves clockwise,
- (b) the particle moves counterclockwise ?

2. (30 pts) The drop in potential, V_{ab} , from one end a to the other end b of a coil, is 8 V at the instant when the current, which flows from a to b , is 1 A and is decreasing at a rate of 2 A/s. At a later instant V_{ab} is 20 V whereas the current, which still flows from a to b , is 0.5 A and is increasing at a rate of 3 A/s. Determine the inductance and resistance of the coil.

3. (30 pts) A converging lens of focal length 7 cm is at a distance of 30 cm in front of a plane mirror. A real object is at a distance of 12 cm in front of the lens (on the side opposite to where the mirror is located). Describe all of the images, i.e. how many are there, where are they located, are they real or virtual, upright or inverted, and what are their magnifications?

4. (25 pts) A light beam, composed of wavelengths in the range 250-300 nm, is incident normally (in air) on a thin film of alcohol lying on a glass surface. The indices of refraction of air, alcohol, and glass are 1.0, 1.4, and 1.5, respectively. The thickness of the film is 200 nm. What is the dominant wavelength of the reflected light?

Formulas and Constants

$$k = 9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$$

$$\mathbf{E} = (kq/r^2)\hat{\mathbf{r}}$$

$$\mathbf{F} = q\mathbf{E}$$

$$V = kq/r$$

$$\text{Work} = q\Delta V$$

$$Q = CV$$

$$V = IR$$

$$\dot{P} = IV \text{ or } I_{\text{rms}}V_{\text{rms}}$$

$$F = IlB \sin \theta$$

$$F = qvB \sin \theta$$

$$\text{centripetal force} = mv^2/r$$

$$\mathcal{E} = -N\Delta\Phi/\Delta t$$

$$\mathcal{E} = -L\Delta I/\Delta t$$

$$V_s/V_p = N_s/N_p \quad (\text{transformer})$$

$$1/f = (1/d_o) + (1/d_i)$$

$$m = -d_i/d_o$$

$$\lambda_2/\lambda_1 = n_1/n_2$$

$$d \sin(\theta) = m\lambda \quad (\text{maximum})$$

$$d \sin(\theta) = (2m + 1)\lambda/2 \quad (\text{minimum})$$

$$D \sin(\theta) = m\lambda, \quad m \neq 0 \quad (\text{minimum})$$

$$n = 1.0 \quad (\text{in air})$$