sics 302
er Quarter 1992
March 17, 1994
George Williams

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FINAL EXAM

Name (print)_____ Name (signed)_____

Discussion Instructor (circle): Basko Chakhbazian DiCarlo Gundlach Romer Wei

Discussion Section # _____

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) Calculate the cyclotron frequency (in Hz) for electrons in a magnetic field of 0.275 T.

$f = qB/2\pi m =$ 7.69×10^9 Hz

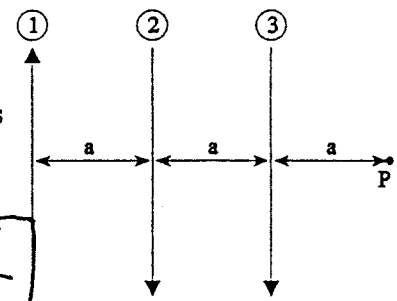
(b) A circular loop of wire has 35 turns and a diameter of 11.0 cm. If the current in the wire is 7.25 A, calculate the magnitude of the magnetic field at the exact center of the loop.

$|\vec{B}|_{center} = \frac{N\mu_0 I}{2r} =$ 2.90×10^{-3} T

(c) A circular coil of 25 turns is placed in a uniform magnetic field given by $B = B_0 \sin \omega t$. The plane of the coil is perpendicular to the magnetic field. $B_0 = 3.25$ mT and $\omega = 400$ rad/sec. The diameter of the coil is 1.75 cm. Calculate the magnitude of the emf induced in the coil.

$\Phi(t) = 25\left[3.25\times10^{-3} \sin 400t\right]\pi\left(\frac{1.75\times10^{-2}}{2}\right)^2 \circ \frac{\partial \Phi}{\partial t} = \mathcal{E}_{mf} =$ 7.82 mV cos 400t

(d) Three long, straight wires are in a plane. They are each a distance a apart. The currents are in the direction of the arrows, and have the magnitudes, $I_1 = 4.00$ A, $I_2 = 3.00$ A and $I_3 = 1.00$ A. Calculate the magnitude of the magnetic field at point P, which is in the same plane as the wires. Take a = 1.00 cm.

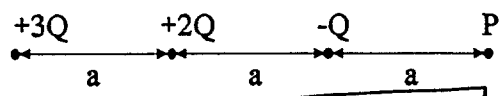


$|\vec{B}| = \frac{\mu_0}{2\pi}\left[\frac{I_2}{2a} + \frac{I_3}{a} - \frac{I_1}{3a}\right] =$ 2.33×10^{-5} T

(e) Electrons are accelerated from rest by a potential difference of 475 V. Calculate the magnitude of their velocity.

$\frac{1}{2} m_e v^2 = q_e \Delta V$ $|\vec{v}| = 1.29 \times 10^7$ m/s

(f) Three charges are arranged as shown. If $|Q| = 4.0 \times 10^{-12}$ C and $a = 3.00 \times 10^{-4}$ m, calculate the electric potential at point P, including sign, using the usual choice for the zero of potential.



$V = \sum_i \frac{Kq_i}{r_i} = \frac{-KQ}{a} + \frac{K2Q}{2a} + \frac{K3Q}{3a} = \frac{KQ}{a} =$ 120 Volts