KEY

Physics 172
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FOURTH MIDTERM

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Name: AVE 14 STD 7

Discussion Instructor (CIRCLE ONE): Aamodt Galler Giddings Leaver

Discussion Section #_____ Mabud Saffer (Sewell) Stone

(a) Find the magnetic field at the center of a circular loop consisting of 25 turns of wire, with each turn carrying 13.2 Amps. The radius of the loop is (0.25) m. 2 sigs $B = \frac{\mu_0 N i}{2r} = 8.3 \times 10^{-4}$ (Tesla) -1 sig fig -1 units

(b) Find the magnetic field in the interior of a solenoid consisting of 1750 turns carrying a current of (0.375) Amps. 3 sigs The solenoid is 10.0 cm long, and (1.2) cm inside diameter. $B = \frac{\mu_0 i N}{L} = 8.25 \times 10^{-3}$ (Tesla)

1.2 not used in computation

(c) Find the cyclotron frequency of an electron in a magnetic field of 0.52 gauss. $f = \frac{qB}{2\pi m} = 1.46 \times 10^{6}$ (1/s)

(d) A cable carries a current of 1000 Amperes. Find the force on 250 m of the cable if there is a magnetic field of 0.50 gauss (about the Earth's field) at right angles to the cable. $F = iLB = 12.5$ (newtons)

(e) Find the magnetic field at a distance of (10 cm) 2 sigs from a bolt of lightning carrying a current of 30,000 A. (A typical peak current.).

$B = \frac{\mu_0 i}{2\pi r} = 6.0 \times 10^{-2}$ (Tesla)

a) $dB = \frac{\mu_0 i N}{4\pi} \frac{dl \sin\theta}{r^2} = \frac{\mu_0 i N}{4\pi r^2} dl = \frac{\mu_0 i N}{4\pi r^2} r\, d\theta \rightarrow B = \frac{\mu_0 i}{4\pi r} \int_0^{2\pi} d\theta$

$B = \frac{\mu_0 i}{2r}$

b) $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_{enc}$

$Bl = \mu_0 i \frac{N}{L} l \rightarrow B = \frac{\mu_0 N i}{L}$

c) $f = \frac{v}{2\pi r}$ v-velocity $\quad qvB = m\frac{v^2}{r} \rightarrow f = \frac{qB}{2\pi m}$ $\quad v = \frac{qBr}{m}$

in MKS system, gauss must be converted to Tesla. (1 Tesla = 10^4 gauss)