# Homework

P.6 – 4 A current $I$ flows lengthwise in a very long, thin conducting sheet of width $w$, as shown in Fig. 6 – 35.

a) Assuming that the current flows into the paper, determine the magnetic flux density $B_1$ at point $P_1(0, d)$.

b) Use the result in part (a) to find the magnetic flux density $\mathrm{B}_2$ at point $\mathrm{P}_2(2w/3, d)$.

P.6 – 5 A current I flows in a $\mathrm{w} \times \mathrm{w}$ square loop as Fig. 6 – 36. Find the magnetic flux density at the off-center $\mathrm{P}(w/4, w/2)$.

P.6 – 11 A long wire carrying a current $I$ folds back with a semicircular bend of radius $b$ as in Fig. 6 – 38. Determine the magnetic flux density at the center point $P$ of the bend.

# Homework

P. 6 – 12 Two identical coaxial coils, each of $N$ turns and radius $b$, are separated by a distance $d$, as depicted in Fig. 6 – 39. A current $I$ flows in each coil in the same direction.

a) Find the magnetic flux density $\mathrm{B} = \hat{x}B_x$ at a point midway between the coils.

b) Show that $dB_x / dx$ vanishes at the midpoint.

c) Find the relation between $b$ and $d$ such that $d^2B_x / dx^2$ also vanishes at the midpoint.

P. 6 – 18 Starting from the expression of A in Eq. (6 – 34) for the vector magnetic potential at a point in the bisecting plane of a straight wire of length $2L$ that carries a current $I$ :

a) Find A at point $P(x, y, 0)$ in the bisecting plane of two parallel wires each og length $2L$, located at $y = \pm d / 2$ and carrying equal and opposite currents, as shown in Fig. 6 – 41.

b) Find A due to equal and opposite currents in a very long two-wire transmssion line.

c) Find B from A in part (b), and check your answer against the result obtained by applying Ampere's circuital law.

d) Find the equation for the magnetic flux lines in the xy-plane.

# Homework

P. 6 – 19 For the small rectangular loop with sides $a$ and $b$ that carries a current $I$, shown in Fig. 6 – 42:

a) Find the vector magnetic potential A at a distance point, $P(x, y, z)$. Show that it can be put in the form of Eq. (6 – 45).

b) Determine the magnetic flux density B from A, and show that it is the same as that given in Eq. (6 – 48).

P. 6 – 20 For a vector field F with continuous first derivatives, prove that

$$\int_V (\nabla \times F)\, dv = -\oint_S F \times ds,$$

where S is the surface enclosing the volume $V$.

# Homework

P. 6 – 23 The scalar magnetic potential, $V_m$, due to a current loop can be obtained by first dividing the loop area into many small loops and then summing up the contribution of these small loops (magnetic dipoles); that is,

$$V_m = \int dV_m = \int \frac{dm \cdot \hat{r}}{4\pi R^2}$$

where

$$dm = \hat{n} I \, ds.$$

Prove that

$$V_m = -\frac{I}{4\pi}\Omega$$

where $\Omega$ is the solid angle subtended by the loop surface at the field point $P$ (see Fig. 6 – 43)