Homework 12
EE 381 Electric & Magnetic Fields (Fall 2026)
Monday, November 16, 2026

1) PE7.3 First, use Biot-Savart's Law to find general solution for the magnetic field along z-axis.

2) A very long thin ribbon ($-\infty \le x \le \infty$, $-2 \le y \le 2$ cm, $z = 0$) carries 16 A of uniformly distributed current in the $-x$-direction. a) Draw a fully labeled sketch of the problem geometry. b) Determine the surface current density vector. c) Use Biot-Savart's Law to compute the magnetic field at some general point along the z-axis ($z \neq 0$) due to this ribbon. d) Evaluate the magnetic field at points $P(0, 0, 9\text{ cm})$ and $Q(0, 0, -16\text{ cm})$.

3) A very long rod of diameter d, centered on the z-axis, carries a uniformly distributed current I in the z-direction. a) Draw a fully labeled sketch of the problem geometry. b) Determine the current density vector. c) Write out the appropriate general position vector form of Biot-Savart's Law (as given in class) to compute the magnetic field and state which coordinate system 'fits'. d) Specifically define all the components (e.g., source $\overline{r}'$ and field $\overline{r}$ position vectors ...) for the form of Biot-Savart's Law selected in this coordinate system to find the magnetic field at some point on the x-y plane ($z = 0$). e) Write-out the specific integral(s) including limits. Do NOT simplify, factor out or rearrange terms, compute cross-products, transform unit vectors, or compute the integral(s).

4) 7.23

5) 7.26

6) 7.38

7) 7.40 Hints: Compute curl & divergence. Use differential/point form of Maxwell's equations.

8) 7.46 Also, does the magnetic vector potential satisfy Coulomb's gauge (7.59)?

Due Monday, November 23, 2026.

Notes:

- If not otherwise specified, assume units of meters for all positions and distances.
- Every problem should include a sketch of the problem geometry (if applicable).