科目：電磁學 適用：應光系

編號：502

考生注意：
1.依次序作答，只要標明題號，不必抄題。
2.答案必須寫在答案卷上，否則不予計分。
3.限用藍、黑色筆作答；試題須隨卷繳回。

1. Current density is given in cylindrical coordinates as $\vec{J}=10\ rz\ \hat{a}_z\ (\mathrm{A/m^2})$ in the region $0 \le r \le 20\ \mu\mathrm{m}$, for $r \ge 20\ \mu\mathrm{m}$ $\vec{J}=0$ (a) Find the total current crossing the surface z = 1m (b) If the volume charge (ρ_v) density at z = 0.1m is -1000 (C/m), find the charge velocity there (as a function of r).

(20%)

2. A certain potential field is given in spherical coordinates by $V=2V_0\ \frac{R}{a}\sin(\theta)$. Find the total charge contained within the region $R<a$.

(20%)

3. A electric dipole for which $\vec{P}=100\epsilon_0\hat{a}_z$ C • m is located at the origin. What is the electric potential at A (2, 2, 1) ?

(20%)

4. Find the permeability of a material in which the magnetic field intensity is five times the magnetization.

(20%)

5. Region 1 (x >0) is a material with μ_{r1}=2, while region 2 (x<0) has μ_{r2}=1. Let the magnetic flux density for region 1 be $\vec{B}_1=2\hat{a}_x+4\hat{a}_y+5\hat{a}_z$

Find the magnetic field intensity in region 2.
(No current in the interface) ($\mu_0=4\pi\times10^{-7}$ H/m)

(20%)