97 學年度 下學期 電磁學第四次小考　日期:5/6

姓名：_____　學號：_____　系級：_____

請詳細寫出計算過程及切勿字跡潦草，否則不以計分。

Problem 1

Calculate the torque exerted on the square loop shown in Fig.1,due to the circular loop (assume r is much larger than a or b).If the square loop is free to rotate,what will its equilibrium orientation be?(30%)

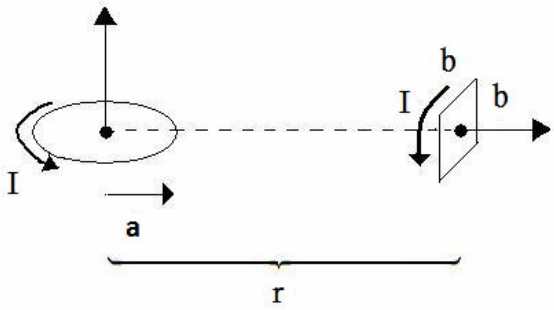

Fig.1

Problem 2

A uniform current density $\vec{J} = J_0 \hat{z}$ fills a slab straddling the yz plane, from x = -a to x = +a.

A magnetic dipole $\vec{m} = m_0 \hat{x}$ is situated at the origin.

(a) Find the force on the dipole, using Eq : $\vec{F} = \vec{\nabla}(\vec{m} \cdot \vec{B})$. (10%)

(b) Do the same for a dipole pointing in the y direction : $\vec{m} = m_0 \hat{y}$. (20%)

(c) In the electrostatic case the expressions $\vec{F} = \vec{\nabla}(\vec{p} \cdot \vec{E})$ and $\vec{F} = (\vec{p} \cdot \vec{\nabla})\vec{E}$ are equivalent (prove it), but this is not the case for the magnetic analogs(explain why). As an example, calculate $(\vec{m} \cdot \vec{\nabla})\vec{B}$ for the configurations in (a) and (b). (40%)