國立中央大學103學年度碩士班考試入學試題卷

所別：機械工程學系光機電工程碩士班 乙組(光機)(一般生)　科目：電磁學　共 1 頁 第 1 頁

本科考試可使用計算器，廠牌、功能不拘　＊請在試卷答案卷（卡）內作答

1. The charged disk with the charge density σ is shown Figure 1. Its radius is R. Find the electric field at the point p in terms of x, σ and R. Discuss the situation that occurs when the point p is far away from the disk ($x>>R$). (20%)
2. Describe Millikan oil-drop experiment including the experimental procedure and conclusion. (10%)
3. Describe Maxwell's equations in vacuum and derive the wave equation from Maxwell's equations. (10%)
4. As shown in Figure 2, a small charged sphere of mass m and charge q hangs from a silk thread that makes an angle θ with a large, flat charged conducting surface. α is the angle between the surface and the gravity g. Find the surface charge density σ in terms of m, q ,θ and α. (10%)
5. An infinitely long and straight conductor with a cross section of radius b carries a steady current I, as shown in Figure 3. Determine the magnetic flux density **inside** ($r_1<b$) and **outside** ($r_2>b$)the conductor. (20%)
6. Consider the magnetic field, **H**, at the interface of two media. Derive the boundary condition for the tangential component of **H**. Assume that there is no surface current at the interface. (10%)
7. A conducting wire with a radius a and a length L has only the surface current. If the distance between the wire and ground is h, determine the mutual inductance between the conducting wire and ground. (20%)

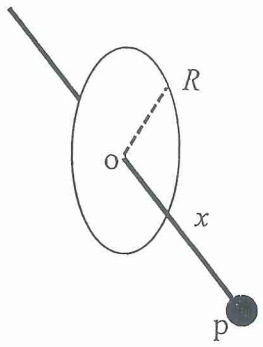

Figure 1

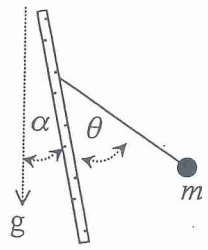

Figure 2

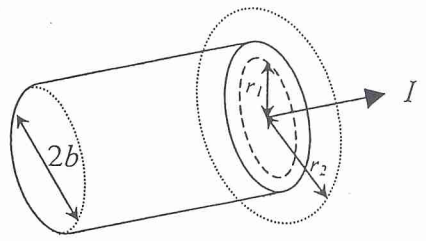

Figure 3