國立嘉義大學九十四學年度
光電暨固態電子研究所碩士班招生考試試題

科目：電磁學

1. A cylindrical capacitor of length L consists of coaxial conducting surfaces of radii r_i and r_0. Two dielectric media of different dielectric constants ε_{r1} and ε_{r2} fill the space between the conducting surfaces as shown in Fig. 1. Determine its capacitance. (20%)

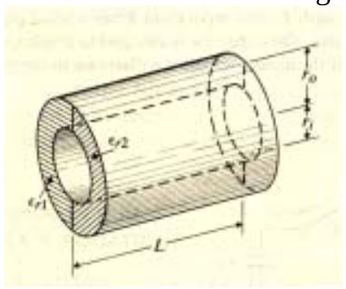

Fig. 1

2.Two grounded, semi-infinite, parallel-plane electrodes are separated by a distance b. A third electrode perpendicular to the both is maintained at a constant potential V_0 as shown in Fig. 2. Determine the potential distribution in the region enclosed by the electrodes. (20%)

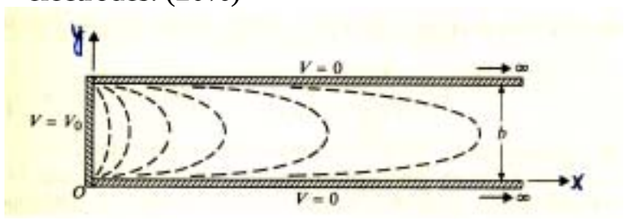

Fig. 2

3.By using the Biot-Savart law, find the magnetic field a distance *s* from a long straight wire *AB* carrying a steady current *I* as shown in Fig. 3. The angles between line *PO* with respect to line *PA* and *PB* are θ_1 and θ_2, respectively. (20%)

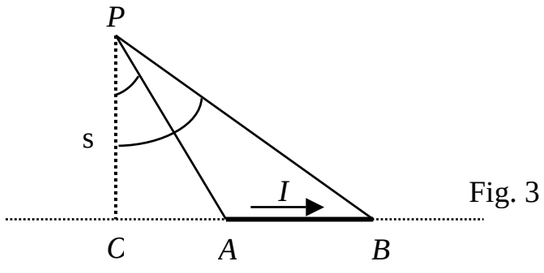

Fig. 3

4. An infinitely long cylinder as presented in Fig. 4, of radius *R*, carries a "frozen-in" magnetization, parallel to the axis,

$$\vec{M} = ks\hat{z},$$

where *k* is a constant and *s* is the distance from the axis; there is no free current anywhere. Calculate all the bound currents and then find the magnetic field inside and outside the cylinder . (20%)

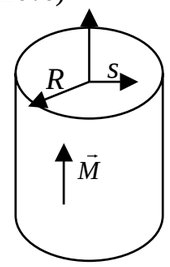

Fig. 4

5. Find the Poynting vector on the surface of a long, straight conducting wire (of radius *b* and conductivity s) that carries a direct current *I*, as sketched in Fig. 5. Verifying the negative surface integral of the Poynting vector is exactly equal to the ohmic power loss in the conducting wire. (20%)

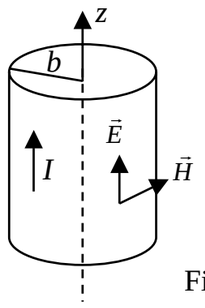

Fig. 5