

科目：電磁學 適用：電機系(系統組)

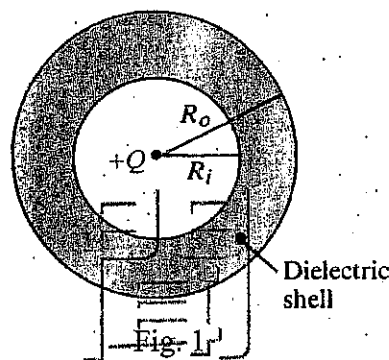
編號：464

考生注意：

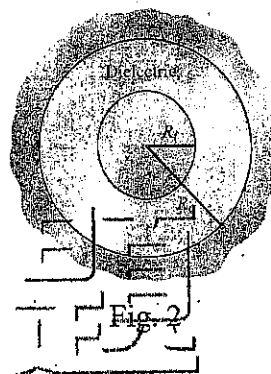
1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本試題  
共 2 頁  
第 1 頁

1. In Fig. 1, a positive point charge  $Q$  is at the center of a spherical dielectric shell of an inner radius  $R_i$  and an outer radius  $R_o$ . The dielectric constant of the shell is  $\epsilon_r$ . Determine  $\vec{E}$ ,  $V$ ,  $\vec{D}$ , and  $\vec{P}$  as functions of the radial distance  $R$  in the region of  $R_i < R < R_o$ . (20%)



2. A spherical capacitor consists of an inner conducting sphere of radius  $R_i$  and an outer conductor with a spherical inner wall of radius  $R_o$ . The space in between is filled with a dielectric of permittivity  $\epsilon$  as shown in Fig. 2. Determine the capacitance  $C$ . (15%)



3. Please write down the differential form (8%) and the integral form (8%) of Maxwell's equations, and explain the physical meaning of each equation. (12%)

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4. Determine the magnetic flux density  $\vec{B}$  inside an infinitely long solenoid with air core having  $n$  closely wound turns per unit length and carrying a current  $I$  as shown in Fig. 3. (9%)

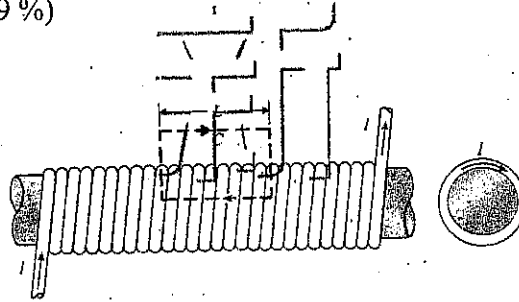


Fig. 3

5. A  $y$ -polarized uniform plan wave  $(\vec{E}_i, \vec{H}_i)$  with  $f = 100 \text{ MHz}$  propagates in air in  $+x$  direction and impinges on a perfect conductor (PEC) plane at  $x = 0$  as shown in Fig. 4. Assuming the amplitude of  $|\vec{E}_i| = 6 \text{ (V/m)}$ , Write the phasor and instantaneous expressions for

(a)  $\vec{E}_i$  and  $\vec{H}_i$  of the incident wave. (8%)

(b)  $\vec{E}_r$  and  $\vec{H}_r$  of the reflected wave. (8%)

(c)  $\vec{E}_t$  and  $\vec{H}_t$  of the total wave in air. (12%)

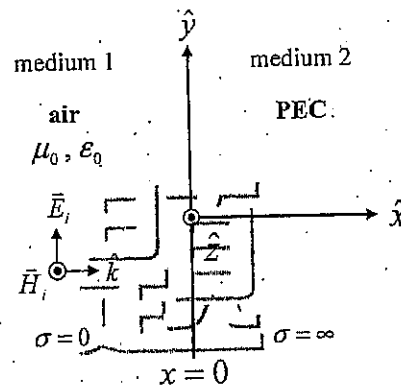


Fig. 4