招生學年度	103	招生類別	碩士班
系所班別	電機光電碩士班聯合招生（電機工程學系碩士班、電機工程學系 電子工程碩士班、光電工程學系碩士班）		
科目名稱	電磁學		
注意事項	本考科可使用掌上型計算機		

1. (20%) Assume that the z = 0 plane separates two lossless dielectric regions with $\varepsilon_{r1}=2$ and $\varepsilon_{r2}=3$. If we know that $\mathbf{E}_1$ in region 1 is $2y\,\mathbf{a}_x-3x\,\mathbf{a}_y+(z+5)\,\mathbf{a}_z$, determine the electric field intensity $\mathbf{E}_2$ and electric flux density $\mathbf{D}_2$ in region 2.

2. (24%) A positive point charge Q is located at the center of a spherical dielectric shell of an inner radius a and an outer shell radius b. The dielectric constant of the shell is ε_r. Determine the electric field intensity **E**, electric potential V, electric flux density **D**, polarization vector **P**, and the surface charge density on the inner shell surface and the outer shell surface.

3. (18%) Determine the capacitance per unit length of a two-wire transmission line with parallel conducting cylinders of different radii r_1 and r_2, and their axes are separated by a distance D, where D is greater than (r_1+r_2).

4. (18%) A ferromagnetic of radius R_0 is magnetized uniformly with a magnetization $\mathbf{M}=K\mathbf{a}_z$, where K is a constant. (a) Determine the equivalent magnetization volume current density $\mathbf{J}_m$ and surface current density $\mathbf{J}_{ms}$. (b) Determine the magnetic flux density at the center of the sphere.

5. (20%) A circular loop of N turns of conducting wire lies in the xy-plane with its center at the origin of a magnetic field given by $\mathbf{B} = \mathbf{a}_z B_0 \sin\omega t \cos(\pi r/2b)$, where b is the radius of the loop and ω is the angular frequency. Determine the emf induced in the loop.