

參考用

1. For a  $z$ -directed electric dipole of dipole moment  $P$ , find
  - (a) the electric field in spherical coordinates. (10%)
  - (b) the field line equation. (6%)
  - (c) the angle  $\theta$  at which the electric field has no  $z$  component. (6%)
2. A conducting sphere of radius  $R$  bearing total charge  $Q$  is placed in an initially uniform electric field  $\vec{E}_0$ . Find the potential at all points exterior to the sphere. (16%)
3. What is the relation between the force and the stored energy in a system of stationary charged objects under the condition of constant charges? Under the condition of fixed potentials (12%)
4. (a) What are the boundary conditions for magnetostatic fields at an interface between two different magnetic media? (10%)  
(b) Explain why magnetic flux lines leave the surface of a ferromagnetic medium perpendicularly. (8%)
5. A  $y$ -polarized uniform plane wave  $(\vec{E}_i, \vec{H}_i)$  with an angular frequency  $\omega$  propagates in air in the  $+x$  direction and impinges normally on a perfectly conducting plane at  $x=0$ . Assuming the amplitude of  $\vec{E}_i$  to be  $E_0$ . Find and sketch the instantaneous  $\vec{E}$  and  $\vec{H}$  of the total wave in air. Determine the location nearest to the conducting plane where  $E$  is zero. (20%)
6. Calculate the force and torque on a circular loop (radius  $R$ , carrying current  $I$ ) in a uniform magnetic field  $\vec{B}$ . (12%)