

招生學年度	101	招生類別	碩士班
系所班別	電機工程學系碩士班(甲組)、光電工程學系碩士班(乙組)		
科目	電磁學		
注意事項	本考科可使用掌上型計算機		

1. Consider two spherical conductors with radii b_1 and b_2 ($b_2 > b_1$) that are connected by a conducting wire. The distance of separation between the conductors is assumed to be very large in comparison to b_2 , so that the charges on the spherical conductors may be considered as uniformly distributed. A total charge Q is deposited on the spheres. Find
 - (a) (10%) the charges on the two spheres,
 - (b) (10%) the electric field intensities at the sphere surfaces.
2. Calculate the amount of electrostatic energy of a uniform sphere of charge with radius b and volume charge density ρ stored in the following regions:
 - (a) (10%) Inside the sphere,
 - (b) (10%) Outside the sphere.
3. (10%) Determine the capacitance per unit length of a two-wire transmission line with parallel conducting cylinders of different radii a_1 and a_2 , their axes being separated by a distance D (where $D > a_1 + a_2$).

4. (20%) We wish to coat a glass surface with an appropriate dielectric layer to provide total transmission from air to the glass at a wavelength 570 nm. The glass has dielectric constant $\epsilon_r = 2.1$. Determine the required dielectric constant for the coating and its minimum thickness.
5. (10%) Given a magnetic material which we shall specify to be operating in a linear mode with $B = 0.4$ T, let us assume $\mu_r = 250$, and calculate values for magnetization vector and magnetic field intensity.
6. (10%) Find the magnetic flux density at the center of a square loop, with side $2w$ carrying a direct current I .
7. (10%) Measurements on a 0.6 (m) lossless coaxial cable at 100 (kHz) show a capacitance of 54 (pF) when the cable is open-circuited and an inductance of 0.30 (μ H) when it is short-circuited. Determine the characteristic impedance and dielectric constant of its insulating medium.