

## 國立台灣科技大學九十六學年度碩士班招生試題

系所組別： 電子工程系碩士班乙三組、丙組  
科 目： 電磁學

總分 100 分

1. Draw schematically the equipotential lines (using dashed lines in your figure) and the electric field lines (using solid lines) for
  - (a) a positive point charge  $Q$  in air located at a distance  $D$  from a semi-infinite grounded conducting plane; [4%]
  - (b) a positive point charge  $Q$  in air located at a distance  $D$  from a semi-infinite block of Class A dielectric (with a dielectric constant  $k=3.5$ ) having a plane surface; [4%]
  - (c) an electric dipole in air. [4%]
  - (d) Find the expressions for the electric field, the equipotential lines, and the electric field lines of an electric dipole with dipole moment  $p$  in air. [8%]
  
2. A transmission line in air with permeability  $\mu_0$  consists of two long parallel conducting wires of radius  $b$ . The axes of the wires are separated by a distance  $D$ , which is much larger than  $b$ . If the two wires carry currents of magnitude  $I$  in opposite directions, find in detail the expressions for
  - (a) the total self-inductance per unit length of the transmission line; [8%]
  - (b) the force per unit length between the two parallel wires. [8%]
  
3. If the two-wire line of Problem 2 is situated in air with permittivity  $\epsilon_0$  and dielectric strength  $E_c$ , find in detail the expressions for
  - (a) the capacitance per unit length of two parallel wires; [6%]
  - (b) the approximate maximum potential difference between the conductors, subject to the condition that there is no corona or sparking at the surface of the conductors. [8%]

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4. A uniform perpendicular ( or TE ) plane wave in air is incident upon a dielectric medium at  $z = 0$  with an angle of  $30^\circ$ , as shown in Fig. p4.
- (a) Find the reflection coefficient  $\Gamma$  . (10%)
- (b) Repeat (a) when the incident signal is a parallel ( or TM ) plane wave . (10%)

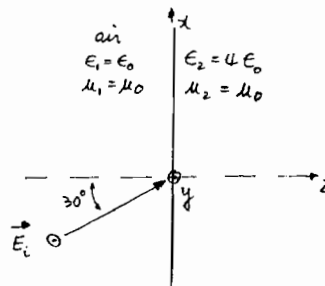


Fig. p4

5. The standing-wave ratio on a 50-ohm transmission line terminated in an unknown load impedance is found to be 4. The distance between successive voltage minimum is 10 cm, and the first minimum is located at 2.5 cm from the load. Determine (a) the reflection coefficient  $\Gamma$  , (10%) and (b) the load impedance  $Z_L$  . (10%)
6. In the system shown in Fig. p7, a line of characteristic impedance 50 ohms and charged to 10V is connected at  $t = 0$  to another line of characteristic impedance 75 ohms and charged to 5V. The one-way travel time is  $T$  for each of the lines. Find: (a) the value of the voltage at  $z = 0$  for  $0 < t < T$  (5%) and (b) the value of the voltage at  $z = l$  for  $T < t < 1.5T$  .(5%).

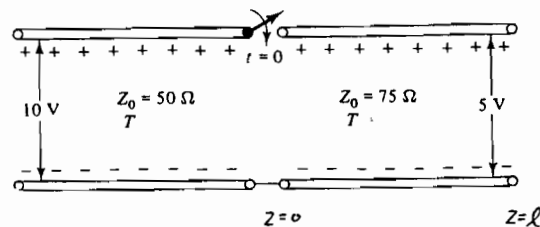


Fig. p7