

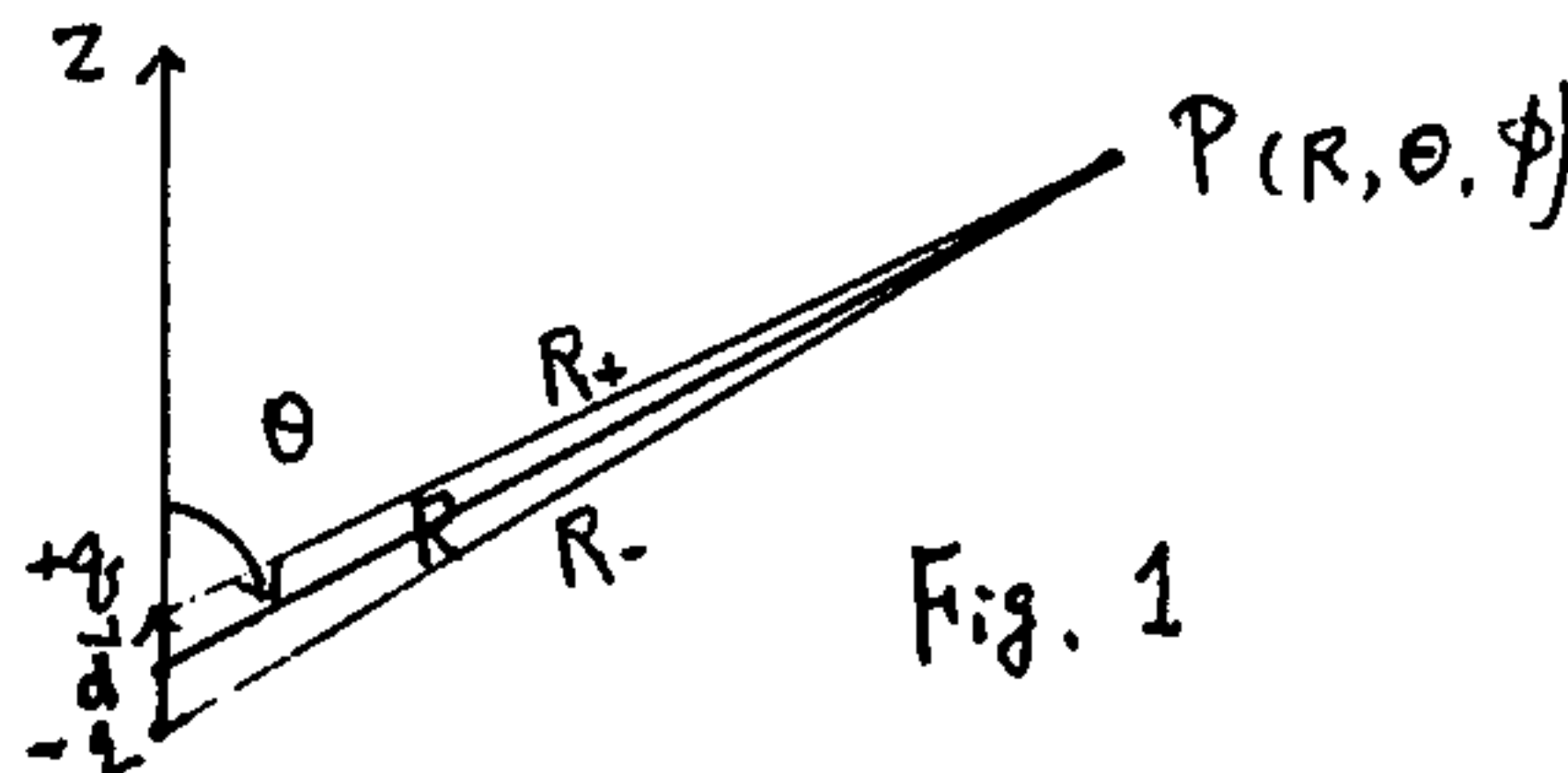
國立臺灣科技大學

九十學年度碩士班招生考試試題

系所組別：電子工程系乙三組、電子工程系丙組

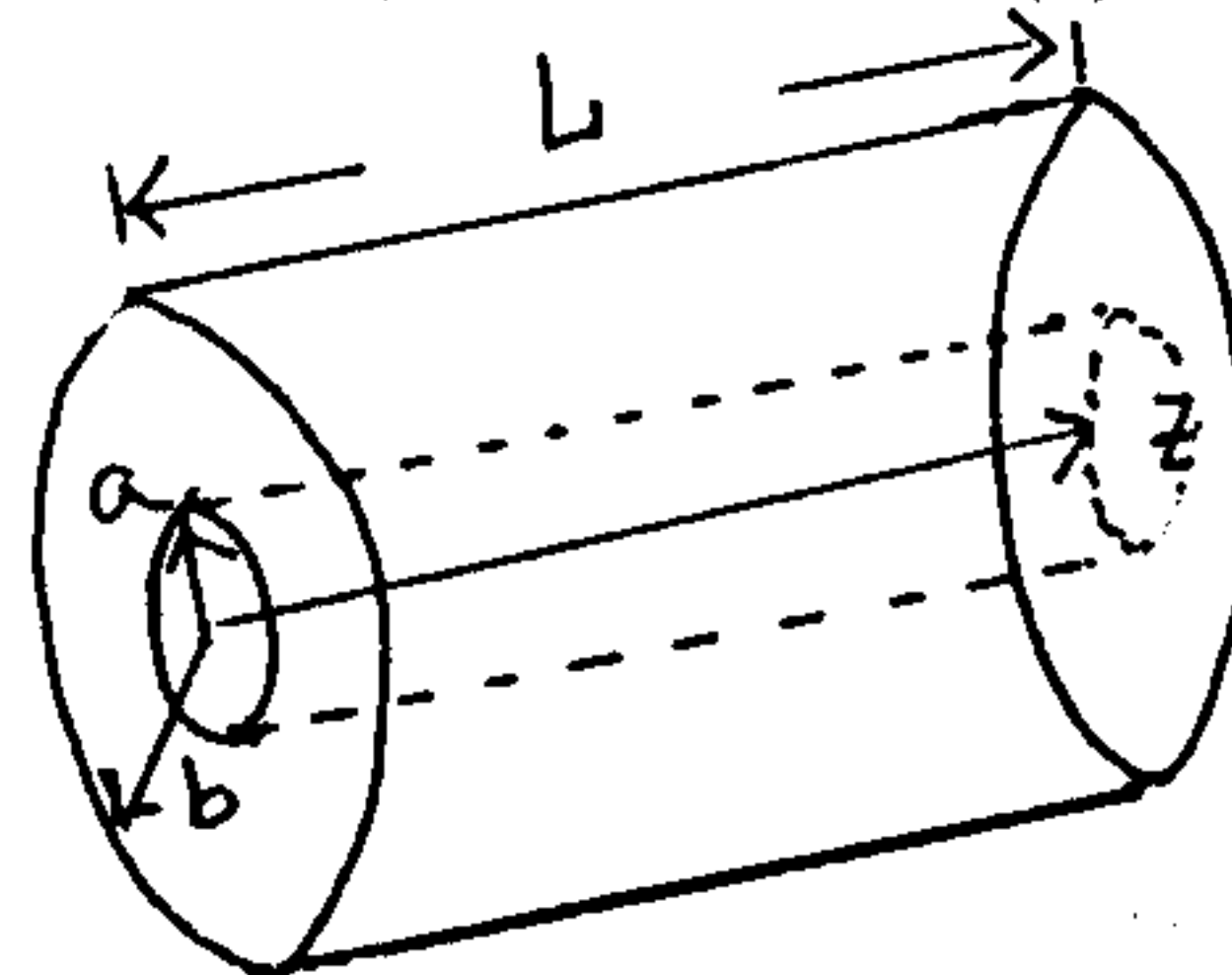
科目：電磁學

- 1) An electric dipole consisting of equal and opposite point charges $+q$ and $-q$ separated by a small distance d is shown in Fig. 1. Determine the potential V and the electric intensity E at an arbitrary point P at a distance $R \gg d$ from the dipole. (14%).



- 2) A d-c voltage of 6 (V) applied to the ends of 1 (km) of a conducting wire of 0.5 (mm) radius results in a current of 1/6 (A). Find (a) the conductivity of the wires (4%), (b) the electric field intensity in the wire (4%), (c) the power dissipated in the wire (4%), and (d) the electron drift velocity, assuming electron mobility in the wire to be $1.4 \times 10^{-3} \text{ (m}^2/\text{V.s.)}$. (4 %)

- 3) By using stored electrostatic energy and magnetic energy, determine (a) the capacitance per unit length and (b) the inductance per unit length of a very long air coaxial transmission line that has a solid inner conductor of radius a and a thin outer conductor of inner radius b as shown in Fig. 2. (10 % + 10%)



$$L \gg a \text{ \& } b$$

- 4) (a) Define reflection coefficient and transmission coefficient of a plane wave at a plane boundary. What is the relationship between them for normal incidence? (b) Define standing - wave ratio. What is the relationship with reflection coefficient? (8 % + 8 %)
- 5) A standard air-filled S-band rectangular wave-guide has dimensions $a = 7.21 \text{ (cm)}$ and $b = 3.40 \text{ (cm)}$. If it is desired that wave-guide operates only in the dominant TE_{10} mode and that the operating frequency be at least 25 % above the cutoff frequency of the TE_{10} mode but no higher than 95 % of the next higher cutoff frequency, what is the allowable operating-frequency range? (20 %)
- 6) A transmission line of characteristic impedance $R_0 = 50 \text{ (}\Omega\text{)}$ is to be matched to a load impedance $Z_L = 40 + j 10 \text{ (}\Omega\text{)}$ through a length L' of another transmission line of characteristic impedance R_0' . Find the required L' and R_0' for matching. (14%)

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