

國立臺灣科技大學
九十三學年度博士班考試試題

系所組別：電子工程系乙組
科 目：電磁理論

總分 100 分

1. Calculate the internal and external inductances per unit length of a transmission line consisting of two long parallel conducting wires of radius a that carry currents in opposite directions. The axes of the wires are separated by a distance d , which is much larger than a . (20%)

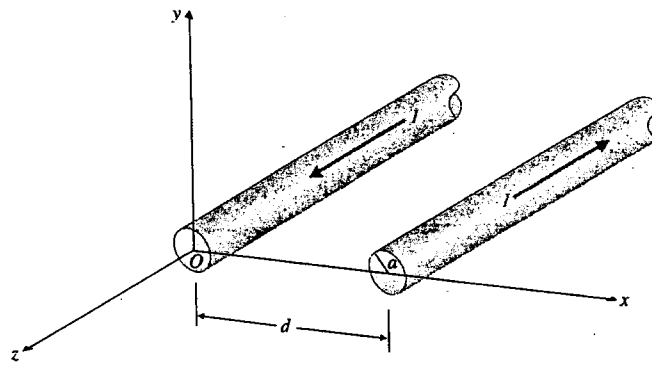


FIGURE A two-wire transmission line

2. An a-c source of amplitude V_0 and angular frequency ω , $v_c = V_0 \sin \omega t$, is connected across a parallel-plate capacitor C_t , as shown in the figure. (a) Verify that the displacement current in the capacitor is the same as the conduction current in the wires. (b) Determine the magnetic field intensity at a distance r from the wire. (20%)

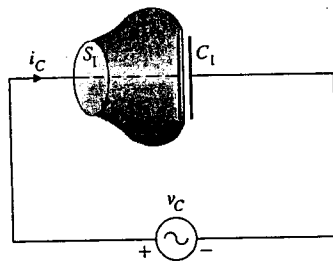


FIGURE A parallel-plate capacitor connected to an a-c voltage source

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3. The standing-wave ratio on a 50Ω transmission line terminated in an unknown load impedance is found to be 3.0. The distance between successive voltage minima is 20 cm, and the first minimum is located at 5 cm from the load. Determine (a) the reflection coefficient Γ , and (b) the load impedance Z . (30 %)
4. A TE_{10} wave at 10 GHz propagates in a rectangular waveguide with inner dimension $a = 1.5$ cm and $b = 0.6$ cm, which is filled with polyethylene ($\epsilon_r = 2.25$, $\mu_r = 1$). Determine (a) the phase constant, (b) the guide wavelength, (c) the phase velocity, and (d) the wave impedance. (30 %)

