

本試題是否可以使用計算機： 可使用， 不可使用（請命題老師勾選）

考試日期：0301，節次：2

Problem 1 (20 Points)

A lossless coaxial line has a velocity  $v = 2.5 \times 10^8$  m/s and characteristic impedance  $Z_0 = 50 \Omega$ . The incident current is  $I^+(z,t) = 2.5e^{j3}e^{-j\pi z/4}e^{j\omega t}$  A. Find (a) the frequency of the signal, (b) the inductance and capacitance per meter of the line, and (c)  $V^+(z,t)$ . If the line for  $z > 0$  is now replaced by another lossless line with  $Z_0 = 100 \Omega$  and  $v = 1 \times 10^8$  m/s, find (d)  $V^+(z,t)$  for  $z > 0$ .

Problem 2 (20 Points)

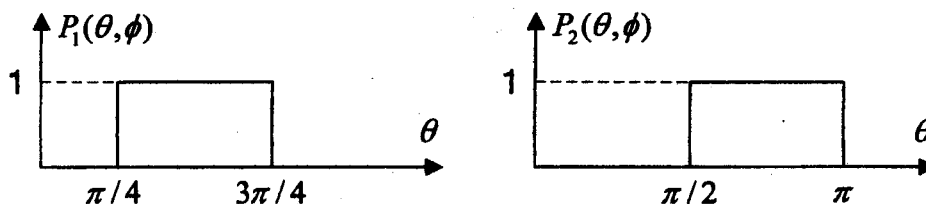
A 1-GHz right-hand circularly-polarized electromagnetic wave is propagating in free space along the direction of  $3\hat{x} + 4\hat{y}$ . (a) Write down the expressions for its electric and magnetic fields, if  $\vec{E} = E_0\hat{z}$  at  $x = y = z = t = 0$  and  $E_0$  is a constant. (b) Find the phase velocities and wavelengths in  $x$ ,  $y$ , and  $z$  directions, respectively.

Problem 3 (20 Points)

An air-filled rectangular waveguide has the dimension of 3 cm by 1 cm. (a) Find the cutoff frequencies of the lowest two propagating modes of electromagnetic waves. (b) Calculate the phase velocity and wave impedance for an 8 GHz propagating wave in this waveguide.

Problem 4 (20 Points)

Two antennas have the normalized radiation power intensity given by the following figures and are all independent of  $\phi$ . Find the beam solid angle, directivity and effective aperture for these two antennas.



(背面仍有題目,請繼續作答)

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Problem 5 (20 Points)

A load has an input admittance of  $0.008 + j0.008 \text{ ohm}^{-1}$ . Assume that the characteristic admittance of all the transmission lines is  $0.02 \text{ ohm}^{-1}$ . Use one short-circuited stub in parallel with the load and one short-circuited stub in parallel with the line at  $d = 0.22\lambda$ ; match the load to  $50 \Omega$  by finding the lengths of the required stubs. Use Smith chart. Also write down every step of your reasoning and the result on your answer sheet. Otherwise it can not be graded.

