※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Problem 1: (20 Points)

(a) Derive the Gauss's law for electric flux from Generalized Ampere's law.

(b) Write down the boundary conditions for electric flux and electric field in differential form.

Problem 2: (20 Points)

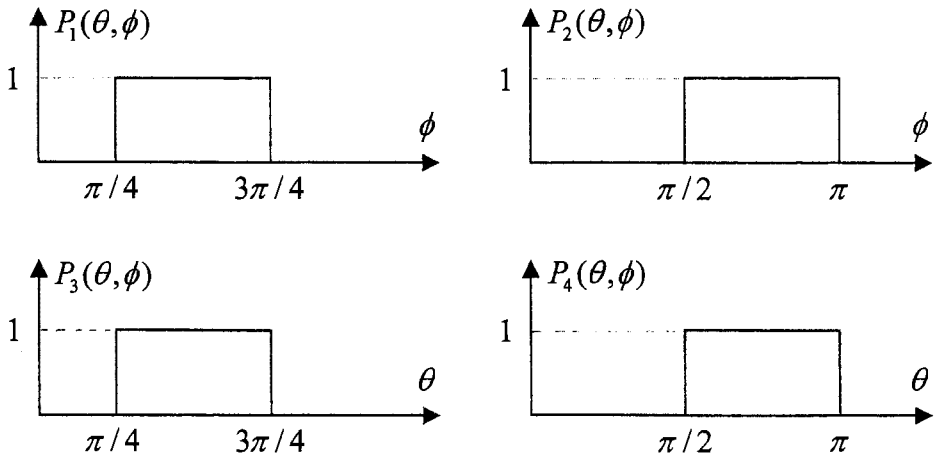
An infinite-long lossless coaxial line, along the z-axis, has a velocity $v = 2\times10^8$ m/s and characteristic impedance $Z_0 = 100\,\Omega$. The incident *CURRENT*, coming from $z = -\infty$, is $I^+(z,t) = e^{j20}e^{-j4\pi z}e^{j\omega t}$ A. Find (a) the frequency of the signal, and (b) the inductance and (c) the capacitance per meter of the line. If the line for $z > 0$ is now replaced by another lossless line with $Z_0 = 25\Omega$ and $v = 1\times10^8$ m/s, Find (d) the reflected *VOLTAGE* $V^-(z,t)$ for $z < 0$ and (e) the transmitted *VOLTAGE* $V^+(z,t)$ for $z > 0$.

Problem 3 (20 Points)

The cross-section of an air-filled metallic rectangular waveguide is 2 cm in the z-direction and 4 cm in the x direction. One wave is propagating in this waveguide along the y-direction and it has $H_y = C_0 f(50\pi z)g(50\pi x)e^{-j25\pi y}$. (a) What is this mode? (b) Are f and g functions *sin* or *cos*? Why? (c) What is its frequency? (d) Find the transverse electric fields of this wave.

Problem 4: (20 Points)

Four antennas have the normalized radiation power intensity given by the following figures, where P_1 and P_2 are independent of θ and P_3 and P_4 are independent of ϕ. Find the beam solid angle, directivity and effective aperture for these four antennas.



(背面仍有題目，請繼續作答)

系所組別：電腦與通信工程研究所丁組

考試科目：電磁波 考試日期：0222，節次：2

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Problem 5: (20 Points)

An antenna with an impedance of $25 + j10\,\Omega$ is to be matched to a $50\,\Omega$ lossless line with an open stub ($Z_0 = 50\,\Omega$ also). Determine (a) the admittance of this antenna, (b) the distance between the stub and antenna, (c) the stub length required, (d) the VSWR on the line between antenna and the open stub, and (e) the VSWR on the open stub. You *MUST* only use a Smith chart to find all the above answers. Using other methods to find the answers give you no points. Write down every step of your reasoning and the results on a simplified Smith chart sketched on your answer sheet.