

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： 0307，節次： 2

※ 考生請注意：本試題 可 不可 使用計算機**Problem 1 (20 Points)**

- (a) What is "retarded potential"?
- (b) Derive the charge conservation law from the generalized Ampere's law.

**Problem 2 (20 Points)**

The VSWR of a loaded transmission line is 3 and the first voltage maximum are  $\lambda/6$  away from the load. (a) Find the normalized load impedance. (b) How far away from the load will the real part of the input impedance equal to its imaginary part?

**Problem 3 (20 Points)**

When a uniform plane wave in air is normally incident onto a planar lossless medium, the reflection coefficient is measured to be  $-0.25$ , and the phase velocity of the transmitted wave is reduced by a factor of 3. Find (a) the relative permittivity and the relative permeability of this lossless medium. (b) Design a match layer before this medium to reduce the reflection to zero.

**Problem 4 (20 Points)**

The cross-section of an air-filled metallic rectangular waveguide is 4 cm in the  $z$ -direction and 2 cm in the  $x$  direction. One wave is propagating in this waveguide along the  $y$ -direction and its has  $E_y = C_1 \sin(50\pi z) \sin(50\pi x) e^{-j25\pi y}$ . (a) What is this mode and what is its frequency? (b) Find the transverse electric fields of this wave.

**Problem 5 (20 Points)**

A helical antenna has a far-field electric field given by  $\vec{E} = (I_0 / r) \cos\theta e^{-j\beta r} \vec{a}_\theta$  for the upper hemisphere ( $0 \leq \theta \leq \pi/2, 0 \leq \phi \leq 2\pi$ ), where  $I_0$  is a constant. Find (a) the total radiated power, (b) the maximum effective area at 1GHz.