

國立成功大學  
110學年度碩士班招生考試試題

編 號：186

系 所：電腦與通信工程研究所

科 目：電磁場與波

日 期：0203

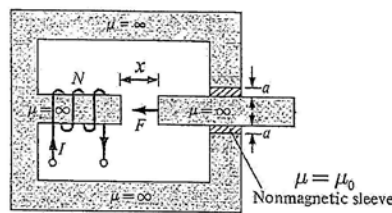
節 次：第 2 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。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)**

As shown in the figure the cross section of an electromechanical system in which the plunger move freely between two nonmagnetic sleeves. Assume that all legs have the same cross-sectional area  $S$ . (a) What are the magnetic motive force (mmf) and the reluctance of this magnetic circuit, and (b) what are the magnetic flux and magnetic force  $F$ , as functions of  $x$ ?

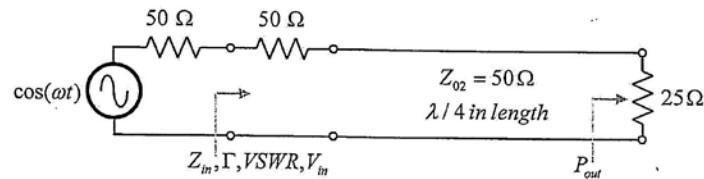


**Problem 2 (30 Points)**

The magnetic field intensity of a plane wave in a homogeneous nonmagnetic ( $\mu = \mu_0$ ) medium is given as  $\vec{H} = \sin(2\pi \times 10^8 t - 2\pi z) \vec{a}_x$  A/m. Determine (a) the wave velocity, (b) the relative permittivity  $\epsilon_r$  of the medium, (c) the wavelength, (d) the electric field intensity, (e) the displacement current density, and (f) the time average power flow per unit area.

**Problem 3 (20 Points)**

A transmission-line circuit is as shown in the figure. (a) Find the impedance  $Z_{in}$ , the reflection coefficient  $\Gamma$ , and the voltage standing wave ratio  $VSWR$  at the input. (b) Find the input voltage  $V_{in}$  and the output power  $P_{out}$  if a signal source  $\cos(\omega t)$  with  $50\Omega$  internal impedance is attached to the input.



**Problem 4 (15 Points)**

In a dielectric medium ( $\epsilon = 9\epsilon_0, \mu = \mu_0$ ), a plane wave with  $\vec{H} = \cos(10^9 t - kx - k\sqrt{8}z)\vec{a}_y$  A/m, where  $k$  is a positive real number, is incident on an air boundary at  $z = 0$ . Find (a) the value of  $k$ , (b) the refraction angle, and (c) the Brewster angle for no reflection.

**Problem 5 (15 Points)**

- (a) An air-filled rectangular waveguide operates at 50GHz. If the cutoff frequency of a  $TE$  mode is 40GHz, calculate the guided (propagating) wavelength and the guided wave impedance of this mode.
- (b) A cylindrical metallic waveguide with a cross-sectional radius of 1 cm is filled with air. Find the cutoff frequency for its  $TE_{12}$  mode. (Bessel functions of the first kind are shown below for your reference.)

