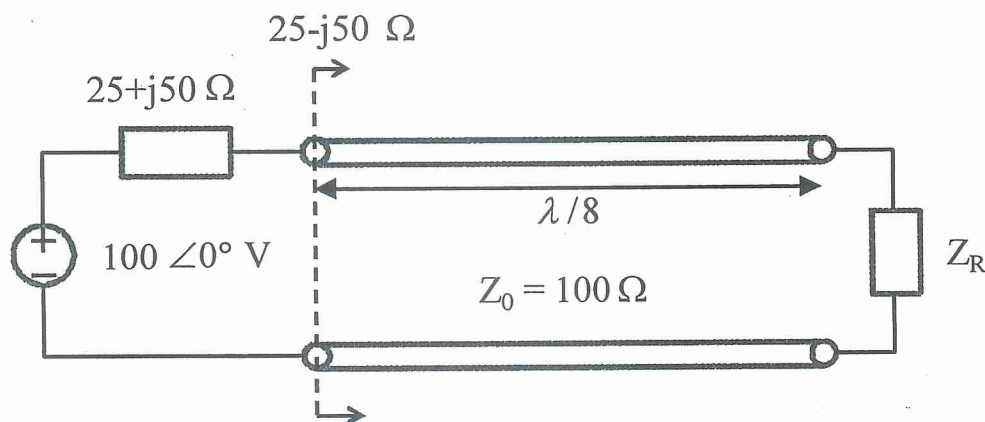


類組：電機類 科目：電磁學 B(3008)

※請在答案卷內作答

1. (20%) Please derive the Poynting's Theorem from the four Maxwell's Equations. And explain its physical meaning in plain language.
2. (10%) Write down the mathematical expression in phasor form for the E field of a plane wave if it is
 - a) Linearly-polarized traveling along $-x$ direction.
 - b) Left-hand circularly-polarized traveling along $+z$ direction.
3. (10%) For a hollow perfect metallic rectangular waveguide with a cross section $a \times b$, please make a drawing of its surface current on guide walls for TE_{10} mode. Here $a = 2b$.
4. (10%) Please explain in plain language why waveguide tends to exhibit the property of a high-pass filter.
5. (15%) Consider a lossless transmission line as shown in the following figure. If the input impedance of the line is $(25-j50)\Omega$, please answer the following questions.



(5A) (8%) the value of the load impedance Z_R

(5B) (7%) the power transferring to the load Z_R

6. (15%) Consider electromagnetic waves:

(6A) (10%) Describe what basic attributes (the parameters) are required for a mathematical formula to model an electromagnetic wave.

(6B) (5%) Use rigorous mathematical expressions to explain why electromagnetic waves are transverse waves.

參考用

注意：背面有試題

類組：電機類 科目：電磁學 B(3008)

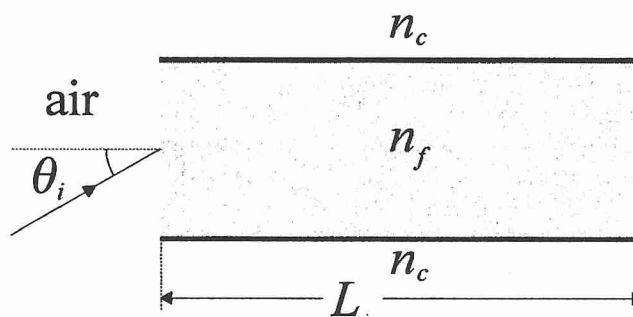
※請在答案卷內作答

7. (10%) The displacement $x(t)$ of a vibrating electron under sinusoidal electric field $E(t)$ of angular frequency ω is given by

$$x(t) = \frac{q_e/m_e}{\omega_0^2 - \omega^2} E(t),$$

where $q_e (>0)$, m_e , ω_0 represent the charge, mass, and resonance angular frequency of an electron. If $E(t) = E_0 \sin \omega t$, plot $E(t)$ and the displacement $x(t)$ for a (i) free electron (with $\omega_0 = 0$), and (ii) bound electron (with $\omega \ll \omega_0$). Justify your answer.

8. (10%) Consider a ray in the air incident on a multi-mode optical fiber of length L with core and cladding indexes n_f , n_c at an angle of θ_i , as shown below



- (8A) (5 %) What is the optical path length l experienced by the ray traversing the fiber? (*Hint*: Path length depends on the tilt angle of the ray inside the fiber core.)
- (8B) (5 %) What is the maximum travel time difference between all guided rays? (*Hint*: Rays can be guided if total internal reflection occurs.)

注意：背面有試題

參考用