# 國立中央大學 108 學年度碩士班考試入學試題

所別： 電機工程學系 碩士班 電波組(一般生)　　

科目： 電磁學

本科考試禁用計算器

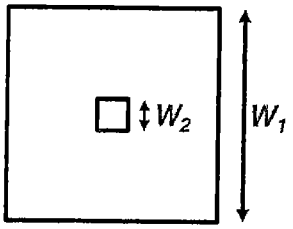
**Problem 1 (25%)　請寫下完整計算或推導流程**

Consider a parallel-plate capacitor. The area of the parallel-plate capacitor is 1 $mm^2$. The distance between the two metal electrodes is 500 nm. The relative permittivity and the conductivity of the dielectric material between the electrodes are 225 and $10^{-7}$ S/m, respectively.

1) (15%) Please calculate the capacitance of the parallel-plate capacitor.
2) (10%) Please calculate the resistance of the parallel-plate capacitor.

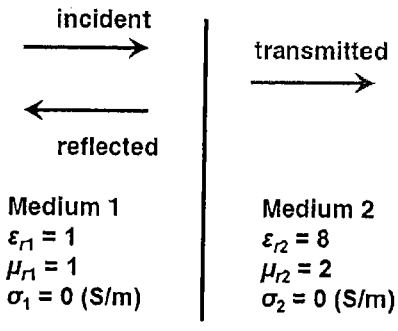
**Problem 2 (10%)　請寫下完整計算或推導流程**

Consider two square conducting loops in free space as shown in the figure below. The small square loop is located at the center of the big square loop. The length of the edges of the big loop is $W_1$. The length of the edges of the small loop is $W_2$. Please find the mutual inductance between the two conducting loops. (Assume $W_1 >> W_2$.)




**Problem 3 (15%)　請寫下完整計算或推導流程**

Consider a uniform plane wave impinging normally upon a plane boundary between two lossless dielectric materials as shown in the figure below. Assume that the average power of the incident wave is 9 W. Please calculate the average power of the reflected wave and that of the transmitted wave.




參考用

注意:背面有試題

# 國立中央大學 108 學年度碩士班考試入學試題

所別： 電機工程學系 碩士班 電波組(一般生)　　共 4 頁 第 2 頁

科目： 電磁學

本科考試禁用計算器

**Problem 4 (50%) – 5% each. Choose only ONE correct answer. 單選題（請於答案卷上作答）**

1) Which of the following does NOT support TEM mode?
   (A) parallel-plate transmission line
   (B) two-wire transmission line
   (C) coaxial transmission line
   (D) rectangular waveguide
   (E) All of the above can support TEM mode.

2) There are three air-filled parallel-plate transmission lines. For line 1, the plate width is 5 mm and dielectric thickness is 1 mm. For line 2, the plate width is 10 mm and dielectric thickness is 2 mm. For line 3, the plate width is 10 mm and dielectric thickness is 1 mm. Which of the following is TRUE for the three characteristic impedances?
   (A) $Z_1 < Z_2 = Z_3$
   (B) $Z_1 = Z_3 > Z_2$
   (C) $Z_1 = Z_2 > Z_3$
   (D) $Z_1 > Z_2 > Z_3$
   (E) $Z_1 > Z_2 = Z_3$

3) Regarding the essential difference between a transmission line and an ordinary electric network, which of the following is FALSE?
   (A) Whereas the physical dimensions of transmission lines are very much smaller than the operating wavelength, electric networks are usually a considerable fraction of a wavelength and may even be many wavelengths long.
   (B) The circuit elements in an ordinary electric network can be considered discrete.
   (C) A transmission line is a distributed-parameter network.
   (D) There are no standing waves existing in an ordinary electric network.

4) What is the input impedance of an open-circuited lossless transmission line if the length of the line is $0.75\lambda$?
   (A) Infinity
   (B) Zero
   (C) 50 Ω
   (D) 73 Ω
   (E) $100 + j100$ Ω

注意:背面有試題

所別： 電機工程學系 碩士班 電波組(一般生)　　

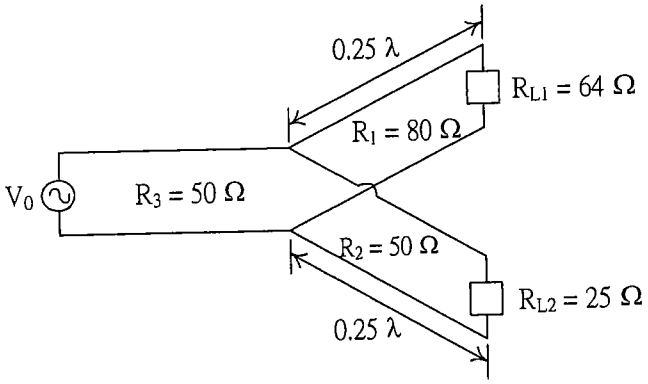
科目： 電磁學

本科考試禁用計算器

5) A lossless transmission line with length = 0.5$\lambda$ and characteristic impedance $Z_0 = 100\ \Omega$ is terminated with a load impedance $Z_L = 50 + j50\ \Omega$. What is the input impedance of such loaded transmission line?
(A) $50 + j50\ \Omega$
(B) $100 + j50\ \Omega$
(C) Zero
(D) Infinity
(E) $25 + j25\ \Omega$

6) Regarding the characteristic impedance of a transmission line, which of the following is FALSE?
(A) For a lossless transmission line, it can be calculated if the inductance and capacitance per unit length are provided.
(B) For a lossy transmission line, it can be calculated if the inductance and capacitance per unit length are provided.
(C) For a distortionless transmission line, it can be calculated if the inductance and capacitance per unit length are provided.
(D) For a lossless transmission line, it can be calculated if the open-circuit and short-circuit impedances measured at the input terminal are provided.

7) For the following network in the figure, which of the following is FALSE?




(A) The two loads $R_{L1}$ and $R_{L2}$ receive equal power from the generator $V_0$.
(B) There is no standing wave on line 3.
(C) There is no standing wave on line 1.
(D) Line 2 is a lossless transmission line.



注意:背面有試題

# 國立中央大學108學年度碩士班考試入學試題

所別： 電機工程學系 碩士班 電波組(一般生) 共4頁 第4頁

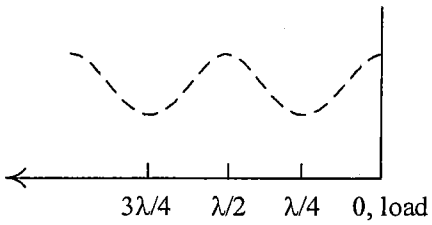
科目： 電磁學

本科考試禁用計算器

8) Regarding the Smith chart, which of the following is FALSE?
(A) All $r$-circles pass through the point $\Gamma_r = 1, \Gamma_i = 0$.
(B) All $x$-circles pass through the point $\Gamma_r = 1, \Gamma_i = 0$.
(C) The centers of all $r$-circles lie on the $\Gamma_r$–axis.
(D) The centers of all $x$-circles lie on the $\Gamma_i$–axis.

9) Regarding the Smith chart, which of the following is FALSE?
(A) It can be used for calculating the input impedance of a lossless terminated transmission line.
(B) It can be used for calculating the impedance $Z_L$ of a given admittance $Y_L$.
(C) The point representing a short-circuit on an impedance Smith chart is the point representing an open-circuit on an admittance Smith chart.
(D) In comparison to using the Smith chart as admittance chart, using the Smith chart as impedance chart is more convenient for solving double-stub matching.

10) For a terminated lossless transmission line, the magnitude of voltage or current standing wave is plotted in the figure. Which of the following is FALSE?






(A) The terminating impedance is purely resistive.
(B) The terminating impedance is higher than the characteristic impedance of the lossless transmission line if the figure shows current standing wave.
(C) The voltage reflection coefficient is positive at the terminating load if the figure shows voltage standing wave.
(D) If the terminating impedance is changed to be the same with the characteristic impedance of the lossless transmission line, the standing wave curve will become a straight line if the figure shows current standing wave.

注意:背面有試題