

國立中山大學 113 學年度

碩士班暨碩士在職專班招生考試試題

科目名稱：電磁學【電機系碩士班戊組、通訊所碩士班乙組、電波聯合碩士班】

— 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

國立中山大學 113 學年度碩士班暨碩士在職專班招生考試試題

科目名稱：電磁學【電機系碩士班戊組、通訊所碩士班乙組、電波聯合碩士班】題號：482004

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題） 共 1 頁第 1 頁

1. (25%) The radius of the inner conducting sphere and the inner radius of the outer spherical conductor are R_i and R_o , respectively. The voltage between these two concentric spherical conductors is V . The space between the conductors is filled with a dielectric medium with the permittivity ϵ . Determine the stored electrostatic energy.
2. (25%) The magnetic flux density vector is $\mathbf{B} = (5kx + 4)\mathbf{a}_x - (3ky + 10y)\mathbf{a}_y + (8kz)\mathbf{a}_z$ in free space. Please determine the value of the constant k .
3. (10%) Write the frequency-domain Maxwell's equations with time-varying source. Define phase velocity and group velocity.

4. (15%) The magnetic field intensity of a linearly polarized uniform plane wave propagating in the $+y$ -direction in seawater [$\epsilon_r = 80, \mu_r = 1, \sigma = 4 \text{ (S/m)}$] is

$$\vec{H} = \hat{a}_x 0.1 \sin \left[10^{10} \pi t - \frac{\pi}{3} \right] \text{ (A/m)}$$

at $y = 0$.

- a) Determine the attenuation constant, the phase constant, the intrinsic impedance, the phase velocity, the wavelength, and the skin depth. (5%)
- b) Find the location at which the amplitude of \vec{H} is 0.01 (A/m). (5%)
- c) Write the expressions for $\vec{E}(y, t)$ and $\vec{H}(y, t)$ at $y = 0.5$ (m) as function of t . (5%)

5. (10%) For the case of oblique incidence of a uniform plane wave with perpendicular polarization on a perfectly conducting plane boundary as shown in Fig. 1, write (a) the instantaneous expressions

$$\vec{E}_1(x, z; t) \text{ and } \vec{H}_1(x, z; t)$$

For the total field in medium 1, using a cosine reference, (5%) and (b) the time-average Poynting vector. (5%)

6. (5%) A standard air-filled S-band rectangular waveguide has dimensions $a = 7.21$ (cm) and $b = 3.40$ (cm). What mode types can be used to transmit electromagnetic waves having the 5-cm wavelengths?

7. (10%) Find the input impedance of the lossless transmission line shown in Fig. 2.

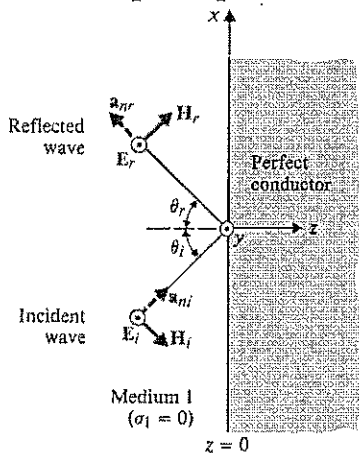


Fig. 1

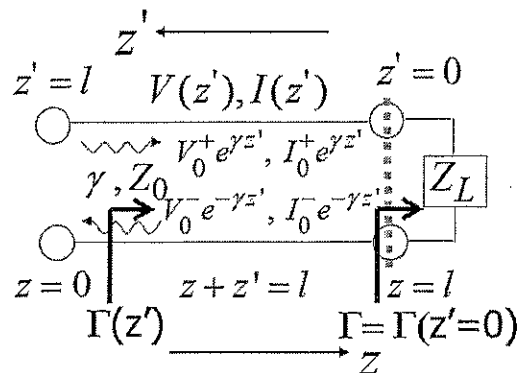


Fig. 2