

國立中山大學 112 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，請斟酌作答(不得另攜帶紙張，亦不得使用應考證空白處作為計算紙使用)。
- 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，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）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。

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 ※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 2 頁第 1 頁

- (25%) The length of a coaxial cable with outer and inner conductors is L . The space between the outer conductor of inner radius a and the inner conductor of radius b is filled by a medium with permittivity ϵ and conductivity σ . The leakage resistance between these two conductors is R and the capacitance of this cable is C . Determine RC .
- (25%) The rectangular and circular loops are coplanar as shown in Fig. 1. The radius of the circular loop is c . Determine the mutual inductance between these two loops. Assume that $b \gg c$ and $c > d$.

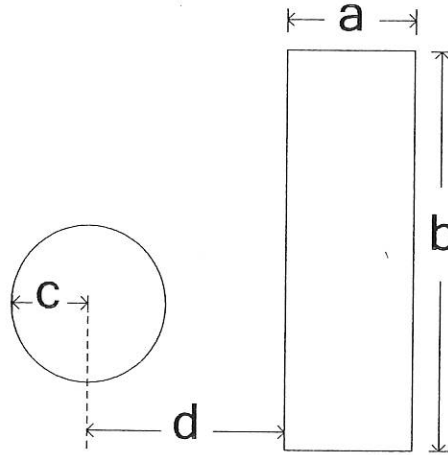


Fig. 1

- (5%) (a) Write Maxwell's equations in differential form.
 (5%) (b) Write the EM boundary conditions.
 (5%) (c) Explain homogeneous Helmholtz's equation.
 (5%) (d) Explain dispersion.
- As shown in Fig. 2, a uniform plane wave ($\mathbf{E}_i, \mathbf{H}_i$) of an angular frequency ω is incident from air on a very large, perfectly conducting wall at an angle of incidence θ_i with perpendicular polarization. Find
 (5%) (a) the current induced on the wall surface, and
 (5%) (b) the time-average Poynting vector in medium 1.

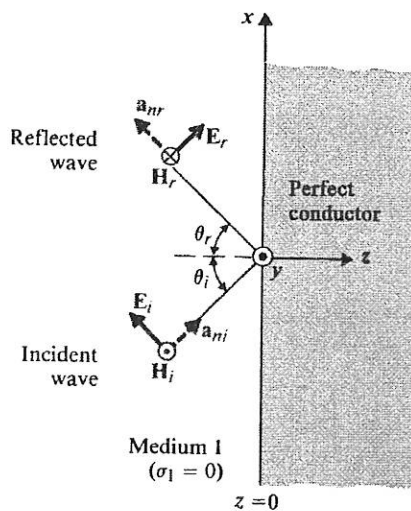
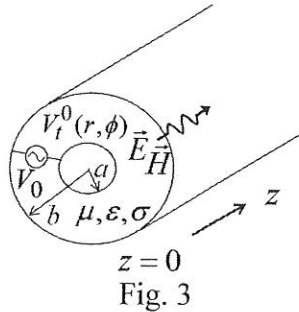


Fig. 2

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5. (10%) As shown in Fig. 3, for a coaxial line in TEM mode, find \mathbf{E} and \mathbf{H} .



6. The open-circuit and short-circuit impedance at the input terminals of a lossless transmission line of length 1.5 (m), which is less than a quarter wavelength, are $-j54.6 \text{ } (\Omega)$ and $j103 \text{ } (\Omega)$, respectively.
- (4%) Find Z_0 and γ of the line.
- (4%) Without changing the operating frequency, find the input impedance of a short-circuited line that is twice the given length.
- (2%) How long should the short-circuited line be in order for it to appear as an open circuit at the input terminals?