

國立臺灣海洋大學 103 學年度研究所碩士班招生考試試題

考試科目：電磁學及電磁波

系所名稱：電機工程學系碩士班電波組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

(1) Maxwell's Equations:

(a) Write the four Maxwell's Equations in the MKS system. (8%)

(b) What are the names and units of the terms contain in the four equations in (a)? (10%) (c) Which of the two Maxwell's equations are redundant and explain the reasons for the redundancy? (8%)

(d) Write the four Maxwell' equations in phasor form for the case of time harmonic field. (4%)

(2) Solve the 2D-Laplace's Equation in the interior of the rectangular region $0 \leq x \leq a, 0 \leq y \leq b$ with the boundary conditions given by $V(0, y) = V(a, y) = V(x, 0) = 0$ and $V(x, b) = V_0$. (20%)

(3) What is the polarization of a wave? (5%) Give an example of (a) linearly polarized wave, (3%)

(b) right handed circularly polarized wave, (3%) (c) left handed circularly polarized wave. (3%).

Show that a linearly polarized wave can be expressed as a linear combination of a right handed and left handed circularly polarized wave. (6%)

(4) Explain the terms TE, TM and TEM waves. (6%) In term of TE, TM and TEM waves, what is a uniform plane wave? (2%) A rectangular waveguide has dimension $a \times b$ with $a > b$, what is the dominant mode. (3%) What is the cutoff frequency of this mode? (3%) Write down the first three modes with the lowest frequencies for (i) $b < a < 2b$ (6%) and (ii) $a > 2b$. (6%) What happen to the first three modes when $a = 2b$? (4%)