

# 國立交通大學 93 學年度碩士班入學考試試題

科目名稱：電磁學(072) 考試日期：93 年 4 月 17 日 第 3 節

系所班別：電信工程學系 組別：乙組 第 1 頁, 共 1 頁

\*作答前, 請先核對試題、答案卷(試卷)與准考證上之所組別與考試科目是否相符!!

1. Three point charges  $q$ ,  $-2q$  and  $q$  are located at  $z = -d$ ,  $0$  and  $d$ , respectively, on the  $z$ -axis in the free space. Derive the electrostatic potential distribution for the far field in the limits  $d \rightarrow 0$ ,  $q \rightarrow \infty$  such that  $qd^2 \rightarrow Q$ . (15 points)
2. Analog to the electrostatic and magnetostatic problems a general vector field  $\mathbf{F}(\mathbf{r})$  is governed by the equations:  $\nabla \cdot \mathbf{F}(\mathbf{r}) = g(\mathbf{r})$  and  $\nabla \times \mathbf{F}(\mathbf{r}) = \mathbf{G}(\mathbf{r})$ , where  $g$  and  $\mathbf{G}$  are known source distributions. Derive  $\mathbf{F}$  in terms of  $g$  and  $\mathbf{G}$  in an infinite space. Hint: Use linear superposition. (15 points)
3. It is known in electrostatic theory that a cavity enclosed by a perfect conductor can shield the electric field from outside the cavity. Give the reason plainly in mathematical point of view. (10 points)
4. (a) Write down the differential and integral forms of Maxwell's equations for the case of a time-varying electromagnetic field in a simple medium. (b) Explain from which the cause-effect relationships among electromagnetic fields and their sources. (c) Derive the two divergence equations from the two curl equations and the equation of continuity. (15 points)
5. (a) What do we mean by TEM wave, uniform plane wave, traveling wave and standing wave? (b) Wave reflection occurs when wave impedances on the two sides of an interface differ, why? (c) What is meant by the polarization of an EM wave? How to represent a right-hand circularly-polarized plane wave, which is assumed to incident obliquely onto a planar dielectric-conductor interface, in terms of a parallel- and a perpendicular-polarization components? (15 points)
6. Please choose and **explain** which kind of the following EM waves **cannot** propagate through hollow metal pipes of an arbitrary cross section: (a) TEM, (b) TE, (c) TM. (15 points)
7. Which one of the following metal lines has the **highest** inductance value? Which one has the **lowest** inductance value? Please **explain**. (15 points)

