國立中央大學 108 學年度碩士班考試入學試題

所別： 太空科學研究所 碩士班 不分組(一般生)
太空科學研究所 碩士班 不分組(在職生)

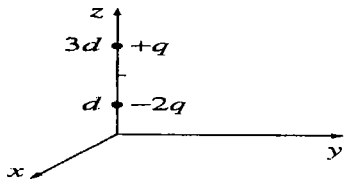
科目： 電磁學

本科考試禁用計算器

＊計算題需計算過程，無計算過程者不予計分

1. If V satifies Lapace's equation, show that $V_{ave}(R)=V(0)$ for all R. Where $V_{ave}(R)$ is the average value of V on the surface of a sphere of radis R, and, V(0) is the value at the origin of the sphere.(20%)

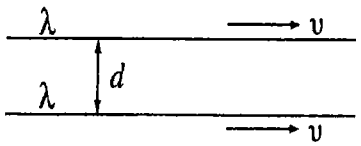
2. Find the force on the charge +q in the figure. (The xy plane is a grounded conductor, i.e. v=0) (10%)



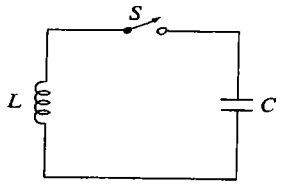
3. What condition is made for the constitution relation $\vec{D}=\varepsilon_0\varepsilon\vec{E}$? (10%)

4. When you polarize a neutral dielectric, please prove that the total bound charge vanishes. (10%)

5. Suppose you have two infinite straight line chargesλ, a distance d apart, moving along at a constant speed v. How great would v have to be in order for the magnetic attraction to balance the electrical repulsion? (15%)



6. A capacitor C is charged up to a voltage V and connected to an inductor L, as shown in the following figure. At time t=0, the switch S is closed. Find the current in the circuit as a function of time (10%). How does your answer change if a resistor R in included in series with C and L (10%)?



7. In magnetostatic, $\vec{A}(\vec{r})=\frac{\mu_0}{4\pi}\int\frac{\vec{j}(\vec{r}')}{n}d\tau'$, where $n=|\vec{r}-\vec{r}'|$. Prove that $\nabla\cdot\vec{A}=0$. (15%)
(Hint:$\nabla\cdot(f\vec{A})=f(\nabla\cdot\vec{A})+\vec{A}\cdot\nabla f$)