

# 大同大學 100 學年度研究所碩士班入學考試試題

考試科目：電磁學

所別：光電工程研究所

第 全 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

1. Charge is distributed over the surface of a circle of radius  $a$  lying in  $xy$  plane with origin at the center. The surface density is given in cylindrical coordinates by  $\sigma = A\rho^2$  where  $A$  is a constant. What is the total charge on the circle? (10%)
2. A certain electric field is given by  $\vec{E} = E_0(\rho/a)^3\hat{\rho}$  for  $0 < \rho < a$  and  $\vec{E} = 0$  otherwise. Find the volume charge density. (20%)
3. The plates of two capacitor  $C_1$  and  $C_2$  are connected by conductors of negligible capacitance as show in Figure 1, that is, they are connect in "parallel". If a potential difference  $\Delta\phi$  is now applied across the terminal T and T', show that this combination is equivalent to a single capacitor of capacitance  $C_p = C_1 + C_2$ . (20%)
4. A point dipole  $p$  at  $r$  is in the field of point charge  $q$  located at the origin. Find the energy of  $p$ , the torque on it. (20%)
5. Four very long straight wires each carry current of the same value  $I$ . They are all parallel to the  $z$  axis and intersect the  $xy$  plane at the point  $(0,0)$ ,  $(a,0)$ ,  $(a,a)$ , and  $(0,a)$ . the first and third have their current in the positive  $z$  direction; the other two have the current in the negative  $z$  direction. Find the total force unit length on the current corresponding to the point  $(a,a)$ . (20%)
6. Explain the hysteresis loop from a ferromagmtic material, and discuss the constant  $\mu$  in the system of B versus H. (10%)

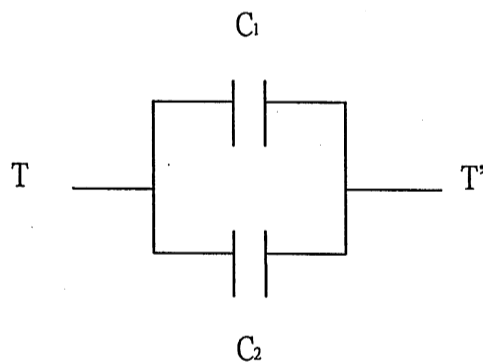


Fig. 1