

中國文化大學 97 學年度轉學招生考試

系組：物理學系三年級

日期節次：7 月 29 日第 3 節

科目：電磁學 (15-25)

考生作答前請詳細閱讀下列注意事項以免評分錯誤：

- 1) 本學科試題包括演算證明題(共四題計100分)
- 2) 演算證明題詳細明列計算過程和最終結果
- 3) 演算證明題附帶之圖形及任何符號請勿作任何更改

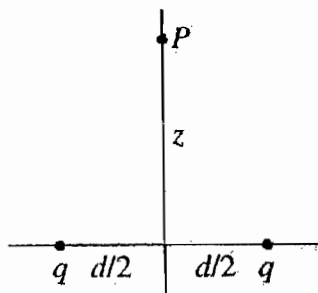


Figure-1

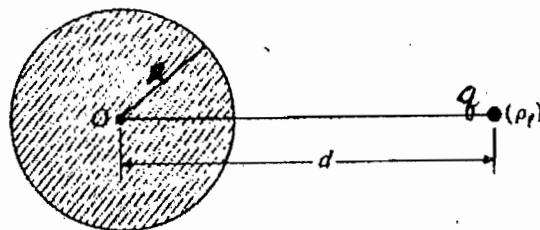


Figure-2

1. (a) Find $\bar{\nabla}\phi$ if $\phi = \frac{1}{|\bar{r}|}$, where $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$. (b) Prove that

$$\nabla^2\left(\frac{1}{|\bar{r}|}\right) = 0, \text{ where } \bar{r} = x\hat{i} + y\hat{j} + z\hat{k}. \text{ (20\%)}$$

2. As shown in Figure-1, find the electric field a distance z above the midpoint between two equal charges q , a distance d apart. (25%)

3. As shown in figure-2, a point charge q is situated a distance d from the center of a grounded conducting sphere of radius R . Find the potential outside the sphere. (30%)

4. (a) Write the Maxwell's equations (in differential form) in free space (means in vacuum). (b) Show that the Maxwell's equations in free space (vacuum) may predict the existence of the electromagnetic wave motions. (25%)