

## 淡江大學八十九學年度碩士班招生考試試題

系別：物理學系

科目：近代物理

本試題共 壹 頁

1. Describe in detail about the photoelectric effect experiment conducted by H. Hertz and explain why the particle nature of light must be used to obtain his results.

(30%)

2. Consider a body rotating freely about a fixed axis. Apply the Wilson-Sommerfeld quantization rules and show that the possible values of the total energy are

predicted to be  $E = h^2 n^2 / 8 \pi^2 I$ , where  $n = 1, 2, \dots$ . (10%)

3. Given the wave function for the lowest energy state of a particle-in-a box is:

$$\Psi(x,t) = \begin{cases} \sqrt{\frac{2}{a}} \cos\left(\frac{\pi x}{a}\right) \exp(-iEt/\hbar) & -a/2 < x < a/2 \\ = 0 & a/2 < |x| \end{cases}$$

Find the average values  $\langle x \rangle$ ,  $\langle x^2 \rangle$ ,  $\langle p \rangle$  and  $\langle p^2 \rangle$  and prove that

$$\Delta x \Delta p \geq h/4 \pi. \quad (30\%)$$

4. Derive the formula for the transmission coefficient T for a particle incident upon a step potential with total energy greater than the height of the step in one dimension.

(30%)