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# 淡江大學 97 學年度碩士班招生考試試題

系別：物理學系

科目：近代物理

准帶項目請打「V」	
X	簡單型計算機

本試題共 1 頁，5 大題

1. (a) Discuss the photoelectric effect and its significance.
- (b) Explain quantum tunneling. Give two physical examples of this effect.
- (c) Discuss the Stern-Gerlach experiment and its significance.
- (d) Explain in pair-annihilation processes why we observe  $e^- + e^+ \rightarrow 2\gamma$  but not  $e^- + e^+ \rightarrow \gamma$ .

2. Discuss following items:

- (a) Zeeman effect
- (b) Compton effect
- (c) Larmor Precession
- (d) Hartree Theory
- (e) LS coupling

3. (a) Derive the Plank's distribution equation shown below:

$$\rho_T(\nu) = \frac{8\pi\nu^2}{c^3} \frac{h\nu}{e^{h\nu/kT} - 1}$$

- (b) Discuss the asymptotic results for  $\nu \rightarrow 0$  and  $\nu \rightarrow \infty$ .
- (c) Obtain  $\rho_T(\lambda)$ , the wavelength form of the spectral energy density, from  $\rho_T(\nu)$ .
- (d) Qualitatively sketch  $\rho_T(\lambda)$  versus  $\lambda$  for several different temperatures.

4. A square well potential is written as:

$$V(x) = \begin{cases} V_0 & x < -a/2, x > +a/2 \\ 0 & -a/2 < x < +a/2 \end{cases}$$

- (a) Find the eigenfunctions of the time independent Schrodinger equation.
- (b) Sketch the eigenfunctions then find the eigenvalues.
- (c) Sketch the energy levels in the potential well.

5. A step potential is written as:

$$V(x) = \begin{cases} V_0 & x > 0 \\ 0 & x < 0 \end{cases}$$

- (a) Find the eigenfunctions in the case of  $E < V_0$  &  $E > V_0$ .
- (b) Find the transmission & reflection probability. ( $E > V_0$ )