

# 國立彰化師範大學 97 學年度碩士班招生考試試題

系所： 顯示技術研究所碩士班

科目： 近代物理

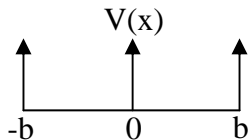
☆☆請在答案紙上作答☆☆

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## Physical constants:

Planck's constant  $h = 6.626 \times 10^{-34}$  J-s,  $m_e = 9.1 \times 10^{-31}$  kg,  $e = 1.602 \times 10^{-19}$  C,  
the Boltzmann's constant  $k_B = 1.38 \times 10^{-23}$  J/K

1. What is (a) uncertainty principle (b) Schrödinger equation (c) Fermi energy (d) work function (e) density of states (f) Hartree self-consistent field method?  
Please give a brief definition or explanation on each of them. (30%)
2. What is the de Broglie wavelength of an electron with a kinetic energy of (a) 130eV  
(b) 150eV? (10%)
3. Suppose a finite well with  $U=200$ eV and  $L=100$ pm confines a single electron in its ground state ( $E_1=30$ eV). Assuming the electron only absorbs one photon from the light, what wavelength of light is needed to free the electron from the potential well? (10%)
4. Consider an infinite square well of width  $2b$ , the wave function of a trapped particle inside the well is found to be:



$$\psi(x) = A \left( \sin \frac{3\pi x}{b} + \cos \frac{\pi x}{2b} \right), \text{ inside the well}$$

$$\psi(x) = 0, \text{ outside the well}$$

- (a) Calculate the coefficient  $A$ . (10%)
  - (b) If one can measure the total energy, what are the possible results, and what is the probability of each of them? (5%)
  - (c) What is the average energy? (5%)
5. What is tunneling effect? How to determine the transmission coefficient for barrier tunneling? Please give a few examples of barrier tunneling applications. (15%)
  6. What are quantum dots? Could we use them to develop a novel self-illuminative display technology? If it is possible, please conceptualize your ideas. If not, please also give the reasons. (15%)