✿ 國立雲林科技大學 **109** 學年度 碩士班招生考試試題	系所：電子系 科目：半導體元件

$n_i(\text{Si}) = 10^{10} \text{ cm}^{-3}$, $q = 1.6 \times 10^{-19}$ C, $kT = 0.025$ eV, $\ln 10 \approx 2.3$, $e^{10} \approx 2.2 \times 10^4$

1. Explain the following terms: (a) Single-crystal (b) Polycrystalline (c) Amorphous (10%)

2. Assume there are five semiconductors: Si, GaAs, Ge, GaP, and $Al_x Ga_{1-x} As$. (a) What are elemental semiconductors? (b) What are compound semiconductors? (10%)

3. Explain the following terms: (a) Energy band (b) Bandgap (10%)

4. (a) What is an intrinsic semiconductor? (b) If a group V element, such as phosphorous (P), is added to pure silicon, will it become an *n*-type or *p*-type semiconductor? Why? (10%)

5. Briefly explain the following two transport mechanisms shown in semiconductor: (a) Drift (b) Diffusion (10%)

6. Explain
   (a) High injection for *pn* diode   (5%)
   (b) Avalanche breakdown   (5%)
   (c) Linearly grade pn junction   (5%)
   (d) Strong inversion of MOS structure   (5%)

7. Calculate the electron and hole current densities of a silicon *pn* diode, with $N_a = 10^{16}$ cm^{-3} and $N_d = 10^{18}$ cm^{-3} by applied forward bias of 0.5V. The μ_n, μ_p, L_n and L_p are 1000 cm^2/V/s, 100 cm^2/V/s, 80 μm and 5 μm, respectively. (15%)

8. The charge distribution of a MOS structure is given as in Fig.1. Draw the field and voltage distributions and band diagram. Where $Q_m + Q_{ss} = qN_a x$. (15%)
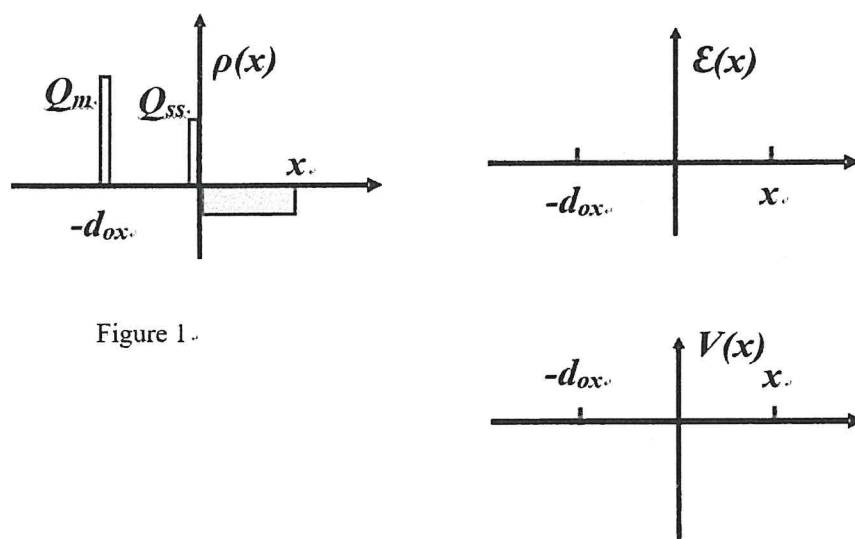

Figure 1