

大葉大學 九十二 學年度 研究所博士班 招生考試試題紙

| 系 所 別 | 組 別 | 考 試 科 目<br>□中文名稱□ | 考 試<br>日 期 | 節 次 | 備 註    |
|-------|-----|-------------------|------------|-----|--------|
| 電機所   | 甲   | 固態電子學             | 6月27日      | 第1節 | 可攜帶計算機 |

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

1. Explain the origin of Zener breakdown and avalanche breakdown. (10%)
2. Draw the energy band diagrams of an ideal MOS capacitor fabricated on p-type silicon in (I) accumulation (II) depletion and (III) inversion. Indicate  $E_c$ ,  $E_v$ ,  $E_i$ , and  $E_F$  on your diagrams. (10%)
3. In Si at 300 K, at what donor concentration ( $N_d$ ) is the probability of donor ionization equal to 95%? Assume the ionization energy of this dopant is 0.05 eV, and the effective density of states in the conduction band ( $N_c$ ) is  $2.8 \times 10^{19} \text{ cm}^{-3}$ . (20%)
4. A Schottky diode with n-type Ga-As at  $T=300 \text{ K}$  yields the  $1/C^2$  versus  $V_R$  plot shown in Fig. 1 where  $C'$  is the capacitance per  $\text{cm}^2$ , the slope of the line is  $1 \times 10^{15} (\text{F/cm}^2)^{-2} (\text{V})^{-1}$ . The  $n_i$  of Ga-As in 300 K is  $1.8 \times 10^6$ ,  $N_c$  is  $4.7 \times 10^{17}$ ,  $N_v$  is  $7 \times 10^{18}$ ,  $\epsilon_s$  is  $1.16 \times 10^{-12} \text{ F/cm}$ . Determine (a)  $V_{bi}$ , (b)  $N_d$ , (c)  $\phi_n$ , and (d)  $\phi_{B0}$ . (20%)

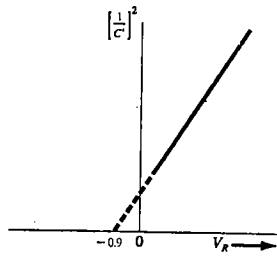


Fig. 1

5. Please explain the “short channel effect”, and “Body Effect” in a MOSFET. (20%)
6. Brief description on the development and trend of semiconductor industry in Taiwan. (10%)
7. Please explain the “hetero-junction bipolar transistor” (HBT). What is the benefit of HBT? (10%)