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<tr><td colspan="7">大葉大學九十一學年度碩士在職專班招生考試試題紙</td></tr>
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<tr><td>電機所</td><td>甲</td><td>電子工程原理</td><td>4 月 14 日</td><td>第 一 節</td><td>可帶計算機
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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）P2-1

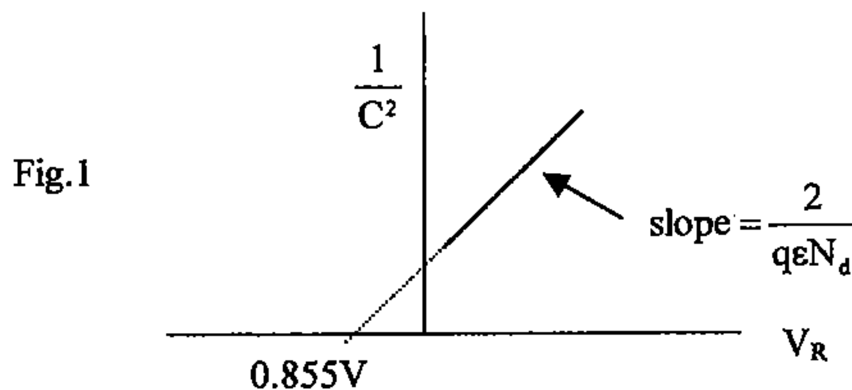
***詳列計算步驟否則一概不予計分**

***1.2.3 三題必選,4-10 題任選二題,總共寫五題。寫超過五題者,祇計前五題分數**

***每題 20 分。本試題共二頁**

1. Please describe in detail the two major physical mechanism of reverse biased p-n junction semiconductor, that is, Zener breakdown and Avalanche breakdown
2. Hall effect is an important phenomena employed in the determination of charge densities in conducting and semiconducting materials. Please describe the principle of Hall effect.
3. bcc (body center cubic)晶格的基元(basis)是由位於 000 和$\frac{1}{2}\frac{1}{2}\frac{1}{2}$兩個相同原子所組成，利用結構因子(structure factor)證明其 X ray 繞射圖形不會出現(100)、(300)、(111)及(221)之平面。
4. What is the different between wet etching and dry etching in semiconductor. Compare their advantages and disadvantages.
5. From the C-V plot, we can obtain some important things. A p^+n junction at T=300 K with $n_i=1.5X10^{10}cm^{-3}$. The C-V plot is given in Fig.1, V_R is the reverse bias, the slop is $1.32X10^{15}$ $(F/cm^2)^{-2}(volt)^{-1}$. Please find (a)built-in voltage V_{bi} (b) carrier concentrations of p side and n side
   ($q=1.6X10^{-19}$ coul, $\varepsilon=11.7X8.85X10^{-14}$F/cm, KT/q=0.0259V)

Fig.1



6. Explain the following briefly(a)Intrinsic semiconductor(b)Diffusion capacitance in p-n junction (c)Channel length modulation in MOSFET(d)Hot carrier effect in MOSFET
7. Consider a bar of conducting material of conductivity σ, length l, and uniform cross-sectional area A, and between the ends of which a voltage V is applied. Please use the Ohm's law to calculate the resistance R of the conducting bar.
8. The potential distribution in a simplified model of a vacuum diode consisting of cathode in the plane $x = 0$ and anode in the plane $x = d$ and held at a potential V_0 relative to the cathode is given by $V(x) = V_0(x/d)^{4/3}$ for $0 < x < d$. Find the following: (a) V at $x = d/8$; (b) $\bar{E}$ at $x = d/8$
9. 考慮一維的自由電子，質量 m，被無限大的位障(potential well)，限制在 0 到 L 的區域內。證明 N 個電子系統之費米能(Fermi energy) ε_F 爲

$$\varepsilon_F = \frac{\hbar^2}{2m}\left(\frac{N\pi}{2L}\right)^2$$

，此處 $\hbar$ 爲 Planck's constant 除以 2π

10. 一二維方形晶格的金屬具有兩個傳導電子，在自由電子的近似下，描繪出電子和電洞的能量曲面，選擇適當的區圖使得描繪出的費米面(Fermi surface)是封閉的