**科目：電子學一(元件)** 適用：電機系

編號：461

考生注意：
1.依次序作答，只要標明題號，不必抄題。
2.答案必須寫在答案卷上，否則不予計分。
3.限用藍、黑色筆作答；試題須隨卷繳回。



[1] Please define the following terms:

(a) Electrons (電子) & holes (電洞) in semiconductor (5 points)

(b) Depletion region (空乏區) of a diode (5 points)

(c) Drift current (飄移電流) & diffusion current (擴散電流) (5 points)

(d) N-type doping (N-型摻質) & P-type doping (P-型摻質) (5 points)

(e) Zener breakdown (齊納崩潰) & Avalanche breakdown (雪崩崩潰) (5 points)

(f) Junction capacitance (接面電容) of a diode (5 points)

(g) CMOS (互補式金氧半電晶體) technology. (5 points)

(h) Body effect (基體效應) in MOSFET. (5 points)

(i) Channel-length modulation (通道長度調變) in MOSFET (5 points)

(j) Sub-threshold conduction (次臨界傳導) in MOSFET. (5 points)

[2] A PN diode employs the following doping levels: $N_A = 2.33\times10^{16}\,cm^{-3}$ and $N_D = 1.17\times10^{15}\,cm^{-3}$. Determine the hole and electron concentrations on the two sides. (Note: $N_i = 1.08\times10^{10}\,cm^{-3}$) (15 points)

[3] (a) Describe the operation principle of a PN Diode. (5 points)

(b) Describe the I-V characteristics of a PN Diode. (5 points)

(c) Plot the cross-sectional schematic of a NMOSFET. (5 points)

(d) Plot the cross-sectional schematic of a CMOS inverter. (5 points)

(e) Describe the operation principle of an NMOSFET. (5 points)

(f) Describe the small-signal model of an NMOSFET. (5 points)

(g) Describe the I-V characteristics of an NMOSFET. (5 points)