中原大學 102 學年度 碩士班 入學考試

102/3/2 10:00 ~ 11:30 電子工程學系光電半導體組

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

科目： 半導體基礎概論 　　　　　　　　　　（共 1 頁第 1 頁）

x□可使用計算機，惟僅限不具可程式及多重記憶者　　□不可使用計算機

1. Does the intrinsic semiconductor have the highest resistivity? Give the reason. (10%)

2. A silicon ingot is doped with 10^{16} arsenic atoms/cm^3. Find the carrier concentrations and the Fermi level at room temperature (300 K). (10%)

3. Assume that an n-type semiconductor is uniformly illuminated, producing a uniform excess generation rate G. Show the change in the semiconductor conductivity $\Delta \sigma$ in steady state. (10%)

4. Show the minority carrier distributions in emitter, base and collector regions of a p-n-p transistor under the active mode of operation. (10%)

5. Show (a) high and (b) low frequency MOS (metal-oxide-semiconductor) C-V (capacitance-voltage) curves. Also show the C-V curves of an MOS diode with (c) a fixed oxide charge and (d) interface traps. (15%)

6. Sketch the cross section of a CMOS inverter with p-well technology and explain the latch-up. (15%)

7. A DRAM must operate with a minimum refresh time of 4 ms. The storage capacitor in each cell has a capacitance of 50 fF and is fully charged to 5 V. Find the worst-case leakage current (i.e., during the refresh cycle 50% of the stored charge is lost) that the dynamic node can tolerate. (15%)

8. A photon is emitted from a recombination of electron and hole. Where is the light emitted from a p-n junction light emitting diode (LED)? How is the wavelength of a LED determined? (15%)