

## 淡江大學 98 學年度轉學生招生考試試題

系列：電機工程學系三年級

科目：電子學

准帶項目請打「V」	
V	計算機

本試題共 5 大題， 頁

1. Briefly explain the meaning of the following terminology.

- (5%) Channel-length modulation.
- (5%) Body effect.
- (5%) Short-circuit transconductance.
- (5%) Zener breakdown.

2. A uniform  $n$ -type piece of silicon with a length of  $L$  m and a cross section area of  $A$  m<sup>2</sup> sustains a voltage difference of  $V$  volt. The mobilities of electron and hole are  $\mu_n$  m<sup>2</sup>/(V·s) and  $\mu_p$  m<sup>2</sup>/(V·s), respectively.

- (10%) Compute the velocities of electrons and holes in this material.
  - (10%) If the doping level is  $N_D$  m<sup>-3</sup> and  $N_D \gg n_i$  where  $n_i$  is the carrier density in intrinsic silicon. Find the total current density flowing through the device.
  - (5%) Is it possible the drift current of hole is equal to the drift current of electron in an  $n$ -type silicon?
3. (15%) Consider the circuit shown in Figure 1, where  $I_S = 6 \times 10^{-16}$  A,  $I_1 = 2$  mA,  $V_T = 26$  mV, and  $V_A = \infty$ . Determine the value of  $V_B$ .

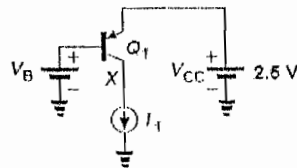


Figure 1

4. (25%) Consider the circuit shown in Figure 2, determine the voltage gain and input/output impedances under the assumption  $V_A = \infty$  and  $C_B$  is very large.

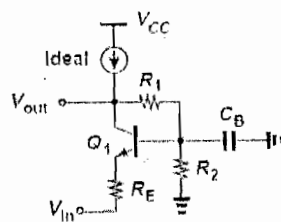


Figure 2

5. (15%) Consider the circuit shown in Figure 3, the parameters are  $\mu_n C_{ox} = 200 \mu\text{A}/\text{V}^2$ ,  $W/L = 20/0.18$ ,  $\lambda = 0$ , and  $V_{TH} = 0.4$  V. Determine the value of  $V_B$  such that  $M_1$  operates at the edge of saturation region.

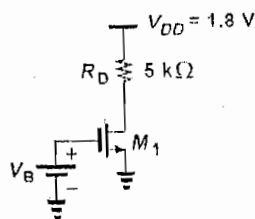


Figure 3