國　立　宜　蘭　大　學

１０７學年度研究所碩士班考試入學

電子學 試題

(範圍相當於 Sedra/Smith 微電子學前七章)

（電子工程學系碩士班）

准考證號碼：

《作答注意事項》

1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。

2.考試時間：100 分鐘。

3.本試卷共有 6 題，第 1 題為 10 個單選題，每題 4 分，小計 40 分，第 2~6 題為非選擇題，小計 60 分，合計 100 分。

4.請將答案寫在答案卷上。

5.考試中禁止使用手機或其他通信設備。

6.考試後，請將試題卷及答案卷一併繳交。

7.本試卷採雙面影印，請勿漏答。

8.本考科可使用非程式型（不具備儲存程式功能）之電子計算機。

1. Choose the correct answer for the following questions. (40%)

(1) Consider the amplifier shown in Fig. 1.(1) with ideal op amps and R_1 = 1 kΩ, R_2 = 3 kΩ, R_L = 1 kΩ. If v_I = 1 V. Then current i_2 =? (A) 0.5 mA (B) 1 mA (C) 1.5 mA (D) 2 mA

(2) Continuing the above problem, current i_L =?
(A) 1 mA (B) 2 mA (C) 3 mA (D) 4 mA

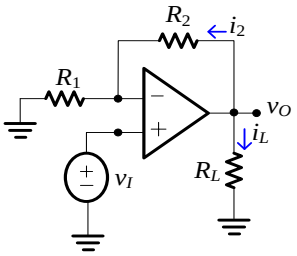

Fig. 1.(1)

(3) If the circuit shown in Fig. 1.(3) is an ideal diode circuit, which is the correct transfer characteristic? In the figures, m is the slope.

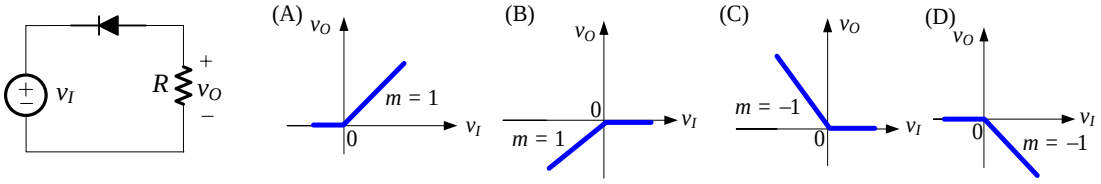

Fig. 1.(3)

(4) For BJT, the h_{FE} is defined as (A) $\frac{I_C}{I_B}$ (B) $\frac{\Delta i_C}{\Delta i_B}$ (C) $\frac{I_C}{I_E}$ (D) $\frac{\Delta i_C}{\Delta i_E}$

(5) The BJT's finite output resistance in active region, r_o, results from
(A) Early effect (B) Avalanche effect (C) Temperature effect (D) Zener Effect.

(6) The symbol shown in Fig. 1.(6) stands for
(A) enhancement-type NMOS (B) enhancement-type PMOS
(C) depletion-type NMOS (D) depletion-type PMOS.

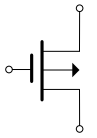
Fig. 1.(6)

(7) An enhancement-type NMOS FET, with V_t = 1 V and k_n' = 25 μA/V^2, has its source terminal voltage = 0.5 V and a 2.5 V dc applied to the gate. What region does the device operate for V_D = 1 V?
(A) Saturation (B) Cutoff (C) Triode (D) Active region.

(8) If a depletion-type NMOS FET is in saturation region, and its current is

$$i_D = \frac{1}{2}k_n(v_{GS} - V_t)^2 \cdot (1 + \lambda v_{DS})$$. Which is correct?

(A) $V_t > 0$ (B) k_n is in proportion to L/W
(C) λ is related to the Miller effect (D) $v_{GS} > V_t$

(9) In Fig. 1.(9), if $R_s = r_o$ = 10 kΩ, g_m = 2 mA/V, then R_{out} =?
(A) 2 kΩ (B) 20 kΩ (C) 200 kΩ (D) 400 kΩ

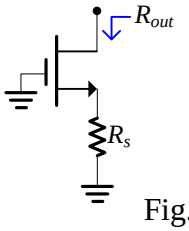

Fig. 1.(9)

(10) Which is correct about CB (Common Base) amplifier?
(A) large input resistance (B) bad high frequency response
(C) high voltage gain (D) used as voltage buffer

2. If the circuit shown in Fig.2 has R_a = 2 kΩ, R_b = 50 kΩ, and C = 2 nF.
(a) What is the circuit?
(b) Find its transfer function $V_o(s)/V_i(s)$.
(10%)

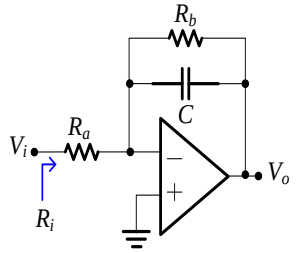

Fig.2

3. Consider a peak rectifier, shown in Fig.3, fed by a 60 Hz sinusoid v_I having a rms value V_{rms} = 24 V. Let the load resistance R = 10 kΩ.
(a)Find the capacitance C that will result in a peak-to-peak ripple of 2 V.
(b)Find the peak value of the diode current $i_{D,max}$.
(10%)

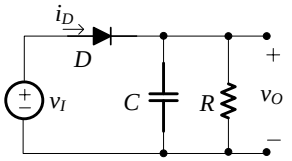

Fig.3

4. For the circuit shown in Fig.4 has that V_{CC} = +9 V, R_B = 100 kΩ. If the β of transistor is specified the range of 50 to 200,
(a) find the maximum value of R_C so that the circuit is in the active mode.(b) Continuing the above problem, what is the range of collector voltage V_C?
(10%)

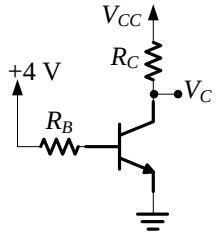

Fig.4

5. For the circuit shown in Fig.5, let V_{DD} = 5 V. The FET operates in saturation with I_D = 0.25 mA, and has V_{tp} = −1 V, $\mu_p C_{ox}(W/L)$ = 1 mA/V^2. Find
(a) $|V_{GS}|$.
(b) What is the largest value that R_D can have while maintaining saturation region operation?
(10%)

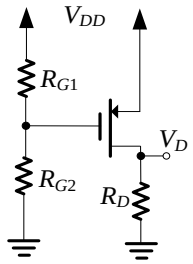

Fig.5

6. (a) Design the CE amplifier, shown in Fig.6, to obtain DC current I_E = 0.5 mA for V_{CC} = +10 V, V_C = 6 V, V_B = 3 V, β = 100, and current through R_{B2} of 50 μA.
(b) What is the function of C_1 and C_2?
(c) Find input resistance R_{in}.
(d) If R_L = 20 kΩ, find $A_v = v_o/v_i$.
(20%)

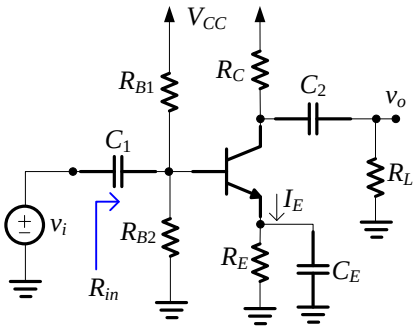

Fig.6