國立勤益科技大學九十八學年度研究所碩士班招生筆試試題卷

所別：電子工程系碩士班　　　　　組別：電子組

科目：電子學

准考證號碼：□□□□□□□□（考生自填）

考生注意事項：

一、考試時間 100 分鐘。

二、試題為選擇題共有六大題，每題再分小題，作答卷必須要有計算式、過程及答案，全對方能給分。

三、應考人不得自行攜帶電子計算器，一律由本校統一提供。

注意：請考生將底下答案表格，含作答結果抄錄於作答卷上（非本試題卷）。作答卷也同時必須要有計算式、過程及答案，方能給分。

試題	答案	試題	答案	試題	答案	試題	答案	試題	答案	試題	答案
1-1		1-2		1-3		1-4		1-5		1-6	
2-1		2-2		2-3		2-4		2-5			
3-1		3-2		3-3		3-4					
4-1		4-2		4-3							
5-1		5-2		5-3							
6-1		6-2		6-3		6-4					

試題一：〈十八分〉

Consider an amplifier operating from ±15V power supplies of Fig.1. It is fed with a sinusoidal voltage having 1V peak and delivers a sinusoidal voltage output of 10V peak to 1-kΩ load. The amplifier draws a current of 10 mA from each of its two power supplies. The input current of the amplifier is found to be sinusoidal with 0.1 mA peak.
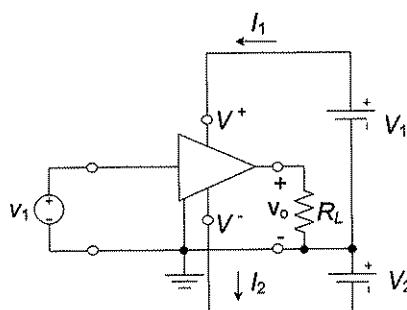

Fig.1

1-1. Find the voltage gain, A.10dB,　　B.10,　　C.15,　　D.20,　　E.100

1-2. Find the current gain, A.100dB,　B. 100,　C.10dB,　D.10　　E.15

1-3. Find the power gain,　A. 50,　　B.100　　C.500　　D.1000　　E.10000

1-4. Find the power drawn from the dc supplies, A.100mW , B. 190mW　C. 150mW ,　D. 300mW ,　E. 600mW

1-5. Find the power dissipated in the amplifier, A. 50mW ,　B. 300mW　C. 149.6mW , D. 250.05mW , E. 0.05mW ,

1-6. Find the amplifier efficiency.   A. 16.67%,   B. 83.35%   C. 21.3%
                                       D. 8.34%,   E. 33.34%

試題二：〈二十分〉

Consider the difference-amplifier circuit of Fig.2. For the case $R_1=R_3=2k\Omega$ and $R_2=R_4=200k\Omega$.

2-1. Find the value of the differential gain A_d.
        A. 10,   B. 50,   C. 100,   D. 150,   E. 200

2-2. Find the value of the differential input resistance R_{id} .
        A. 1KΩ B. 2KΩ,   C. 4KΩ,   D. 100KΩ,   E. 200KΩ

2-3. Find the output resistance R_0.
        A. 0KΩ,   B. 2KΩ,   C. 50KΩ,   D. 100KΩ,   E. 200KΩ

2-4. If the resistors have 1% tolerance (i.e., each can be within ±1% of its nominal value), find the worst-case common-mode gain A_{cm}
        A. 0.01,   B. 0.02,   C. 0.03,   D. 0.04,   E. 0.05,

2-5. Find the corresponding value of CMRR.
        A. 34dB   B. 68dB,   C. 10dB,   D. 50dB,   E. 100dB
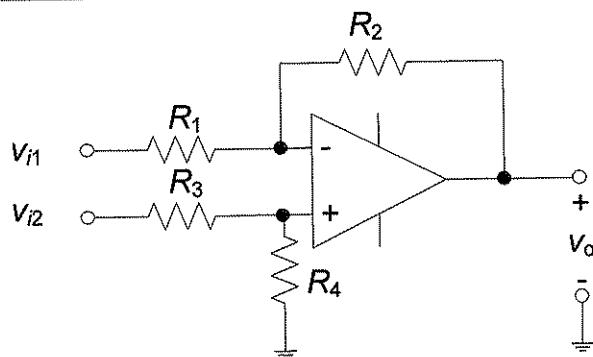
Fig.2

試題三：〈十二分〉

Assuming the diodes to be ideal in the circuits of Fig.3 (a) and Fig.3 (b),

3-1. Find the value of I. shown in Fig.3 (a).   A. 0mA,   B. 1mA,   C. 1.33mA,
                                                D. 2mA,   E. 4mA,

3-2. Find the value of V. shown in Fig.3 (a).   A. 0V,   B. 3.3V,   C. -10V,
                                                D. 10V,   E. 6.7V.

3-3. Find the value of I. shown in Fig.3 (b).   A. 0mA,   B. 1mA,   C. 2mA,
                                                D. 3mA,   E. 4mA,

3-4. Find the value of V. shown in Fig.3 (b). A. 0V, B. 1V, C. 2V, D. 3V, E. 5V,
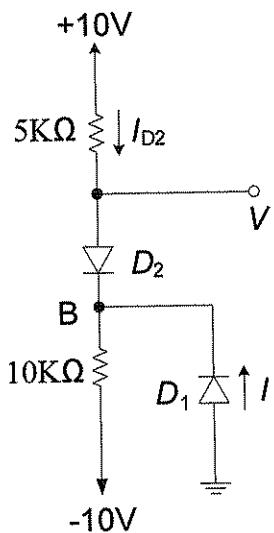
Fig.3(a)
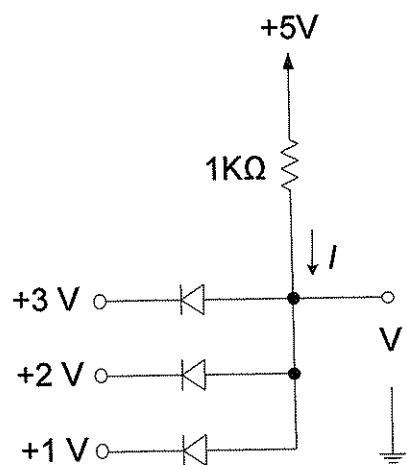
Fig.3(b)

試題四：〈十五分〉

The NMOS transistors in the circuit of Fig. 4 have $V_t = 1V$, $\mu_n C_{ox} = 120\mu A/V^2$, $\lambda = 0$, and $L_1 = L_2 = 1\mu m$. Find

4-1. the required values of gate width for Q_1. (A)$2\mu m$ (B)$4\mu m$ (C)$6\mu m$ (D)$8\mu m$ (E)$10\mu m$ (5 %)

4-2. the required values of gate width for Q_2. (A)$2\mu m$ (B)$4\mu m$ (C)$6\mu m$ (D)$8\mu m$ (E)$10\mu m$ (5 %)

4-3. the value of R. (A)$1.5k\Omega$ (B)$3.5k\Omega$ (C)$6.5k\Omega$ (D)$12.5k\Omega$ (E)$24.5k\Omega$ (5 %)

to obtain the voltage and current values indicated.
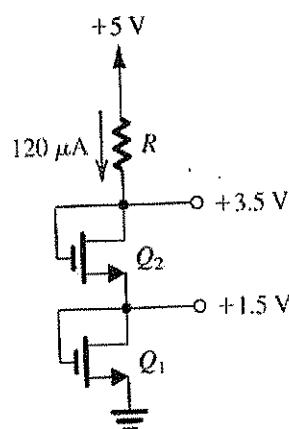
Fig. 4

試題五：〈十五分〉

A *pnp* power transistor operates with an emitter-to-collector voltage of 5V, an emitter current of 10 A, and $V_{EB} = 0.85V$. For $\beta = 15$,

5-1. What base current is required? (A)$0.313A$ (B)$0.625A$ (C)$0.937A$ (D)$1.25A$ (E)$1.563A$ (5 %)

5-2. What is I_S for this transistor? (A) $3.216 \times 10^{-14}A$ (B) $8.04 \times 10^{-15}A$ (C)$1.608 \times 10^{-14}A$ (D)$6.914 \times 10^{-16}A$ (E)$1.383 \times 10^{-15}A$ (5 %)

5-3. Compare the emitter-base junction area of this transistor with that of a small -signal transistor that conducts $i_C = 1mA$ with $v_{EB} = 0.70V$. How much larger is it? The junction area of this transistor is (A) larger than above one is 2.3 times (B) larger than above one is 4.6 times (C) smaller than above one is 4.6 times (D) smaller than above one is 23.3 times (E) larger than above one is 23.3 times (5 %)

試題六：〈二十分〉

As shown in Fig. 6, a CMOS common-source amplifier fabricated in a $0.18 - \mu m$ technology has $W/L = 7.2\mu m / 0.36\mu m$ for all transistors, $k_n' = 387\mu A/V^2$, $k_p' = 86\mu A/V^2$, $I_{REF} = 100\mu A$, $V_{An}' = 5V/\mu m$, and $|V_{Ap}'| = 6V/\mu m$. Find

6-1. the transconductance g_{m1}. (A)$1.25mA/V$ (B)$0.63mA/V$ (C)$2.5mA/V$ (D)$3.75mA/V$ (E)$5mA/V$ (5 %)

6-2. the output resistance r_{o1}. (A)$4.5k\Omega$ (B)$9k\Omega$ (C)$18k\Omega$ (D)$27k\Omega$ (E)$36k\Omega$ (5 %)

6-3. the output resistance r_{o2}. (A)$2.7k\Omega$ (B)$5.4k\Omega$ (C)$10.8k\Omega$ (D)$16.2k\Omega$ (E)$21.6k\Omega$ (5 %)

6-4. the voltage gain A_v. (A) $-6.2V/V$ (B)$-12.3V/V$ (C)$-18.5V/V$ (D)$-24.6V/V$ (E)$-30.9V/V$ (5 %)

Fig. 6