

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：電子工程系碩士班

組別：乙一、乙二、乙三

科目：電子電路學

I. 填充題

注意：1-4 題屬於填充題，請在分析後，依子題順序將答案填寫在答案卷上即可；單位必需填寫否則不予計分。每一子題完全答對者可得五分。(80%)

1. As shown in Fig. P1 is a voltage amplifier, in which both two transistors are identical. The relevant parameters include $V_{BE(on)}=0.7V$, $\beta=100$, and $V_T=26mV$ (at $T=300K$). The reactance's of all capacitors are neglected. Please analyze this circuit and then only write down the results of the following problems in order on the answer sheet. (where $R_1=100k\Omega$, $R_2=47k\Omega$, $R_{C1}=4.7k\Omega$, $R_{C2}=2k\Omega$, $R_{E1}=1.5k\Omega$, $R_{E2}=1.5k\Omega$, and $R_L=10k\Omega$)

(注意：僅依序寫下答案即可，且必需有單位，否則不予計分)

- (1) Find the operating point of Q_1 ,

$$I_{CQ1} = \underline{\hspace{2cm}}$$

- (2) Find the operating point of Q_2 ,

$$I_{CQ2} = \underline{\hspace{2cm}}$$

- (3) Find the input π resistance of Q_1 ,

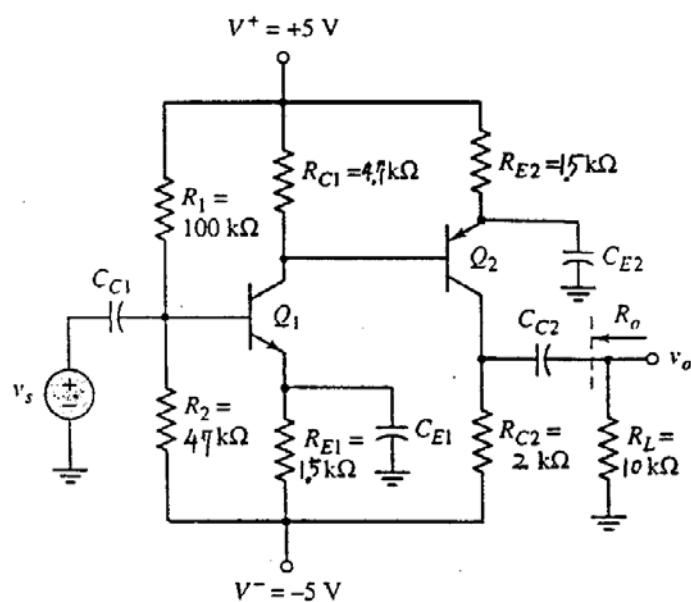
$$r_{\pi1} = \underline{\hspace{2cm}}$$

- (4) Find the transconductance of Q_2 ,

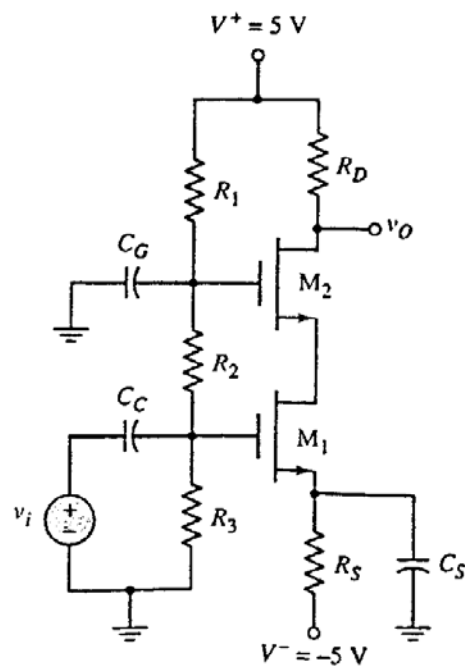
$$g_{m2} = \underline{\hspace{2cm}}$$

- (5) Find the voltage gain of this amplifier shown in Fig. P1

$$A_v = v_o/v_s = \underline{\hspace{2cm}}$$



P.1



P.2

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：電子工程系碩士班

組別：乙一、乙二、乙三

科目：電子電路學

2. A cascode amplifier is shown in Fig. P2, in which both two MOSFET's are identical. The relevant parameters include the threshold voltage $V_{th(on)}=1.2V$ and the conduction parameter $k=0.8mA/V^2$. The reactance's of all capacitors are neglected. Please analyze this circuit and then only write down the results of the following problems in order on the answer sheet.

(注意：僅依序寫下答案即可，且必需有單位，否則不予計分)

- (6) Find the gate-to-source voltage of M_1 ,

$$V_{GS1} = \underline{\hspace{2cm}}$$

- (7) Find the operating point of M_1 ,

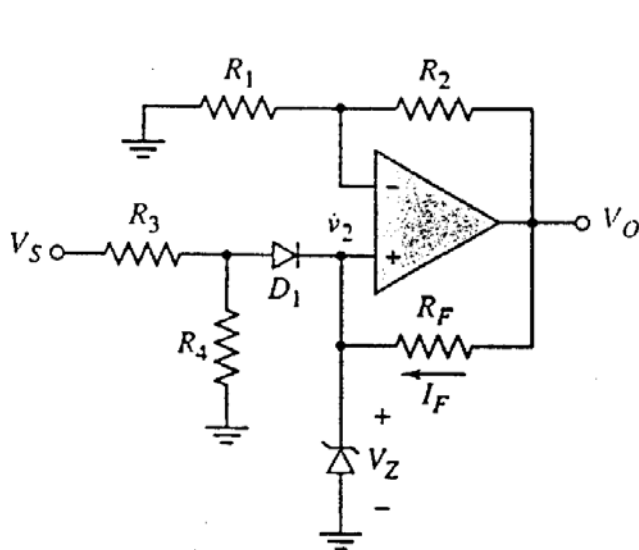
$$I_{DQ1} = \underline{\hspace{2cm}}$$

- (8) Find the transconductance of M_1 ,

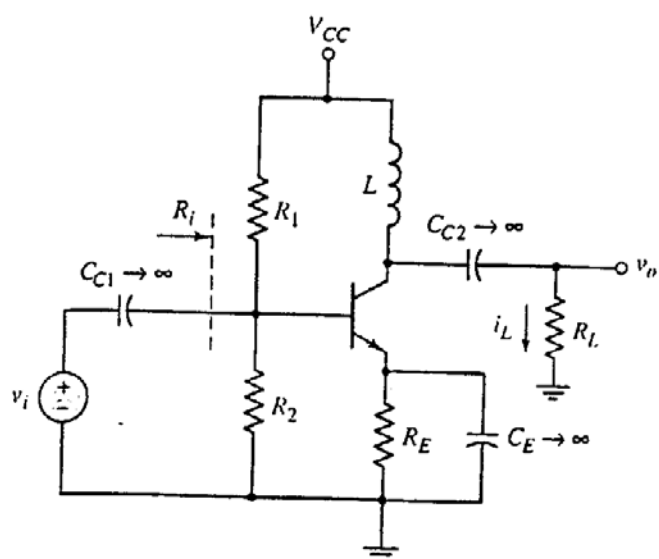
$$g_{m1} = \underline{\hspace{2cm}}$$

- (9) Find the voltage gain of this amplifier shown in Fig. P2

$$A_v = v_o/v_i = \underline{\hspace{2cm}}$$



P.3



P.4

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：電子工程系碩士班

組別：乙一、乙二、乙三

科目：電子電路學

3. An operational amplifier is used as a reference voltage source shown in Fig. P3, in which a divider circuit formed by R_3 and R_4 is used only to start up the circuit. All components and the OP Amp in this problem are ideal. The relevant parameters include $V_z=4.7V$, $V_{D(on)}=0.7V$, and $R_2=30k\Omega$. The Zener diode is specified biasing between 1mA and 1.2mA. If the output of the OP Amp is desired to be 10.0V and the start-up voltage is $V_s=10V$ with allowable maximum input current $I_3=4mA$, please analyze this circuit and then only write down the results of the following problems in order on the answer sheet.

(注意：僅依序寫下答案即可,且必需有單位,否則不予計分)

(10) Find the resistance,

$$R_1 = \underline{\hspace{2cm}}$$

(11) Find the resistance,

$$R_F = \underline{\hspace{2cm}}$$

(12) Find the resistance,

$$(R_3, R_4) = \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$$

4. A power amplifier is shown in Fig. P4, in which the transistor have the specifications, i.e., $P_{C,max}=6W$ (after derating), $BV_{CEO}=50V$, and $i_{C,max}=4A$. In this problem, $R_E=1\Omega$, $R_L=10\Omega$, and the reactance's of all capacitors are neglected. Please analyze this circuit and then only write down the results of the following problems in order on the answer sheet.

(注意：僅依序寫下答案即可,且必需有單位,否則不予計分)

(13) Find the operating point of the transistor to achieve a maximum symmetrical swing

$$(I_{CQ}, V_{CEQ}) = \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$$

(14) Find the possible supply voltage V_{CC} in this circuit,

$$V_{CC} = \underline{\hspace{2cm}}$$

(15) Find the maximum output power $P_{L,max}$ for a sinusoidal input signal

$$P_{L,max} = \underline{\hspace{2cm}}$$

(16) Find the maximum power efficiency η_{max} in this amplifier

$$\eta_{max} = \underline{\hspace{2cm}}$$

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：電子工程系碩士班

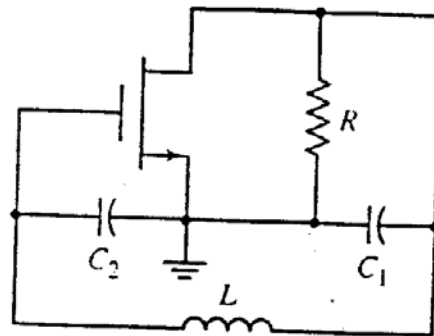
組別：乙一、乙二、乙三

科目：電子電路學

II. 析論題

5. What is the oscillator shown in Fig. P5? Please plot its small-signal equivalent circuit, derive the oscillation frequency ω_o , and find the oscillation condition C_2/C_1 . (20%)

(注意：沒有推導過程不予計分)



P. 5