

國立勤益科技大學九十七學年度研究所碩士班招生筆試試題卷

所別：電子工程研究所

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、

三、

試題一：〈 15 分 〉

We wish to analyze the circuit of Fig.1 to determine the voltages at all nodes and the currents through all branches. What is the forced β that this transistor is operating? Assume that the transistor β is specified to be *at least* 50.

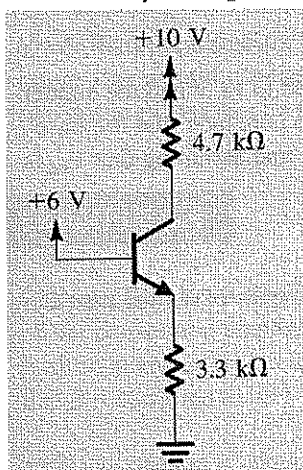


Fig. 1

試題二：〈 15 分 〉

A common-emitter amplifier that can be represented by the equivalent circuit of Fig. 2 has $C_{\pi} = 10\text{pF}$, $C_{\mu} = 0.5\text{pF}$, $C_L = 2\text{pF}$, $g_m = 20\text{mA/V}$, $\beta = 100$, $r_x = 200\Omega$, $R'_L = 5\text{k}\Omega$, and $R_{sig} = 1\text{k}\Omega$. Find the midband gain A_M , and an estimate of the 3-dB frequency f_H using the Miller equivalence.

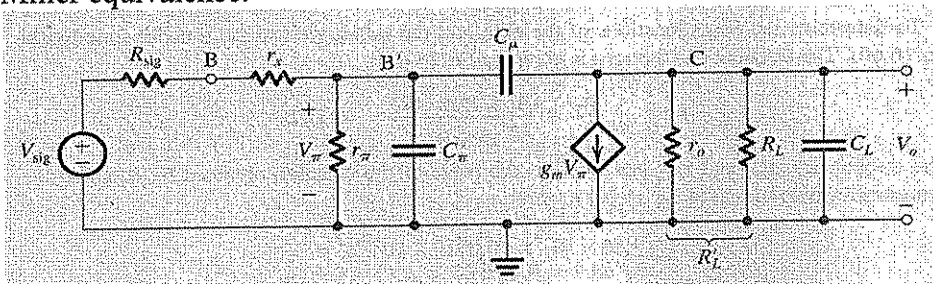


Fig. 2

試題三：〈 20 分〉

The differential amplifier circuit of Fig. 3 utilizes a resistor connected to the negative power supply to establish the bias current I .

- (a) For $v_{B1} = v_d/2$ and $v_{B2} = -v_d/2$, where v_d is a small signal with zero average, find the magnitude of the differential gain, $|v_o/v_d|$.
- (b) For $v_{B1} = v_{B2} = v_{CM}$, find the magnitude of the common mode gain, $|v_o/v_{CM}|$.
- (c) Calculate the CMRR.
- (d) If $v_{B1} = 0.1\sin 2\pi \times 60t + 0.005\sin 2\pi \times 1000t$ volts,
 $v_{B2} = 0.1\sin 2\pi \times 60t - 0.005\sin 2\pi \times 1000t$ volts, find v_o .

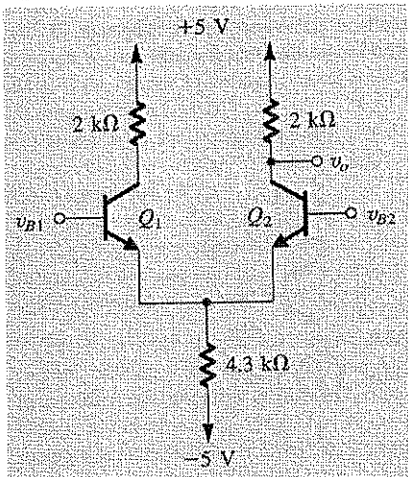


Fig. 3

試題四：〈 15 分〉

Consider a differential amplifier with linear gain control in Fig.4.

- (a) Derive the formula of the overall gain $v_o/(v_2-v_1)$.
- (b) Let $R_1=R_3=10\text{ k}\Omega$, $R_2=20\text{ k}\Omega$, specify suitable value for R_G such that gain can be varied from 1 V/V to 50 V/V.

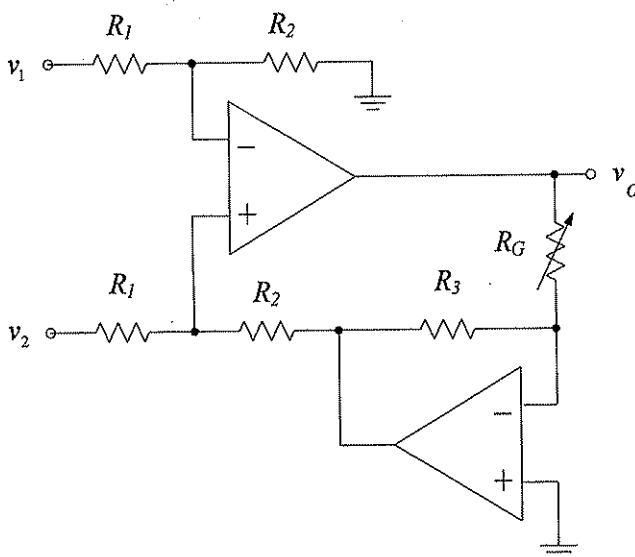


Fig.4

試題五：〈 15 分〉

For the 741-type op amp the maximum current that the first stage can supply is $19.5 \mu\text{A}$ and the compensation capacitor C is 30 pF . The op amp with $\pm 15\text{V}$ supplies is configured as a non-inverting amplifier with a gain of 10V/V .

- Find the slew rate.
- If the ac input amplitude is $V_{im}=0.5\text{V}$, what is its full-power bandwidth?

試題六：〈 20 分〉

Figure 6 shows an enhancement MOSFET amplifier. The transistors has $V_t=1.5\text{V}$, $K=0.125 \text{ mA/V}^2$, and the Early voltage $V_A=64\text{V}$. Determine (a) its small-signal voltage gain and (b) its input resistance R_{in} . (Here $C=\infty$, and $i_D=K(v_{GS}-V_t)^2$)

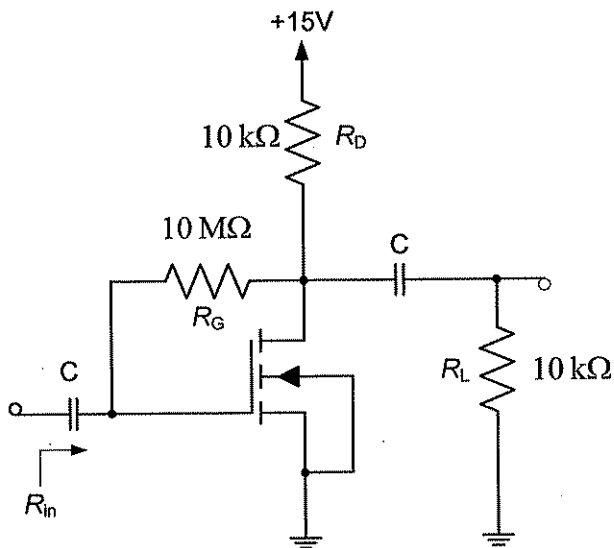


Fig.6