

國立臺北科技大學 109 學年度碩士班招生考試

系所組別：2401 光電工程系碩士班

第二節 電子學 試題 (選考)

第 1 頁 共 2 頁

注意事項：

1. 本試題共六題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (14%) Please answer the following questions.
 - (1) What are the differences between intrinsic silicon and extrinsic silicon? (3%)
 - (2) What are the differences between the enhancement-type MOSFET and the depletion-type MOSFET from the channel perspective? (3%)
 - (3) What is the channel length modulation effect? (3%)
 - (4) What are the four basic feedback topologies? (5%)
2. (10%) For the circuit shown in Fig. 2, please find:
 - (1) the expression v_o as a function of v_1 and v_2 . (2%)
 - (2) the input resistance seen by v_1 alone. (2%)
 - (3) the input resistance seen by v_2 alone. (2%)
 - (4) the input resistance seen by a source connected between the two input terminals. (2%)
 - (5) the input resistance seen by a source connected to both input terminals simultaneously. (2%)

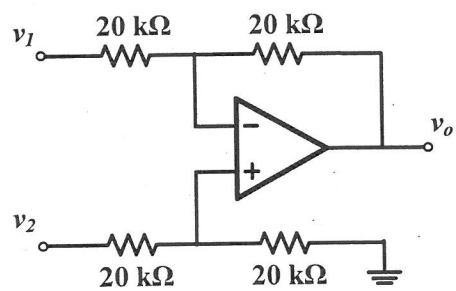


Fig. 2

3. (16%) A transistor amplifier has an input terminal connected to a signal source with an open-circuit voltage of 10mV and an internal resistance of 100kΩ. The voltage v_i at the amplifier input and the output voltage v_o are measured both without and with a load resistance 10kΩ connected to the amplifier output. When the load resistance is not connected, the measured results are $v_i=9$ mV and $v_o=90$ mV. When the load resistance is connected, the measured results are $v_i=8$ mV and $v_o=70$ mV. Find the following amplifier parameters: open-circuit voltage gain (A_{vo})(1%), open-circuit overall voltage gain (G_{vo})(1%), voltage gain (A_v)(1%), overall voltage gain (G_v)(1%), input resistance (R_{in})(3%), input resistance with no load (R_i)(3%), output resistance (R_{out})(3%), output resistance of amplifier proper (R_o)(3%).

4. (20%) The wideband common-source amplifier circuit with a source resistance R_s is shown in Fig. 4. Its input terminal is fed by a signal source with an open-circuit voltage of V_{sig} and an internal resistance of R_{sig} . Its output terminal is connected to a load resistance R_L and a load capacitance C_L .
 - (1) Find the transconductance G_m (4%) and the output resistance R_o . (4%)
 - (2) Find the resistance R_{gd} seen by C_{gd} (4%), the resistance R_{gs} seen by C_{gs} (4%), the resistance R_{cl} seen by C_L (2%).
 - (3) Find the 3dB frequency (2%).

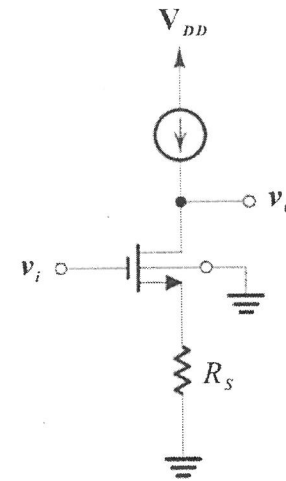


Fig. 4

5. (20%) For the feedback amplifier shown in Fig. 5, the transistors have $\beta=100$ and the dc component of V_S is zero. Find the value of A (6%), β (2%), A_f (4%), R_{in} (4%), R_{out} (4%).

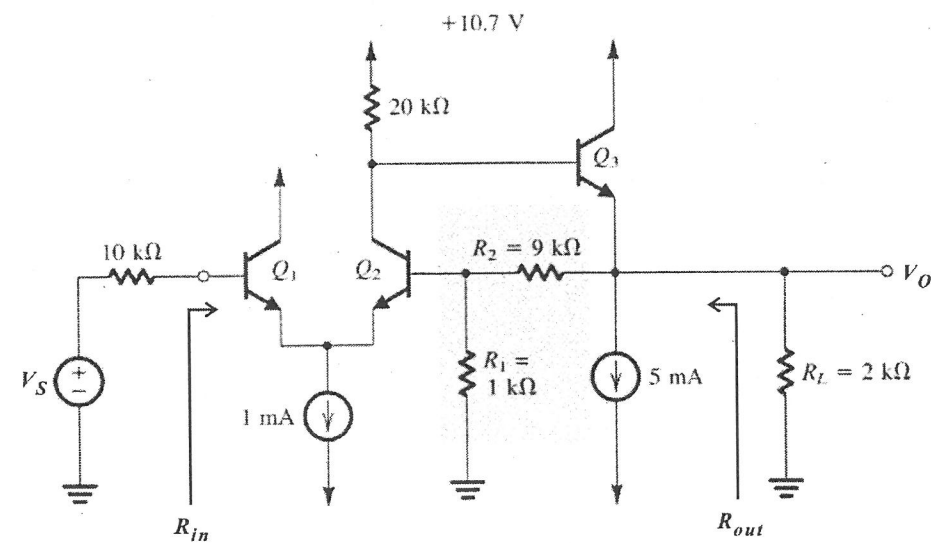


Fig. 5

注意：背面尚有試題

6. (20%) Fig. 6 shows a bipolar op-amp circuit.
- (1) Perform an approximate dc analysis to calculate the dc currents and voltages everywhere in the circuit. (5%)
 - (2) Calculate the quiescent power dissipation in this circuit. (3%)
 - (3) Plot the equivalent circuits of each stage (4%) and find the gains of each stage (8%)

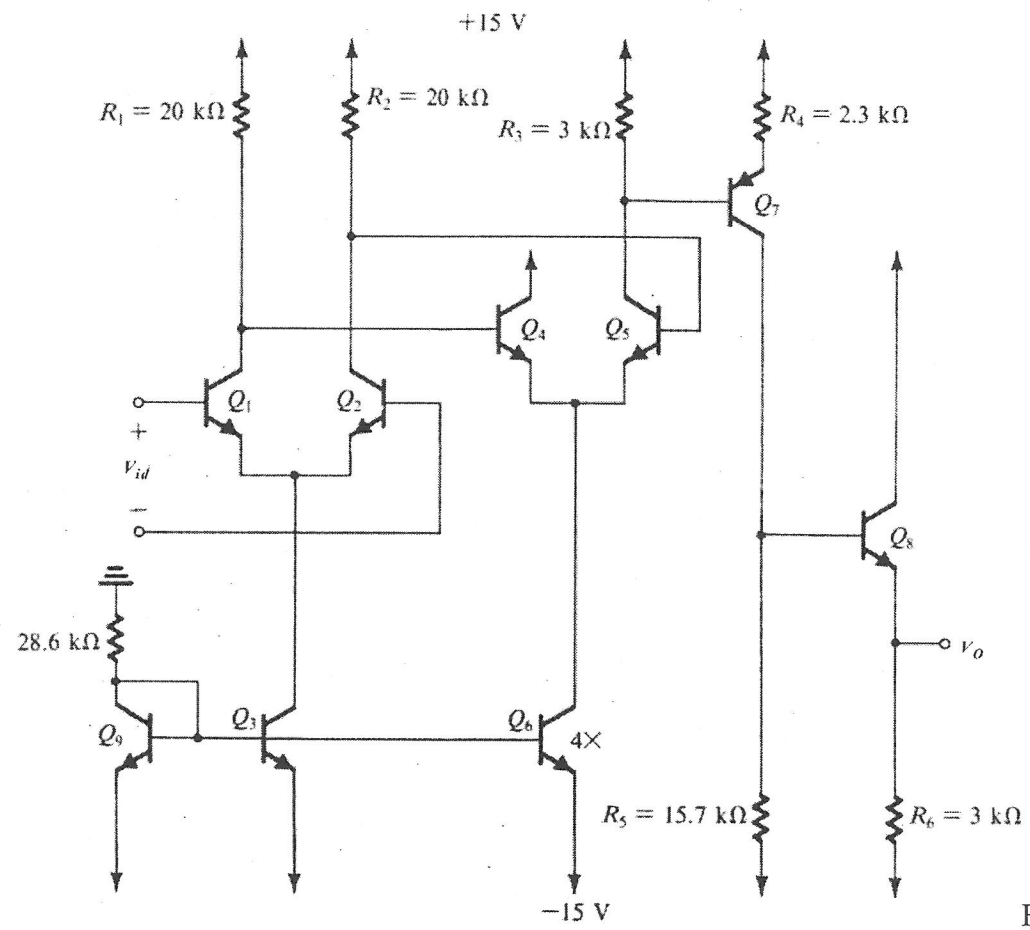


Fig. 6