

國立臺北科技大學 107 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)

第一頁 共二頁

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
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. In Fig. 1, a shunt regulator utilizes a zener diode whose voltage is 6.8 V at a current of 5 mA and whose incremental resistance is 20 Ω and knee current is 0.2 mA. The diode is fed from a supply through a resistor of $R=500 \Omega$. The supply voltage V^+ is nominally 10 V but can vary by ± 1 V.
 - (a) Find V_o with no load and with V^+ at its nominal value.
 - (b) When the circuit has no load, please find the line regulation ($\Delta V_o / \Delta V^+$).
 - (c) When the circuit connects a load resistance R_L that draws a current $I_L = 1$ mA, please find the load regulation ($\Delta V_o / \Delta I_L$).
 - (d) What is the minimum value of R_L for which the diode operates in the breakdown region? (每小題 5 分)

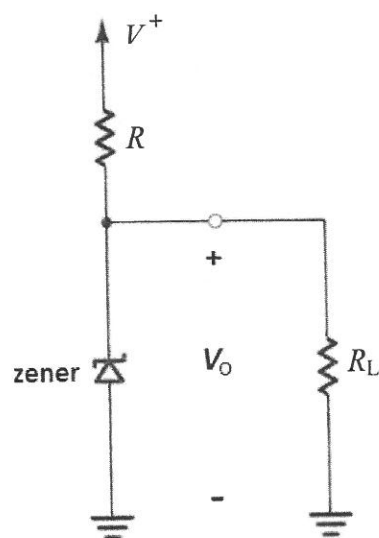


Fig. 1

2. In Fig. 2, a common source amplifier has $R_G=4.7 \text{ M}\Omega$, $R_D=R_L=15 \text{ k}\Omega$, $g_m=1 \text{ mA/V}$, $r_o=150 \text{ k}\Omega$, $C_{gs}=1 \text{ pF}$, and $C_{gd}=0.4 \text{ pF}$ and connects a signal source with an internal resistance $R_{sig}=100 \text{ k}\Omega$. The coupling capacitors and bypass capacitor are $C_{c1}=3.3 \text{ nF}$, $C_{c2}=0.53 \text{ }\mu\text{F}$, and $C_S=1.6 \text{ }\mu\text{F}$, respectively.
 - (a) Find the midband voltage gain $A_M (=V_o/V_{sig})$.
 - (b) Find the upper 3-dB frequency f_H .
 - (c) Find the break frequencies corresponding to the three capacitors C_{c1} , C_{c2} , and C_S .
 - (d) According to the break frequencies, find the lower 3-dB frequency f_L .
 (每小題 5 分)

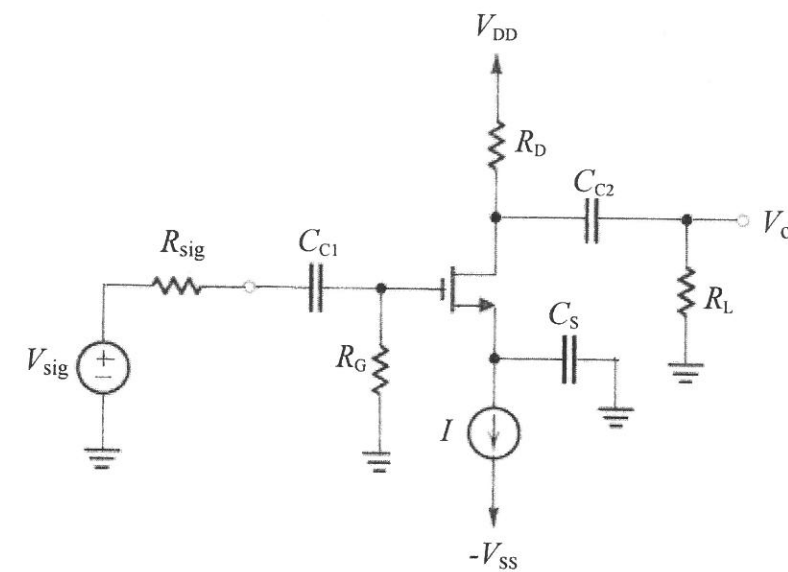


Fig. 2

3. For the amplifier of Fig. 3, the BJTs have parameters of $\beta=100$, $C_\pi=6 \text{ pF}$, $C_u=2 \text{ pF}$, and the current I is 0.5 mA. A voltage source V_{sig} with resistance of $R_{sig}=10 \text{ k}\Omega$ is connected to the input. The output is connected to a resistor with resistance of $R_L=10 \text{ k}\Omega$. By neglecting the BJT's base resistance r_x and collector output resistance r_o , please find
 - (a) the low-frequency overall voltage gain $A_M (=V_o/V_{sig})$,
 - (b) the input resistance R_{in} ,
 - (c) the frequencies of the poles, and
 - (d) the 3-dB frequency f_H exactly, according to the frequencies of the poles.
 (每小題 5 分)

注意：背面尚有試題

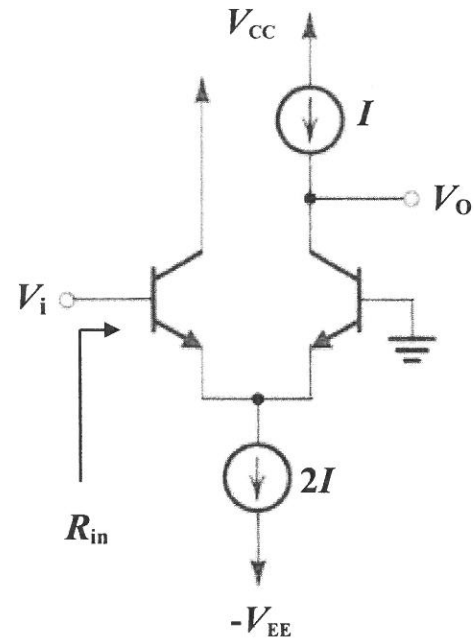


Fig. 3

4. Fig. 4 shows an inverting op-amp circuit where the op amp has an open-loop gain $\mu=10^4$ V/V, a differential input resistance $R_{id}=100$ k Ω , and an output resistance $r_o=1$ k Ω . With $R_s=1$ k Ω , $R_f=1$ M Ω , and $R_L=2$ k Ω , please find

- (a) the input resistance R_{in} ,
- (b) the output resistance R_{out} , and
- (c) the voltage gain V_o/V_s using feedback method.

(各小題配分: 5 分, 5 分, 10 分)

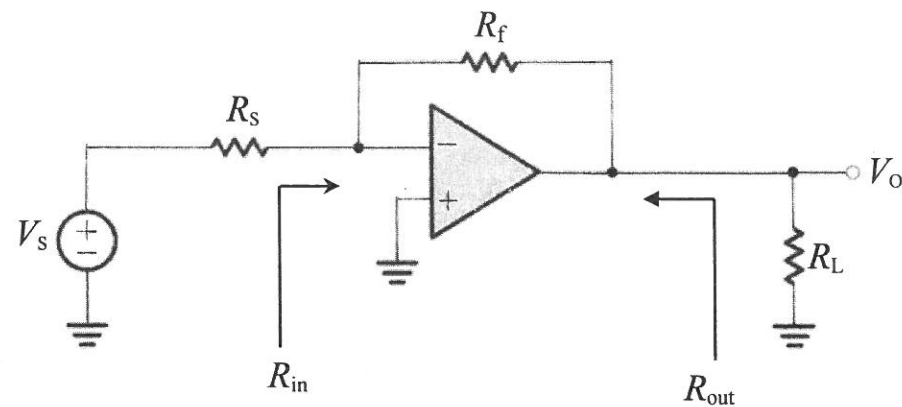


Fig. 4

5. Fig. 5 shows a Wien-bridge oscillator circuit.

- (a) Please derive the loop gain of a Wien-bridge oscillator.
- (b) Based on (a), find the setting of potentiometer P at which oscillations just start, and
- (c) the oscillation frequency.

(各小題配分: 10 分, 5 分, 5 分)

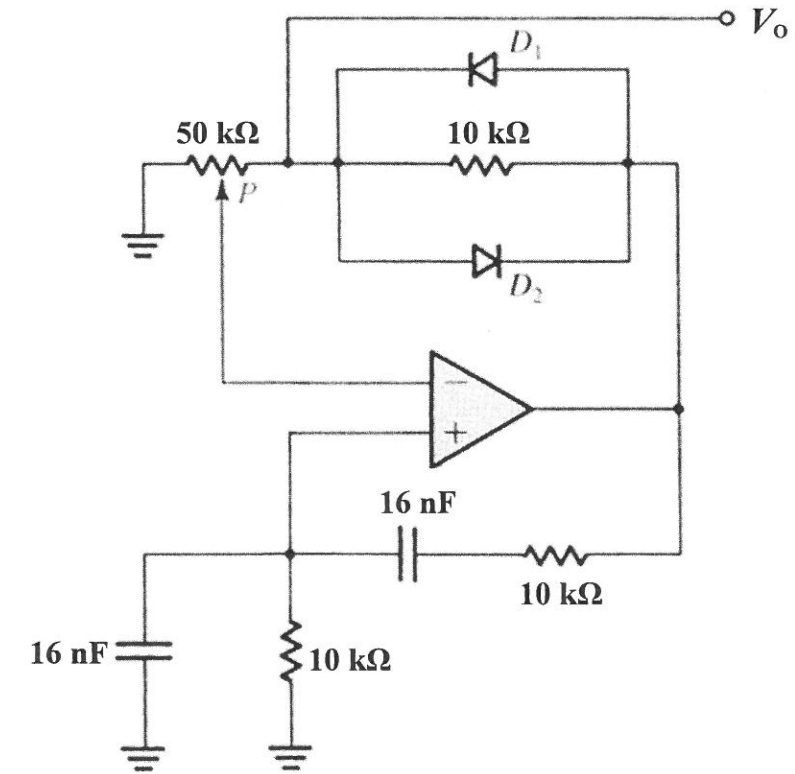


Fig. 5