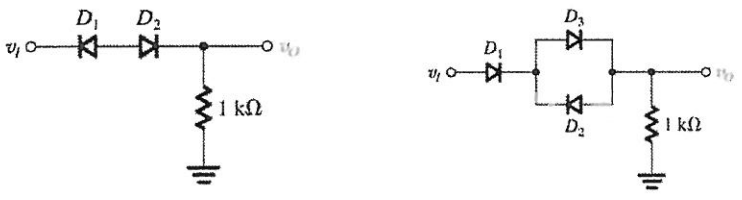
(107)輔仁大學碩士班招生考試試題	考試日期：107 年 3 月 9 日第 二 節
	本試題共 二 頁 (本頁為第 一 頁)

科目：電子學　　系所組：電機工程學系

1. 選擇題 (30%)： 請標明題號，作答於彌封答案卷內。
   (1) The most populate materials for the semiconductor devices are (A) Si and Ge (B) Fe and Pb (C) I and Na (D) C and S
   (2) When the density of charge carriers in a piece of semiconductor is not uniform. The generated current is caused by (A) drift (B) diffusion (C) doping (D) ion implantation.
   (3) How to forward-bias a *p-n* junction? (A) Both sides connect to positive voltage. (B) Both sides connect to negative voltage. (C) The *n* side connects to positive voltage and the *p* side connects to negative voltage. (D) The *p* side connects to positive voltage and the *n* side connects to negative voltage.
   (4) In the BJT's active mod, i_C shows a slight dependent on v_{CE}. This phenomenon is called (A) Miller effect (B) Early effect (C) Hall effect (D) Junction effect
   (5) Which one cause the gain falling off at high-frequency band of a discrete-circuit amplifier. (A) coupling capacitors (B) Miller effects (C) internal parasitic capacitors (D) bypass capacitors.
   (6) Which one is the Darlington Configuration? (A) CC-CE (B) CD-CS (C) CD-CE (D) CC-CC.
   (7) Which one is the property of the negative feedback in amplifier design? (A) Sensitize the gain. (B) Induce nonlinear distortion. (C) Extend the bandwidth. (D) Enlarge open-loop gain.
   (8) For the following MOS configurations, which one has the wide bandwidth by proper design? (A) CS (B) CG (C) CD (D) CS with degeneration
   (9) For a transresistance amplifier, its topology is (A) Series-shunt (B) Series-series (C) Shunt-shunt (D) Shunt-series.
   (10) Which circuit is **not** unconditional stable when applied as the feedback amplifier? (A) STC circuit (B) Amplifier with single pole (C) Amplifier with two poles (D) Amplifier with three poles.

2. In each of the ideal-diode circuit shown in Fig.1, v_I is a 1-kHz 10-V amplitude sin wave. Sketch the waveform resulting at v_o for 2 periods. What are its positive and negative peak values? (10%)



(a)　　(b)

Fig. 1.

※ 注意：1.考生須在「彌封答案卷」上作答。
2.本試題紙空白部份可當稿紙使用。
3.考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。

3. Derive the transfer function of the circuit in Fig.2 (for ideal op amp) and show that it can be written in that form

$$\frac{V_o}{V_i}=\frac{-R_2/R_1}{[1+(\omega_1/j\omega)][1+j(\omega/\omega_2)]}$$

where $\omega_1=1/C_1R_1$, and $\omega_2=1/C_2R_2$. Assuming that the circuit is designed such that $\omega_2 >> \omega_1$, find approximate expression for the transfer function in the following frequency region: (20%)

(1) $\omega << \omega_1$

(2) $\omega_1 << \omega << \omega_2$

(3) $\omega >> \omega_2$

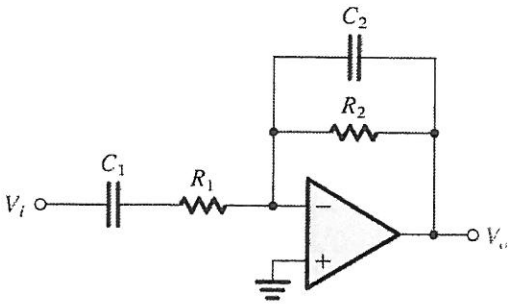


Fig. 2.

4. Consider an MOS IC CS amplifier fed with a source V_{sig} having $R_{sig}=0$ and having an effective load resistance R'_L composed of r_o of the amplifier transistor in parallel with an equal resistance r_o of the current-source load. (20%)

(1) Sketch the high frequency small signal equivalent circuit, and find $V_o(s)/V_{sig}(s)$.

(2) Sketch the Bode plot for the gain of circuit in 4.(1).

(3) Let g_m=1.2 mA/V, r_o=20kΩ, C_{gs}=20fF, C_{gd}=5fF, and C_L=25fF, find A_M, f_H, f_t, and f_z.

5. The operational amplifier in Fig.3 has open-loop gain of 10^6, input resistance of 100 kΩ and output resistance of 1kΩ. As R_L=2kΩ, R_1=1kΩ, R_2=1MΩ, and R_s=10kΩ, find the closed loop gain V_o/V_s, input resistance R_{in} and the output resistance R_{out} of Fig. 3 by using the feedback analysis. (Hint: You **cannot** regard the op amp as ideal.) (20%)

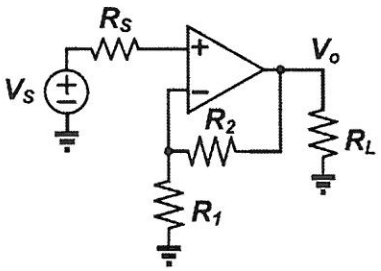


Fig. 3.