國立臺北科技大學 110 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）

注意事項：

1. 本試題共 5 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。

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1. The circuit in Fig. 1 implements a complementary-output rectifier. Assume a 0.7-V drop across each conducting diode. If the magnitude of the average of each output is to be 15 V.

   (a) Plot and label the waveform of v_o^+ and v_o^- and (b) find the amplitude of the sine wave across the secondary winding v_s (c) What is the PIV of each diode?
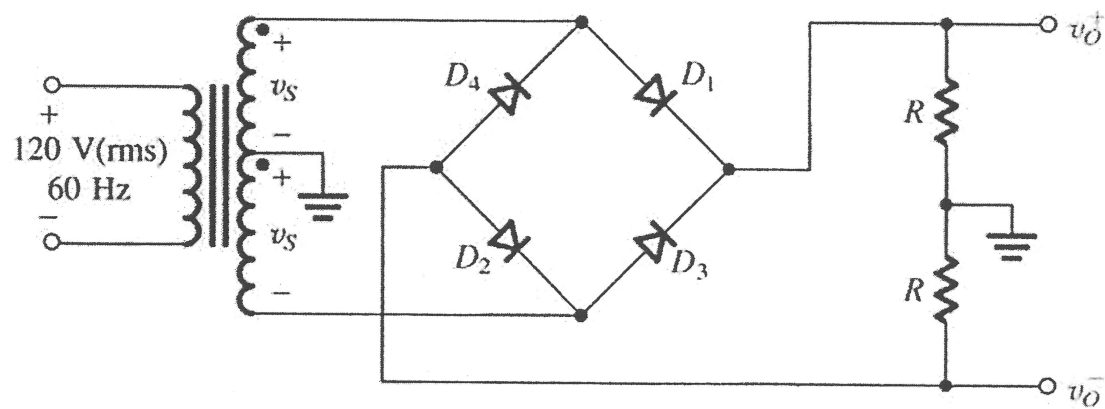
   (各小題配分: 10 分，5 分，5 分)

Fig. 1

2. A difference-amplifier circuit in Fig. 2 has $R_1 = R_3 = 2\ \text{k}\Omega$ and $R_2 = R_4 = 200\ \text{k}\Omega$.

   (a) Find the value of the differential gain A_d.

   (b) Find the value of the differential input resistance R_{id} and the output resistance R_o.

   (c) If the resistors have 1% tolerance (i.e., each can be within ±1% of its nominal value), find the worst-case common-mode gain A_{cm} and the corresponding value of CMRR.　(各小題配分: 5 分，10 分，5 分)
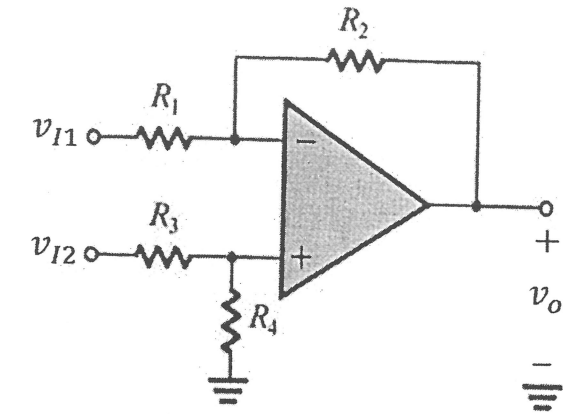

Fig. 2

3. The amplifier shown in Fig. 3 has $R_{sig} = R_L = 1\ \text{k}\Omega$, $R_C = 1\ \text{k}\Omega$, $R_B = 47\ \text{k}\Omega$, $\beta = 100$, $C_\mu = 0.8$ pF, and the unity-gain frequency $f_T = 600\ \text{MHz}$.

   (a) Find the dc collector current of the transistor.

   (b) Neglecting r_o, find the midband voltage gain (v_o/v_b) from base to collector (neglect the effect of R_B).

   (c) Use the gain obtained in (b) to find the input resistance R_{in} that arises as a result of R_B.

   (d) Find the overall gain at midband (v_o/v_{sig}).
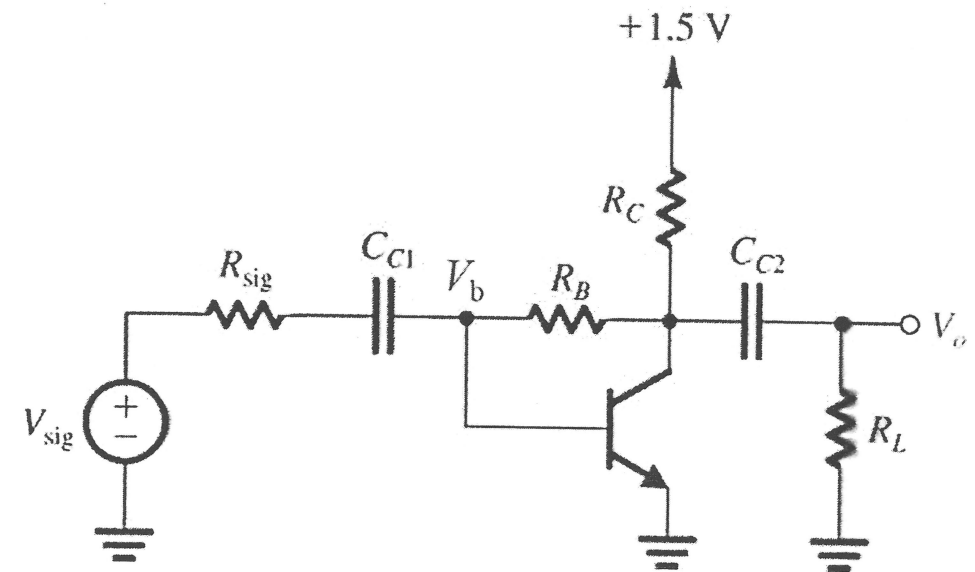
   (e) Find upper 3 dB frequency f_H.

   (每小題 5 分)

Fig. 3

4. A CS amplifier circuit is shown in Fig. 4, where the NMOS transistor is biased to have $g_m = 1$ mA/V and $r_o = 100$ kΩ. If $C_{gs} = 1$ pF and $C_{gd} = 0.2$ pF. Please find
   (a) midband gain (v_o/v_{sig})
   (b) input resistance connected to the source v_{sig}
   (c) lower 3 dB frequency f_L
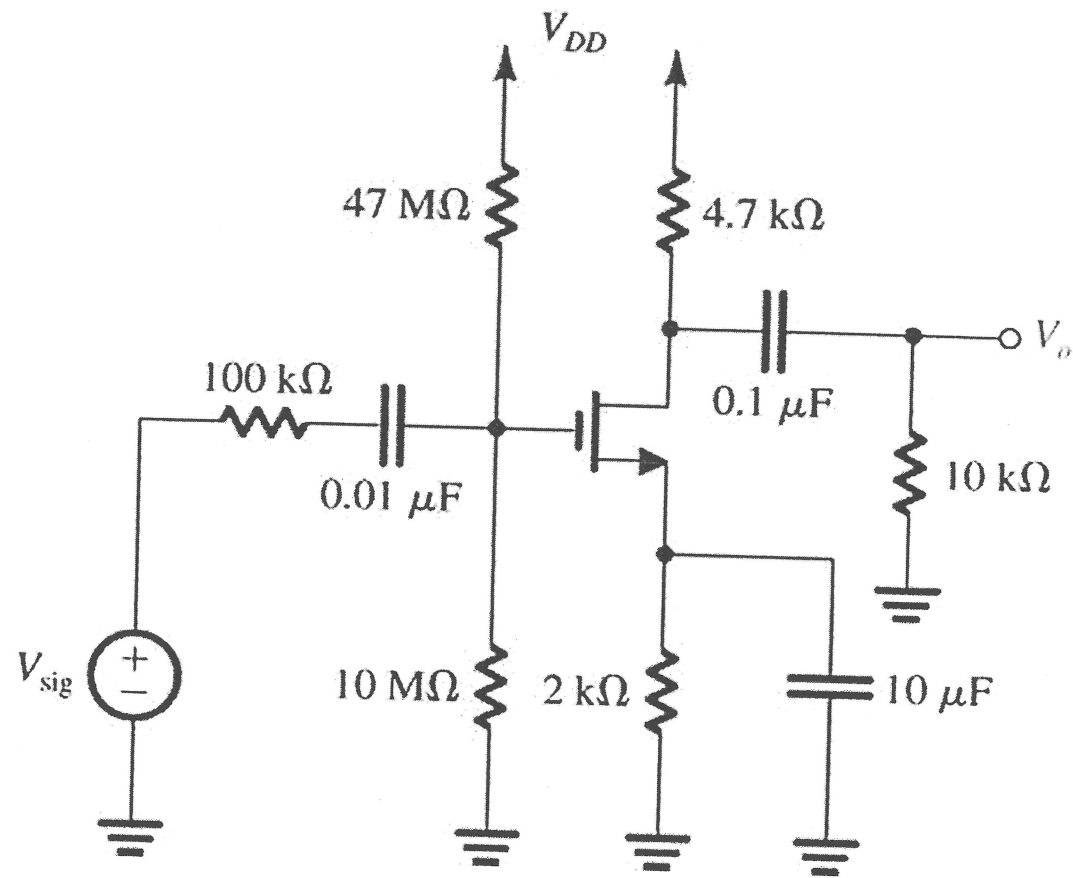   (d) upper 3 dB frequency f_H.
   (每小題 5 分)

Fig. 4

5. Consider ideal diodes in the circuit of Fig. 5. Please plot and label the transfer characteristic curve of the circuit.　(本題 15 分)
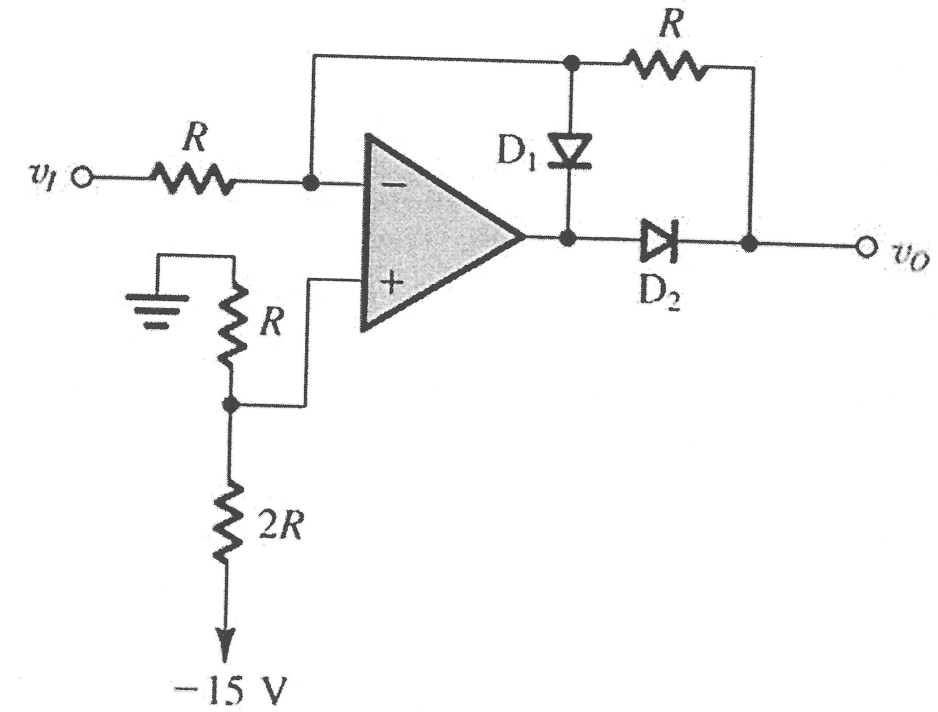

Fig. 5