

國立彰化師範大學 101 學年度碩士班招生考試試題

系所： 電子工程學系

組別： 甲、乙組

科目： 電子學

☆☆請在答案卷上作答☆☆

共 2 頁，第 1 頁

1. (20%) For the instrumentation amplifier shown in Fig. 1, assume ideal op amps and show that

$$v_O = \frac{R_4}{R_3} \left(1 + \frac{R_2}{R_1} \right) v_{Id}$$

where $v_{Id} = v_{I2} - v_{I1}$.

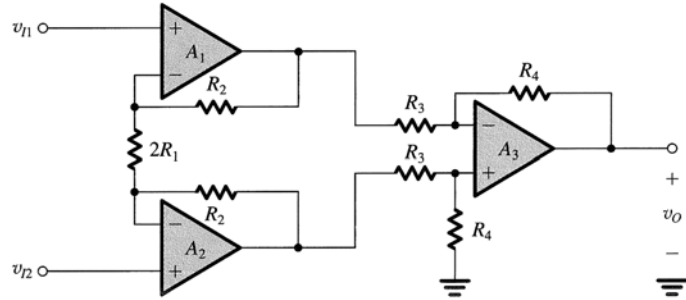


Fig. 1

2. (10%) Draw the transfer characteristics ($v_O - v_S$ or $v_O - v_I$) of the following two rectifier circuits (in Fig. 2).

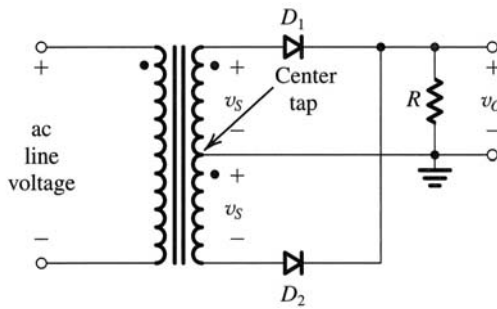


Fig. 2(a)

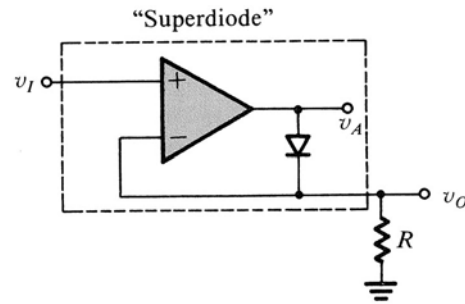


Fig. 2(b)

3. (20%) For the common-base amplifier shown in Fig. 3, replace the BJT with its small-signal T model (without r_o) and find expressions for R_{in} , R_o , and $A_{v_S} = v_o / v_{sig}$.

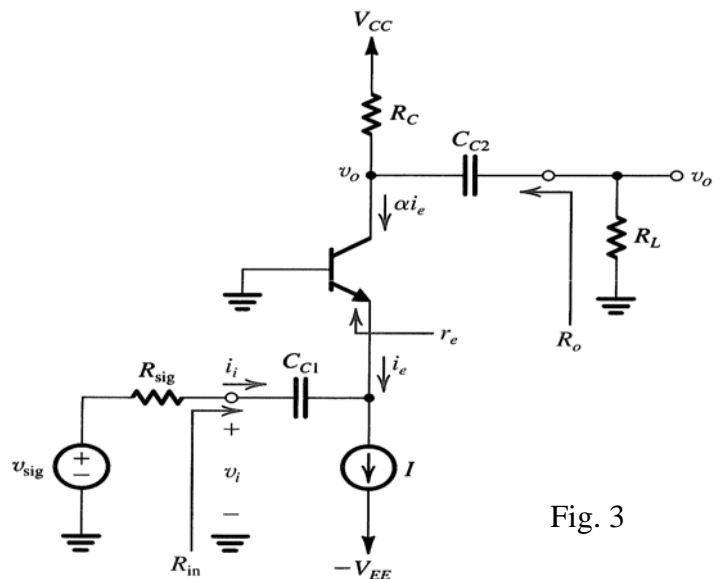


Fig. 3

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4. (15%) The amplifier in Fig. 4 is biased to operate at $I_D = 0.2 \text{ mA}$ and $g_m = 0.5 \text{ mA/V}$. Neglecting r_o , find the midband gain. Find the value of C_S that places f_L at 20 Hz.

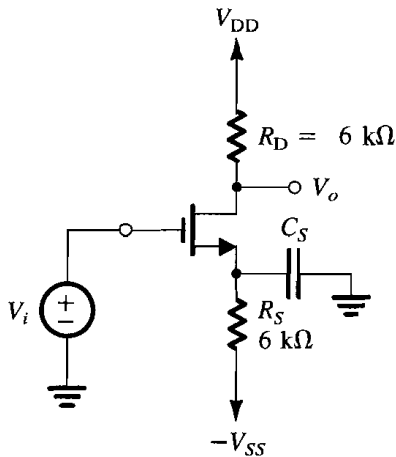


Fig. 4

5. (15%) For a particular amplifier connected in a feedback loop in which the output current is sampled and input current is mixed, measurement of the output resistance after and before the loop is connected shows a change by a factor of 80. Is the output resistance with feedback higher or lower? Is the input resistance with feedback higher or lower? What is the value of the loop gain $A\beta$? If $R_{if} = 5 \text{ k}\Omega$ and $R_{of} = 100 \text{ k}\Omega$, what is R_i and R_o without feedback?
6. The differential amplifier circuit of Fig. 5 utilizes a resistor connected to the negative power supply to establish the bias current I .
- (1) (10%) For $v_{B1} = v_{id}/2 + 0.7$ and $v_{B2} = -v_{id}/2 + 0.7$, where v_{id} is a small signal with zero average, find the magnitude of the differential gain, $|v_o/v_{id}|$.
 - (2) (5%) For $v_{B1} = v_{B2} = v_{icm} + 0.7$, where v_{icm} is a small signal with zero average, find the magnitude of the common mode gain, $|v_o/v_{icm}|$.
 - (3) (5%) Find the common-mode rejection ratio (CMRR).

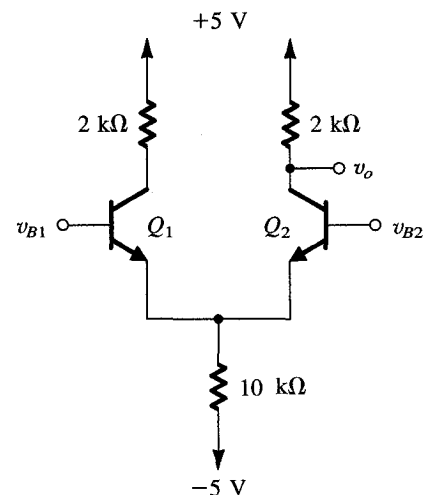


Fig. 5