題號： 347
科目：電子學(B)
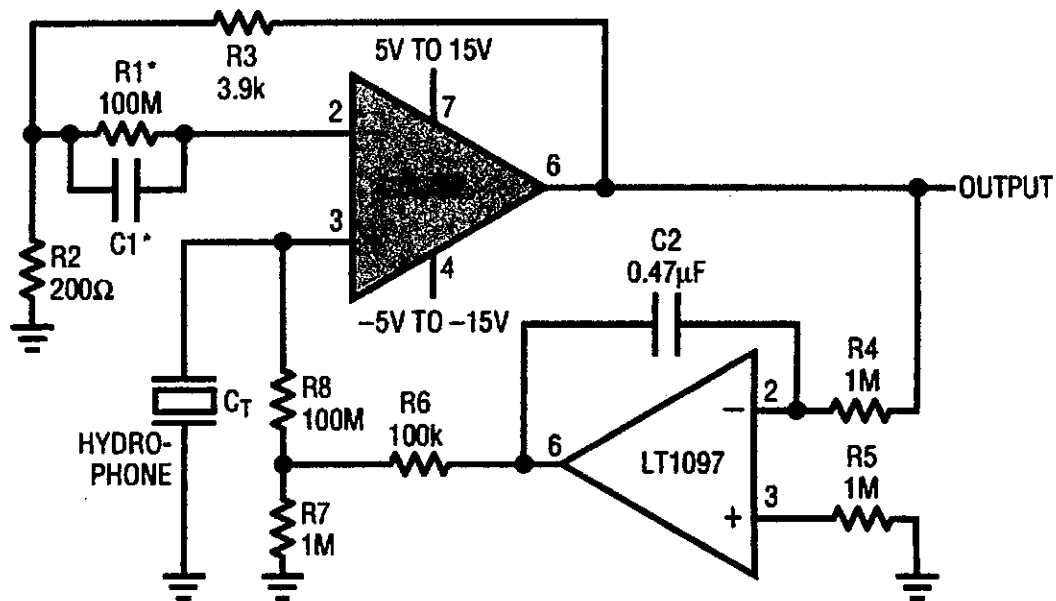節次： 4

國立臺灣大學 106 學年度碩士班招生考試試題

題號： 347
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1. Consider the following circuit, and answer the questions as follows.

(1) (4%) If R1 is shorted, determine the voltage gain A_v of the LT1792.

(2) (4%) Considering R2, R3, and LT1792 only, plot the output if the input from the HYDRO-PHONE is $\sin(200\pi t)$.

(3) (4%) Taking only R6, C2, and LT1097 into account, what is that?

(4) (4%) Following (3), what is the function of that?

(5) (4%) Following (3) and (4), deescribe the effects on LT1792 and the final output.

2. A simple voltage regulator is shown below. The source voltage V_{in} varies from 12 to 20 V, and the load current varies from 10 to 70 mA. Assume that the Zener diode is ideal and avalanched at −5 V .
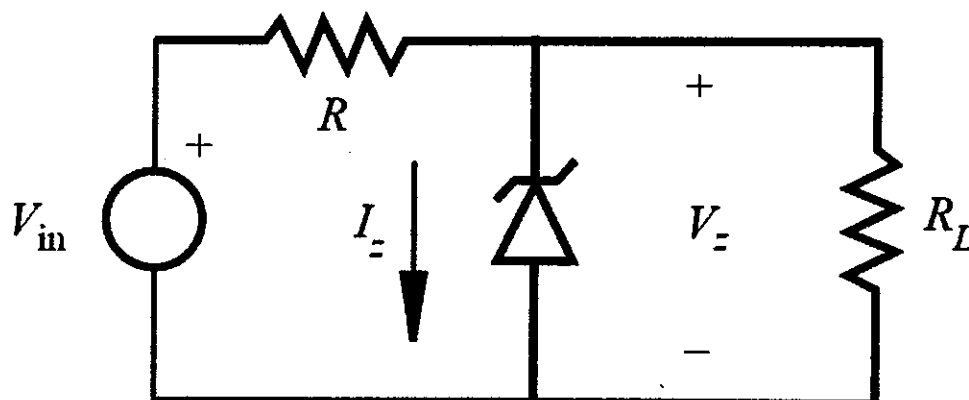
(1) (4%) Determine the R_L range to have the current variation described above.

(2) (4%) Determine the greatest resistance of R, so that the load voltage remains constant with variations in load current and source voltage.

(3) (4%) Using the R you determined in (2), determine the maximum power dissipation in R.

(4) (4%) Using the R you determined in (2), determine the minimum and maximum current through the Zener diode (I_Z).

(5) (4%) Using the R you determined in (2), determine the power rating should be chosen for the Zener diode.

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3. Consider the following FET (field effect transistor) amplifier, in which Q_1 and Q_2 are n-channel JFETs.
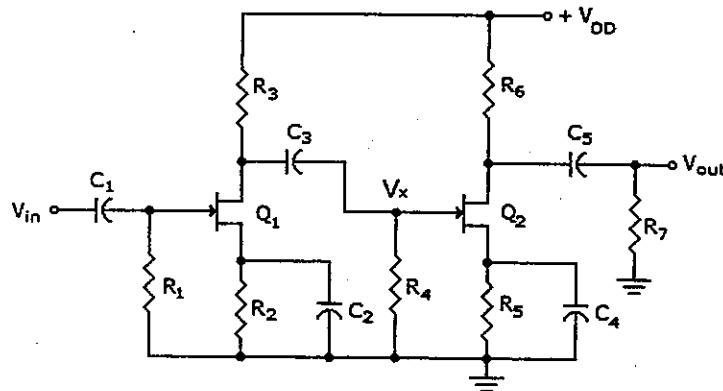
(1) (5%) Please describe the functional roles of the capacitors, C_1, C_2, C_3, C_4, and C_5, respectively.

(2) (10%) Please give the expression of V_x and V_{out}, respectively, in terms of V_{in} and the resisters as well as the parameters of Q_1 and Q_2 (transconductance g_m and small-signal output resistance r_o).

(3) (5%) If R_6 opened, please give the expression of V_x in terms of V_{in} and the resisters as well as the parameters of Q_1 and Q_2 (transconductance g_m and small-signal output resistance r_o).

4. Consider the following BJT (bipolar junction transistor) amplifier.
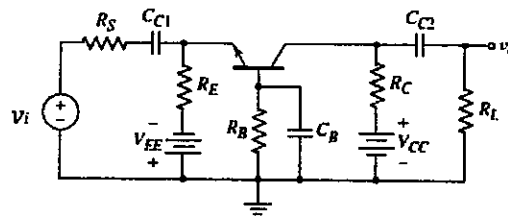
(1) (5%) Please derive the small-signal model of this amplifier, where v_i is the input signal and v_o is the output signal.

(2) (5%) What is the output resistor of this amplifier?

(3) (10%) If biasing using a constant-current source (I) is considered, please redraw the circuit, including the circuit for implementing the current source (I) that uses two additional BJTs.

5. Consider the following two cascading amplifiers (A and B) using BJT transistors.
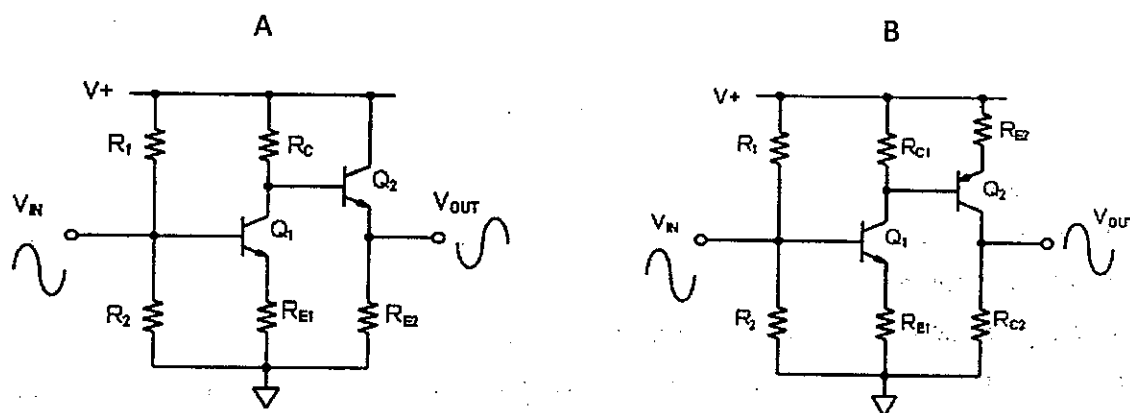
(1) (10%) Please identify the types of the single-stage amplifiers used in each of the two-stage amplifiers (A and B), respectively.

(2) (10%) What circuit (A or B) is more similar to an ideal amplifier? Please describe the characteristics of an ideal amplifier before providing your answer.

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