請按題目順序,作答於答案紙

1. A class B output stage is shown in Fig. 1. Derive the maximum power-conversion efficiency and the maximum power dissipation. (10分)

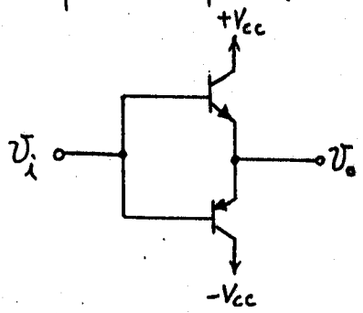

Fig. 1

2. The MOSFETs in the circuit of Fig. 2 are matched, with $K=25\,\mu A/V^2$, and $|V_t|=2V$. The resistance $R=5\,M\Omega$. For G and D open, what are the drain currents I_{D1} and I_{D2}? For $r_o=\infty$, what is the voltage gain of the amplifier from G to D? (10分)

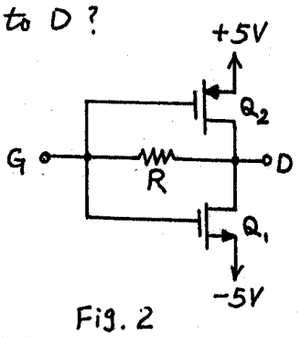

Fig. 2

3. Sketch and label the transfer characteristic of the circuit in Fig. 3 (10分)

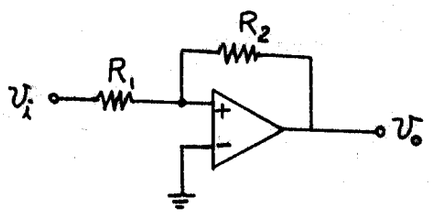

Fig. 3

4. Determine the input impedance $Z_{in}(s)$ of Fig. 4. (10分)

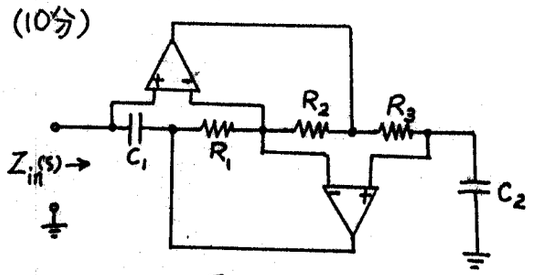

Fig. 4

5. For the circuit of Fig. 5, use the feedback method to find the voltage gain V_o/V_s. The op amp has open-loop gain $A=10^4\,V/V$, $R_{id}=100K\Omega$, $R_{icm}=\infty$, and $r_o=1K\Omega$. (15分)

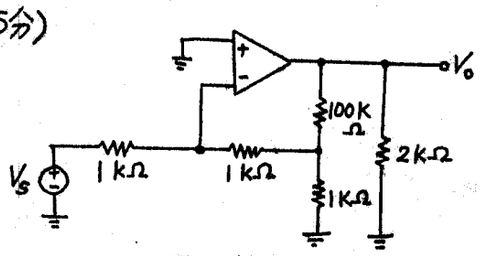

Fig. 5

6. Fig. 6 shows an astable multivibrator. Derive an expression for the period T of V_o. (15分)

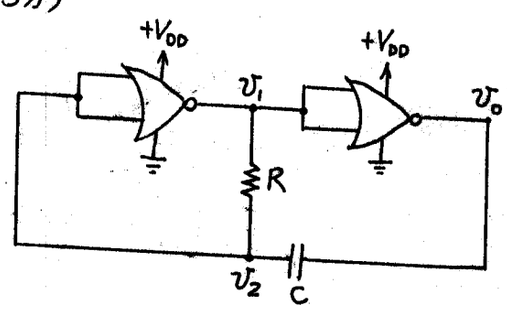

Fig. 6

(背面仍有題目,請繼續作答)

7. It is required to design a zener shunt regulator (Fig.7) to provide a regulated voltage of about 10V. The zener diode is specified as follows: $V_Z = 10V$ and $r_z = 7\Omega$ for $I_Z = 25\,mA$. The raw supply available has a nominal value of 20V but can vary by as much as ±25%. The regulator is required to supply a load current of 0 to 20 mA. Design for a minimum zener current of 5 mA.

(a) Calculate the required value of R.

(b) What is the change in V_o expressed as a percentage, corresponding to the ±25% change in V_s ?

(c) What is the maximum current that the zener in your design should be able to conduct ?

(15分)

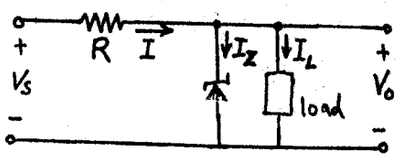

Fig. 7

8. Find the transfer function of a Butterworth filter that meets the following low-pass specifications: $f_p = 10\,kHz$, $A_{max} = 2\,dB$, $f_s = 15\,KHz$, and $A_{min} = 15\,dB$.

(15分)