題號： 425
科目：應用電子學
節次： 4

國立臺灣大學101學年度碩士班招生考試試題

題號： 425
共 2 頁之第 1 頁

*請依題號順序作答

一、多選擇題(40%，每題 10%，不倒扣，答案卷上需按題號答題)

1. Which of the following statements of DC circuit analysis are correct?

   (A)The current of an ideal current source can be determined by the network to which it is applied; (B) The total resistance of parallel resistors is always less than the value of the smallest resistor; (C) In linear circuit system, the different independent sources can be analyzed by superposition; (D) Mesh analysis is based on the Kirchhoff's current law; (E) Based on Thevenin's theorem, any two-terminal linear circuit network can be reduced to one having only a voltage source and a parallel resistor.

2. To understand the operation of a circuit, ac network analysis is essential. Which of the following statements are correct?

   (A) The frequency of a sinusoidal ac waveform is the number of cycles appearing in 1 second; (B) The reactance of an inductor is invariant to frequency; (C) The average value of a sinusoidal waveform without bias over one full period is zero; (D) Adding sinusoids of the same frequency is equivalent to add the real part of the corresponding phasors; (E) The impedance of a circuit is the resistive characteristic of the phasor.

3. The oscilloscope is important to measure the electrical signal in experiments. Which of the following statements are correct?

   (A) Bandwidth can be specified at the frequency of -3dB point; (B) In oscilloscope, the waveform alias can be avoided by increasing the rising time of read-out circuit; (C) In oscilloscope, "DC coupling" means the dc component will be blocked; (D) In oscilloscope, the typical input impedance of input terminal is $1M\Omega$ to measure voltage; (E) In digital oscilloscope, increasing the sampling rate can have better resolution in time axis.

4. The operational amplifier (OP) is the most useful circuit in applied electronics. Please refer to Fig. 1, which of the following statements are correct?

   (A) For an ideal OP, the open-circuit voltage gain should be infinite; (B) In Fig. 1, we should increase R1 to have better gain; (C) In Fig. 1, we should increase R1 to have better bandwidth; (D) To have better input resistance, the input stage of OP should be implemented by Bipolar Junction Transistors; (E) In Fig. 1, the output signal has 180 degree phase different to input signal.
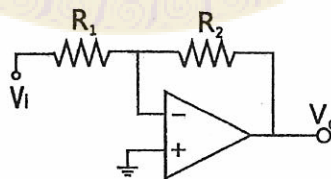

Figure 1

二、非選擇題 (60%)

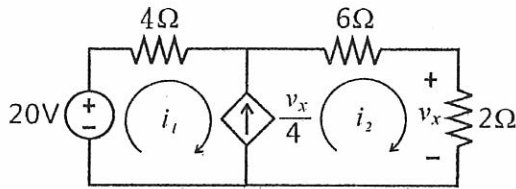1. (10%) Please solve for the currents in the circuit of Fig. 2.

見背面

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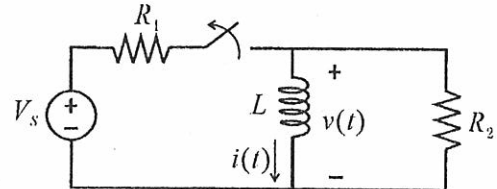Figure 2   Figure 3

2. (15%) Consider the circuit shown in Fig. 3. Please find the expressions for the current $i(t)$ and the voltage $v(t)$. Assume the voltage source V_S is a dc source. In addition, assume the circuit is in steady state before $t = 0$.

3. (15%) Assume the op-amp is ideal for this problem. As the circuit shown in Figure 4, determine an expression for the overall gain $A_v = v_o / v_i$; Find the input conductance, $G_{in} = i_i / v_i$ seen by the voltage source.
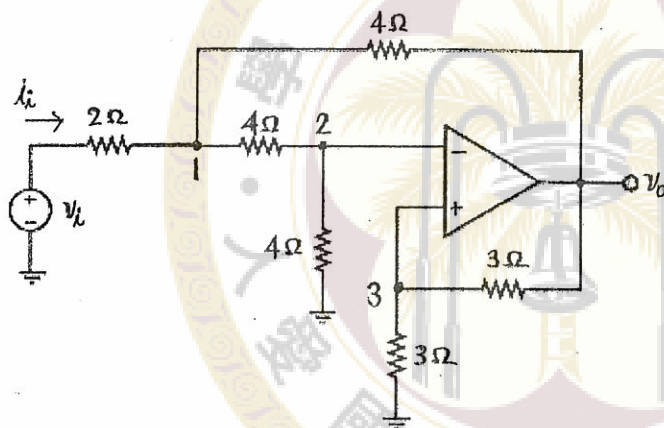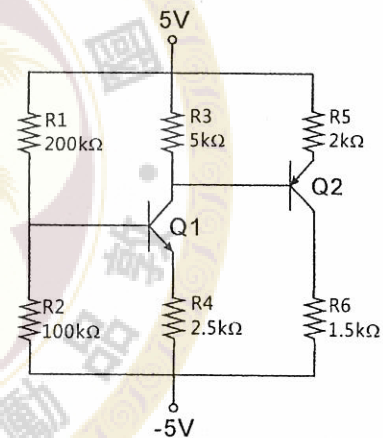

Figure 3   Figure 4

4. (20%) Please refer Fig. 4. Calculate the dc voltages at each node of Q1 and Q2. In addition, also calculate the dc currents flowing through each node of Q1 and Q2. Finally, please give the transconductance and the input resistance at the base of both Q1 and Q2. Please do the iteration if necessary. Assume both of Q1 and Q2 have the same $\beta = 100$; $|V_A| = 100V$; and the turn on voltage $V_{BEQ1} = |V_{BEQ2}| = 0.7V$.

試題隨卷繳回