Analogue Electronics 1 (EE204FZ)

Tutorial 4

Q1. Circle the correct answer.

1. An Ideal operational amplifier has _____.
A. infinite output impedance
B. zero input impedance
C. infinite bandwidth 无线带宽
D. all of the above

2. Another name for a unity gain amplifier is _____.
A. differential amplifier
B. comparator
C. instrumentation amplifier
D. voltage follower 单位增益放大器 = 电压跟随器

3. The closed-loop voltage gain of an inverting amplifier equals _____.
A. the ratio of the input resistance to the feedback resistance
B. the open-loop voltage gain
C. the feedback resistance divided by the input resistance
D. the input resistance

4. A noninverting closed-loop op-amp circuit generally has a gain factor _____.
A. less than one
B. greater than one 同相闭环运算放大器电路
C. of zero
D. less than zero

5. Op-amps used as high- and low-pass filter circuits employ the _____ configuration.
A. noninverting
B. comparator
C. open-loop
D. inverting

Q2. Answer the following questions.

1. List the characteristics of ideal and practical op-amps.

2. With the help of a diagram, define what the slew rate of an operational amplifier is. Explain why it is an important parameter in op-amp circuit design.

3. Explain the difference between the open-loop gain and the closed-loop gain of an op-amp.

Q3. The input to the circuit shown in Figure Q3 is $v_I = -0.20$ V.

(i) What is v_O?

(ii) Determine i_2, i_O, and i_L.

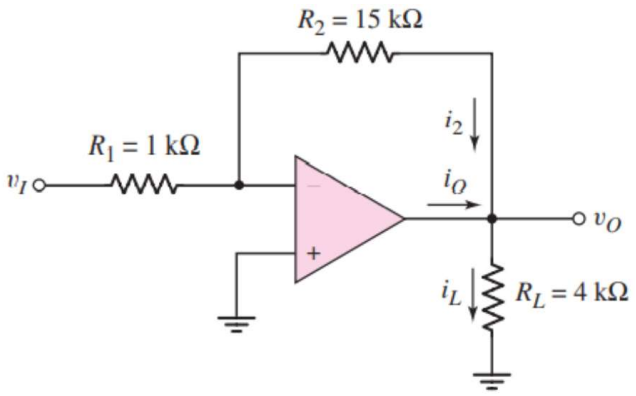

Fig. Q3

Q4. Consider the ideal noninverting op-amp circuit in Figure Q4.

(i) Derive the expression for v_O as a function of v_{I1} and v_{I2}.

(ii) Find v_O for $v_{I1} = 0.2$ V and $v_{I2} = 0.3$ V.

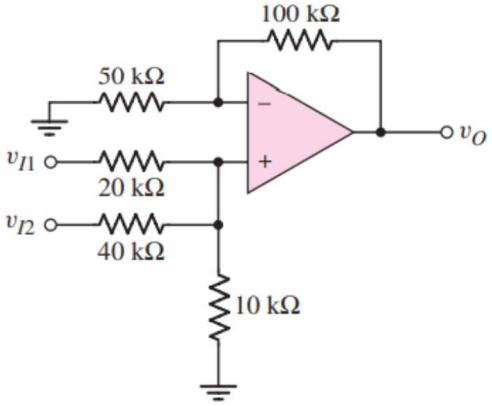

Fig. Q4

Q5. The circuit in Figure Q5 is a first-order low-pass active filter.

(i) Show that the voltage transfer function is given by $A_v = -(\frac{R_2}{R_1})\frac{1}{1+j\omega R_2 C_2}$.

(ii) What is the voltage gain at DC ($\omega = 0$)?

(iii) At what frequency is the magnitude of the voltage gain a factor of $\sqrt{2}$ less than the DC value (This is the −3 dB frequency)?

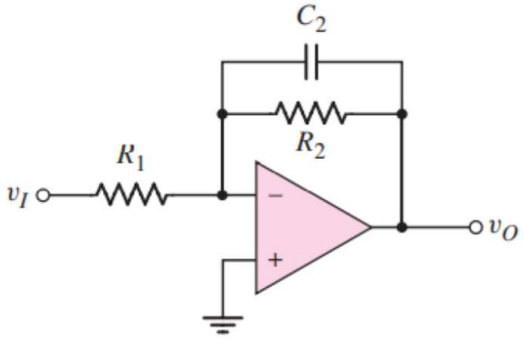

Fig Q5