※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

*請依題號順序作答

一、多選擇題(20%，每題 10%，不倒扣，答案卷上需按題號答題)

1. Practical operational amplifiers (op-amp) are not ideal devices but exhibit a number of limitations that should be take into consideration. Which of the following is TRUE for Practical Op Amp?
(A) To prevent the output current above short-circuit limitation I_{SC}, we design a smaller load resistance R_L. (B) In a practical op-amp, the product of closed-loop gain and bandwidth is constant, which is determined by the product of open-loop gain and cut-off frequency. (C) The practical op-amp output voltage is limited by the external DC voltage supplies. (D) The higher the Common-mode rejection ratio (CMRR), the better the practical op-amp is. (E) The maximum rate at which the OP Amp output voltage can change is called the slew rate.

2. There are four circuits in Fig. 1. Which one is low pass filter?

(A)　(B)　(C)　(D)

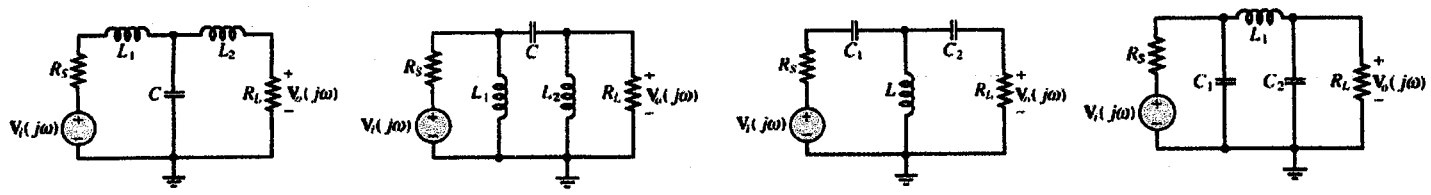

Figure 1

二、簡答題(20%)

1. (10%) Draw the circuit figure of a notch filter. Explain the function of the notch filter.

2. (10%) Draw the circuit figure of a level shifter. Explain the function of the level shifter.

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三、非選擇題 (60%)

1. (25%) For $t < 0$, the circuit shown in Figure 2 is at steady state. The switch is thrown at $t = 0$. Assume: $V_{S1} = 17\ V, V_{S2} = 11\ V, R_1 = 14\ k\Omega, R_2 = 13\ k\Omega, R_3 = 14\ k\Omega$, and $C = 70\ nF$. Determine the: (a) (10%) Current through the capacitor, i_C, for $t > 0$, (b) (10%) voltage across R_3, v_3, for $t > 0$, and (c) (5%) the time require for i_C and v_3 to change by 98% of their initial values at $t = 0^+$.

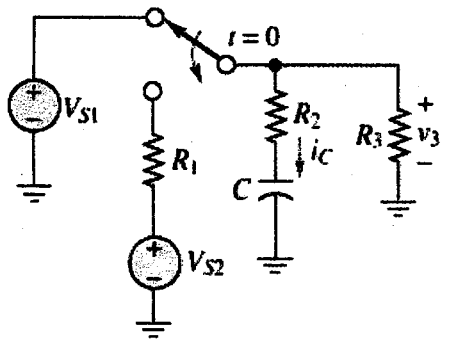

Figure 2

2. (20%) The circuit shown in Figure 3 is a Wheatstone bridge, which can be used to determine the reactance X_4 of an inductor or capacitor. R_1 and R_2 are adjusted until v_{ab} is zero.
(a) (5%) Assume a balanced bridge ($v_{ab} = 0$) and determine X_4 in terms of the other circuit elements.
(b) (10%) Assume a balanced bridge and let $C_3 = 4.7\mu F$, $L_3 = 0.098$ H, $R_1 = 100$ohm, $R_2 = 1$ohm, and $v_S(t) = 24 \sin(2{,}000t)$. What is the reactance of the unknown circuit element? Is it a capacitor or an inductor? What is its value?
(c) (5%) What frequency should be avoided by the source in this circuit, and why?

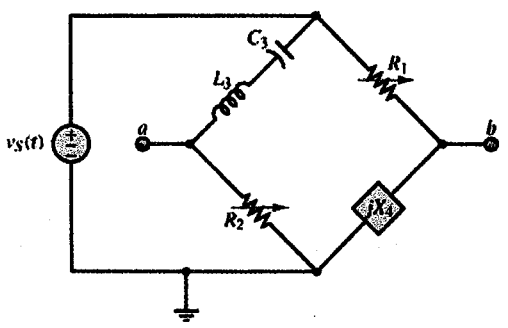

Figure 3

3. (15%) The Zener regulator shown in Figure 4 holds the load voltage at Vo = 14V. Find the range of load resistance Ro for which regulation can be obtained if the Zener diode is rated at 14 V, 5 W.

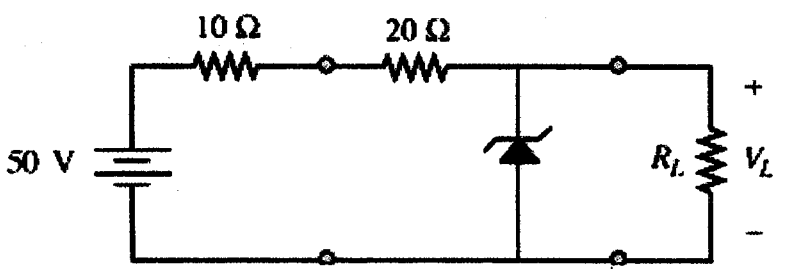

Figure 4

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