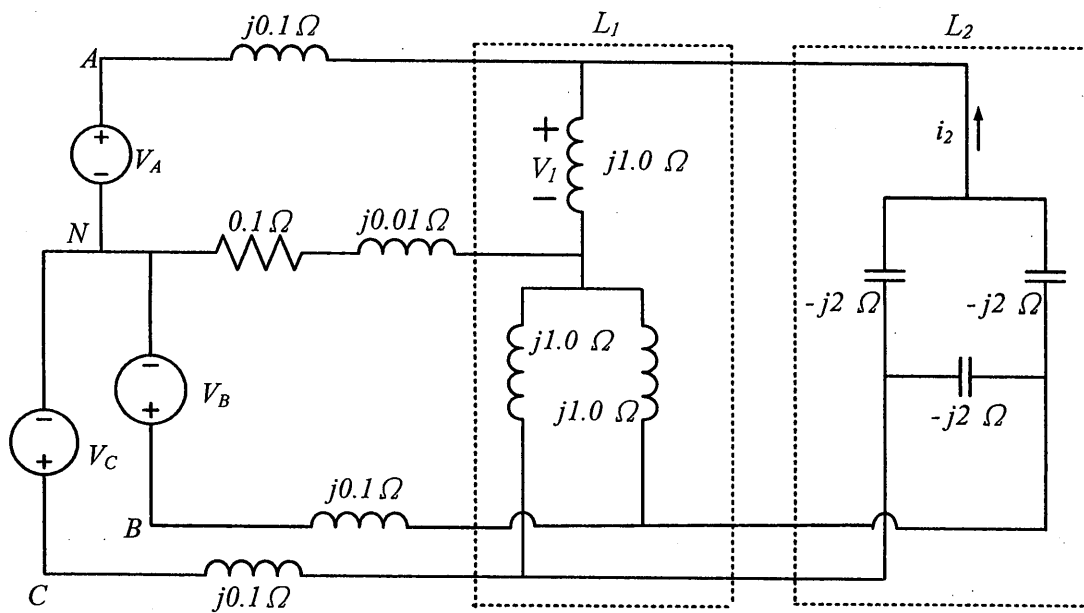


類組：電機類 科目：電路學(3009)

※請在答案卷內作答

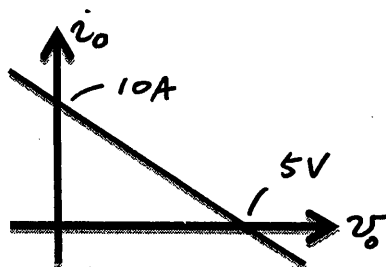
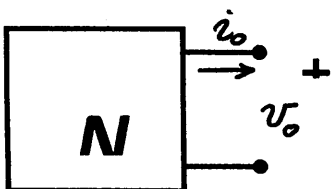
一、Consider the three-phase system shown in the following figure. Two loads L_1 and L_2 are paralleled connected to a three-phase voltage source $V_A=100 \angle 0^\circ$, $V_B=100 \angle 120^\circ$, and $V_C=100 \angle -120^\circ$.

- (一) Draw the single-phase equivalent circuit of the figure. (4%)
- (二) Determine the root-mean-square (RMS) voltage of $V_1(t)$ and the rms current of $i_2(t)$. (4%)
- (三) Find the instantaneous power generated by the voltage source V_A . (4%)
- (四) Find the reactive power generated by the voltage source V_B . (4%)
- (五) Will this circuit result in maximum average power transferred from the three-phase voltage source, V_A , V_B , and V_C , to these parallel loads L_1 and L_2 ? Please justify your answer. (4%)



二、The terminal characteristics of a circuit N is as illustrated in the v_o-i_o plane. (15%)

- (一) Calculate the load resistor R_{load} which results in maximum power consumption on itself while being connected across the output terminals. (5%)
- (二) Can you estimate the total power consumption inside circuit N when R_{load} is connected across the output terminals (Yes/No)? If yes, please show your analysis; if no, please explain why. (10%)



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三、You are to design a 3 bit digital-to-analog converter of the following specifications: (15%)

- Logic "0" is 0V; Logic "1" is 1V. The 3 bit digit is represented by X_0 (LSB), X_1 , and X_2 (MSB), respectively.
- At the output V_O , "000" should be converted to 0V, and "111" should be converted to +10V.

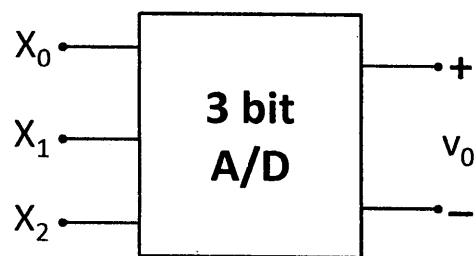
The following components are available:

- OPAMPs driven by +15V and -15V.
- Identical resistors of R ohm.

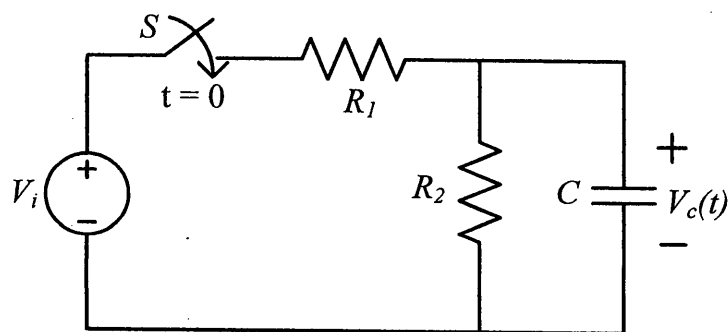
Unlimited numbers of OPAMPs and resistors are available, but you should use as few as possible.

(一) Please draw the circuit diagram of your design and show the relationship between output V_O and inputs X_0 , X_1 , and X_2 . (10%)

(二) If you can choose either $R=100$ ohm or $R=50k$ ohm to implement your circuit, which one would you choose? Explain why. (5%)



四、Given an RC circuit with initial condition of $V_c(0) = 5$ V and dc input voltage V_i , determine $V_c(t)$. (10%)

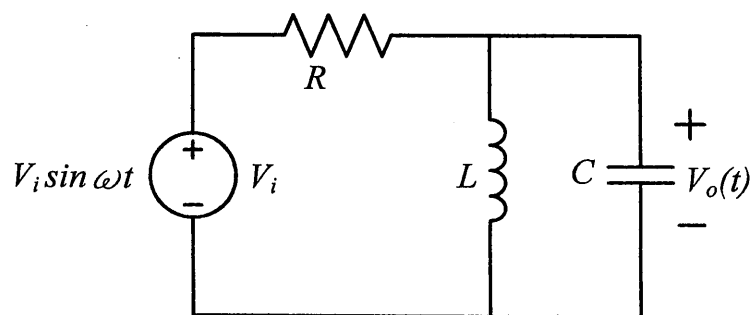


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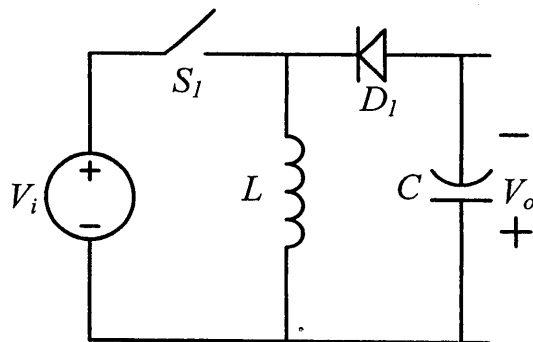
※請在答案卷內作答

五、Given an RLC circuit driven by a sinusoidal voltage source V_i , determine output voltage $V_o(t)$ in the sinusoidal steady state. (10%)



六、A buck-boost converter is shown below. Answer the following questions:

- (一) What is the input-to-output voltage transfer ratio (V_o/V_i) when it operates in continuous conduction mode and with duty ratio d of switch S_1 . (10%)
- (二) What are the voltage stresses imposed on switch S_1 and diode D_1 . (5%)

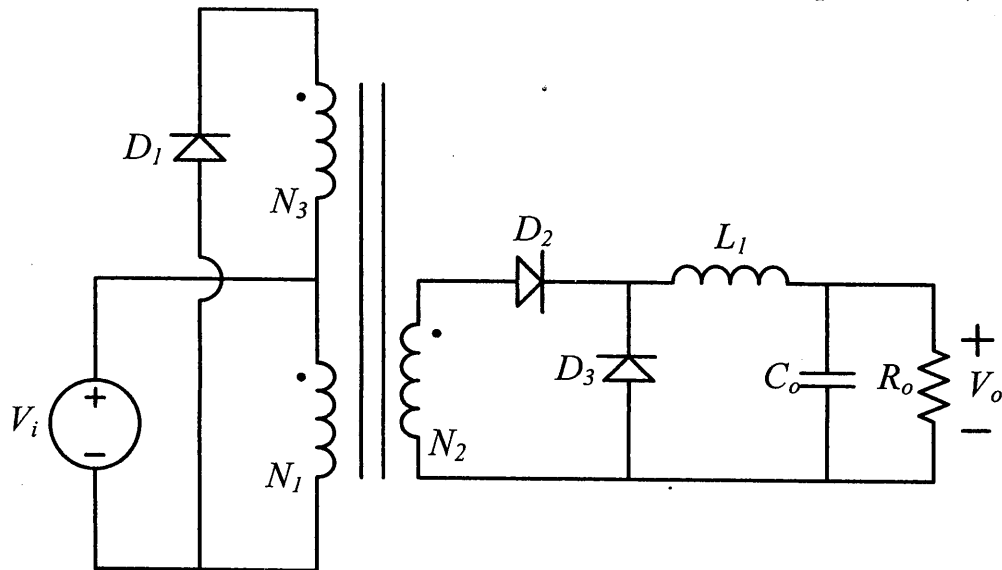


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- 七、A forward converter operated in continuous conduction mode and with duty ratio d of switch S_1 is shown below, in which the numbers of turns of the windings are N_1 , N_2 and N_3 . Answer the following questions:
- (一) How to reset the core of the transformer in every switching cycle? (5%)
 - (二) What is the voltage stress imposed on diode D_3 ? (5%)
 - (三) What is the maximum duty ratio limitation under normal operation? (5%)



注意：背面有試題