題號： 420
科目：電路學
節次： 7
國立臺灣大學 104 學年度碩士班招生考試試題
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1. A periodic triangular voltage $v_s(t)$ as shown in Figure 1 is directly applied to a 25Ω resistor. Please determine the root-mean-square (rms) value of the periodic triangular voltage and the power consumption of the resistor. [15]

2. Please design a difference amplifier, which can magnify the voltage differences between ANY two points in a circuit, by using one ideal op-amp and four resistors. Your designed difference amplifier should be able to convert the input voltage -150mV~150mV into -5V~5V at the output terminal. You have to describe your design procedure and explain how to determine the values for the four resistors. [15]

3. As shown in Figure. 2, please use node analysis method to determine the voltage $\vec{V}_1$ and $\vec{V}_2$ as well as the average power supplied by the 12V voltage source. [20]

4. Please draw the asymptotic Bode plot (both amplitude gain and phase) for the following transfer function: $H(s) = \dfrac{-600s}{(s+200)^2}$. Also, determine its maximum amplitude gain in dB. [20]

5. For the circuit shown in Figure 3, please find the output voltage $v_o(t)$ for $t \geq 0$ with the input voltage $v_s(t)= 10$V for $t < 0$ and $v_s(t)= -5$V for $t \geq 0$. [20]

6. As shown in Figure 4, the ideal two-way switch SW is switching periodically with a very high frequency between point A and point B assuming zero switching transient time. If the time for the SW connecting to point B is twice the time for the SW connecting to point A and the inductance and capacitance values are very large, please determine the output voltage in steady state. [10]
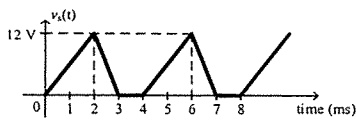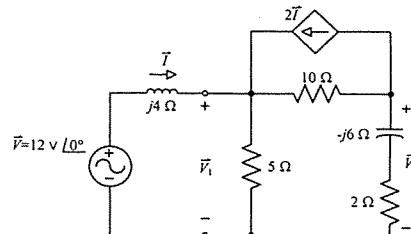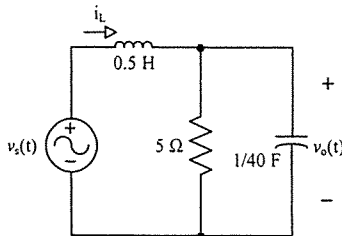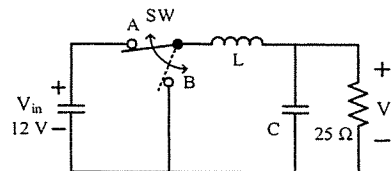
Figure 1

Figure 2

Figure 3

Figure 4

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