國　立　清　華　大　學　命　題　紙

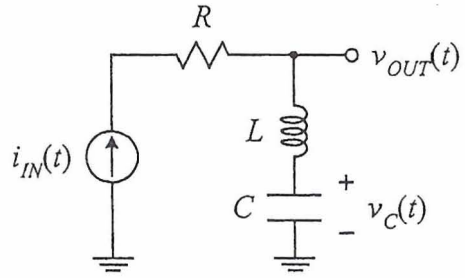
95 學年度 電機領域聯合招生 系（所） 組碩士班入學考試

科目 電路學 科目代碼 9908 共 3 頁第 1 頁 *請在【答案卷卡】內作答

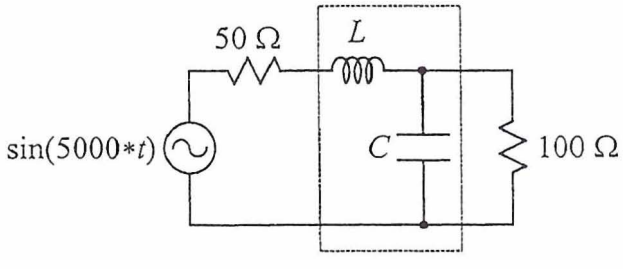
1. For the following circuit, assume the values of the resistor R is 1 kΩ, the value of the inductor L is 1 mH, and the value of the capacitor C is 0.5 nF. The current source $i_{IN}(t) = 2\times\sin(10^6\times t)$ mA and the initial voltage of the capacitor is -4 V, i.e., $v_C(0) = 4$ V.
   (a). Please find the steady-state response of $v_{OUT}(t)$. (5%)
   (b). **Please find the expressions of $E_L(t)$ and $E_C(t)$, which** represent the energy stored in the inductor L and the capacitor C, respectively. **(6%)**
   (c). Assume the quality factor Q is defined as

$$Q = 2\pi \times \frac{\text{Maximum energy stored in } L \text{ and } C}{\text{Energy consumed by } R \text{ per period}}.$$

   Please calculate the Q value. (6%)



2. As shown below, a voltage source with 50 Ω output impedance is used to drive a 100 Ω loading. In order to deliver the maximum power to the 100 Ω loading, a LC circuit is added between the voltage source and the loading. Please find the values of the inductor and capacitor in this LC circuit. **(8%)**



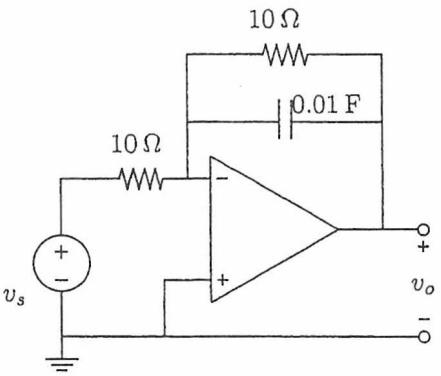
3. Assume the OPAMP of the given circuit operates in linear range. $v_s = 10\cos(10t)u(t)$ V, where $u(t)$ represents the unit step function. The initial condition of the capacitor is given as $v_c(t=0) = 0$.

(a) Find the complete time domain expression $v_o(t)$;

(b) Use the phasor analysis technique to find the output voltage in the time domain.

(c) Are the answers of (a) and (b) the same (yes/no)? Explain their relationship.

(15%)



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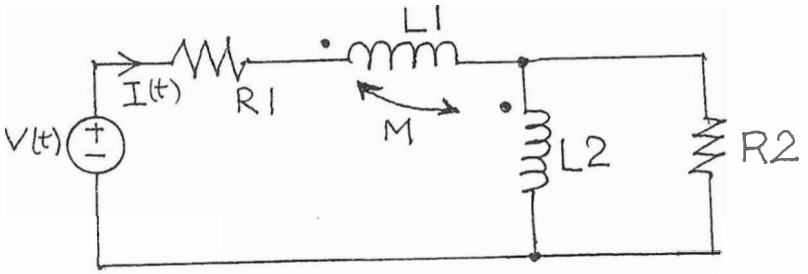
4. (a) Can you find the phasor representation of $v(t) = \cos(100t) + 3\cos(200t)$ (Yes/No)? Explain your answer.

(b) If an OPAMP circuit operates in the saturation mode, can this circuit be analyzed by using the superposition technique (Yes/No)? Explain your answer.

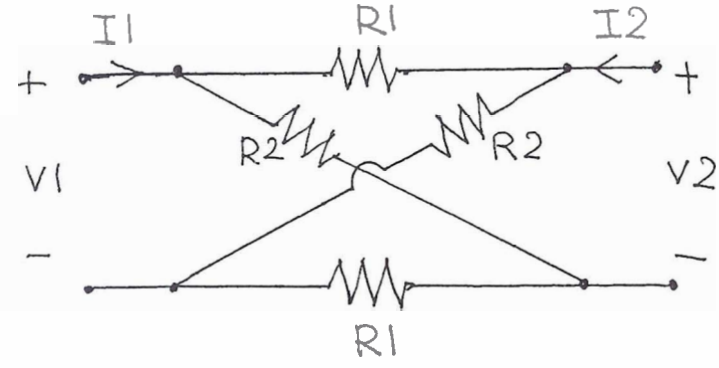
(c) Can a light bulb consume only reactive power while emitting light(Yes/No)? Explain your answer.

(15%)

5. Given the following circuit, L1=2H, L2=8H, M=4H, R1=R2=2.0 ohms, V(t)=100 COS(t) volts, find the steady state solution of I (t). (15%)



6. Find the impedance parameters (i.e.,Zij) of the following linear circuit.(15%)



7. Find the real power P, reactive power Q, apparent power S and power factor of the following three phase load. Assume the balanced three phase voltage source has a line to line voltage of 200 volts and Z = 3 + j 4 ohms. (15%)