國立臺灣科技大學
九十二學年度碩士班招生考試試題
系所組別：電機工程系碩士班甲組
科　目：電路學

電路學總分 100 分，共五題，每題 20 分

1. A cathode-ray oscilloscope (CRO) is used to measure the voltage across a coil having an inductance of 40mH and a resistance of 20kΩ. The laboratory setup is illustrated in Fig. 1. The input circuit of the CRO consists of a 900kΩ resistor in parallel with a 20pF capacitor. A sinusoidal voltage source operating at a frequency of $10^6$ rad/s and having an internal resistance of 110kΩ is used to excite the coil. The peak amplitude of the sinusoidal voltage source is 10V when the source is operating open circuit. What is the percent error in measuring the amplitude of the voltage across the coil? (20%)

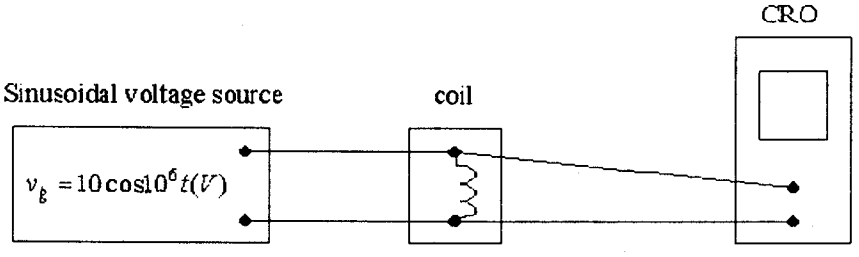


Figure 1.

2. The switch in the circuit in Fig. 2 is moved to position a at t=0. The switch remains in position a for 20ms and then moves instantaneously to position b. The switch remains in position b. How many milliseconds after the switching sequence starts does the ideal op amp saturate? (Assume $v_0(0^-) = 0V$) (20%)

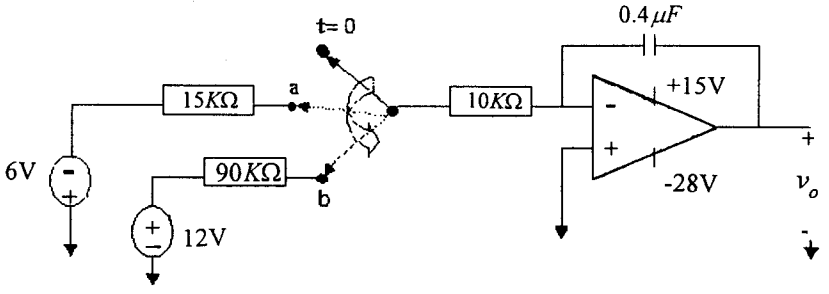


Figure 2.

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3. Find the complete response of $vc(t)$ for $t \geq 0$ in Fig.3, given that

$vs(t) = 20$ V　　$t < 0$

$vs(t) = -20$ V　　$t \geq 0$　　(20 %)

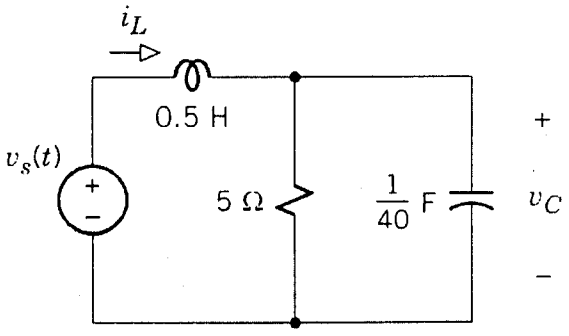


Fig.3

4. Suppose the circuit in Fig.4 satisfies the series resonance condition $X(\omega_0) = 0$ with $\omega_0$=2000 rad/sec. If $R_1$ = 2 Ω, C = 5 $\mu$F, and $R_2$ =75 Ω, then what are the values of $L$ and $Z(j\omega_0)$ seen from the voltage source? Does $\omega_0^2$ equal $1/LC$ ?　　(20 %)

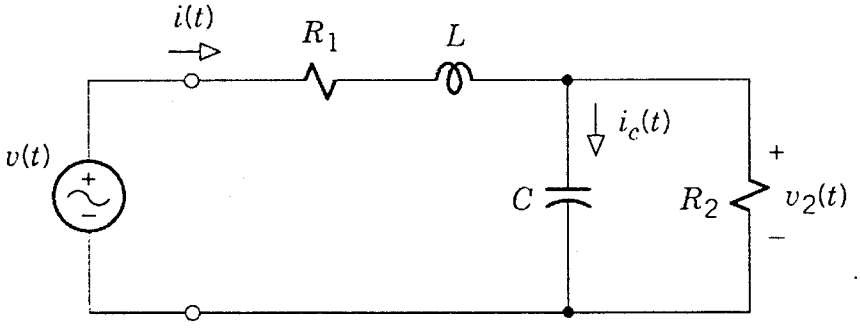


Fig.4

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5. Use $s$-domain matrix node analysis for $v_1$ and $v_2$ in Fig.5 to obtain network function $H_1(s)$ and $H_2(s)$, which defined as below: (20 %)

$H_1(s) = V_1(s)/I_s(s)$

$H_2(s) = V_2(s)/I_s(s)$

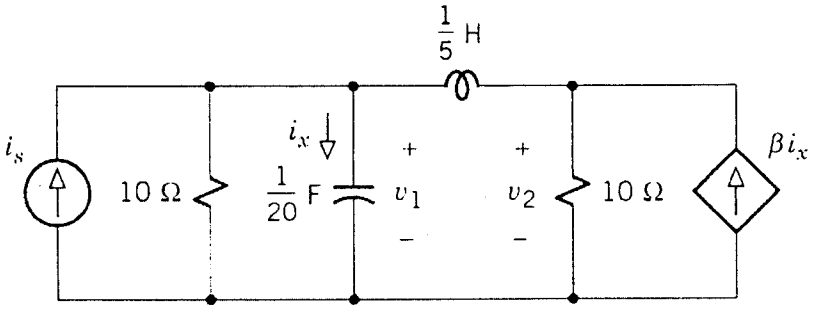


Fig.5