編號： 134

國立成功大學 104 學年度碩士班招生考試試題

系所組別：系統及船舶機電工程學系丁組

考試科目：電路學

考試日期：0211，節次：2

※考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please translate the following paragraph into Chinese.

Magnetic resonance imaging (MRI, 磁振造影) is receiving more and more attention as scientists strive to improve the quality of the cross-sectional images of the body so useful in medical diagnosis and treatment. MRI does not expose the patient to potentially hazardous X-rays or injected contrast materials such as those employed to obtain computerized axial tomography (CAT, 電腦斷層掃描) scans. (12%)

2. For the circuit shown in Fig 1, the switch closes at $t = 0$. There is no energy stored in the capacitor for $t<0$. Solve for the following:

(1) For V=10 V, L = 1.8 mH and C =0.2 mF, determine R such that the system is critically damped (denoted Rc here). (8%)

(2) For R = 50% Rc, determine $V_C(t)$. Indicate the type of damping. (12%)

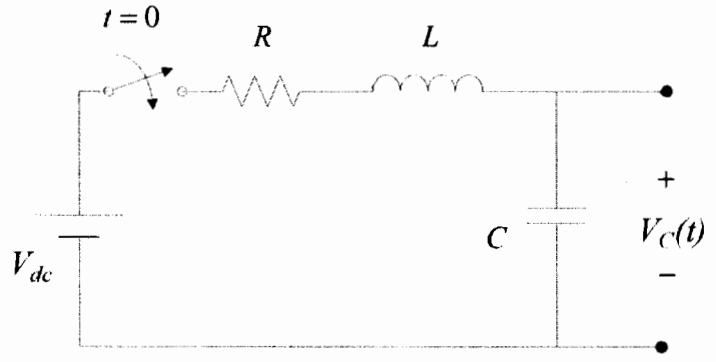

Fig. 1

3. As shown in Fig. 2(a), the circuit is in sinusoidal steady state. With the output waveform $v_{out}(t)$ shown in Fig 2(b), sketch the input waveform $v_{in}(t)$ on the same graph. Indicate the magnitude and the phase difference with $v_{out}(t)$. (**Note:** π **=3** for simplicity)(18%)

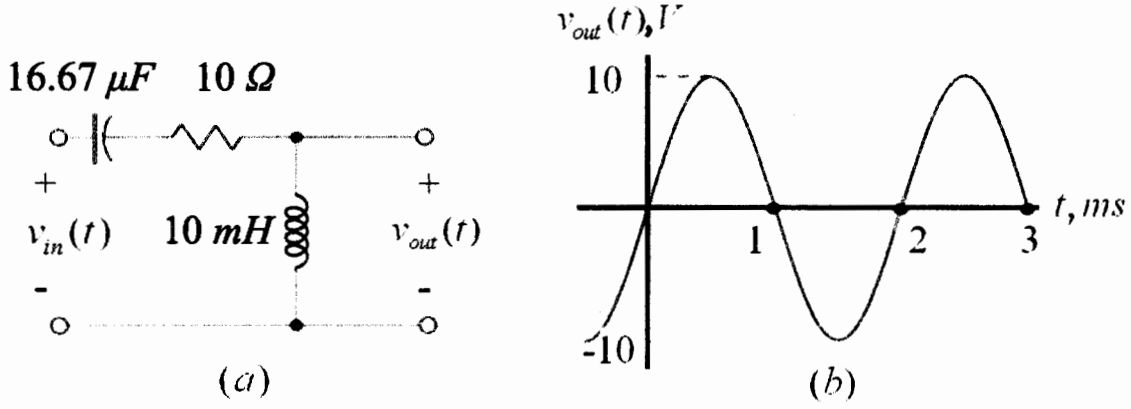

Fig. 2

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4. A voltage source with $V_s(t) = 120\sqrt{2}\cos(250t)\,V$ is connected in series with a resistor R=100 Ω, an inductor L=0.8 H and a capacitor C=25 μF.

(1) Find the equivalent impedance for all R, L and C at the source frequency. (5%)

(2) Determine the sinusoidal steady-state current, $i(t)$. (5%)

(3) Draw a phasor diagram to describe the voltages across all the elements (including the source and R, L, C) and the current. Indicate the magnitudes and phase angles. (6%)

(4) What is the apparent power out of the voltage source and what is the power factor? (4%)

5. After being open a long time, the switch in Fig. 3 is closed at t=0 for 4 s, then opened again. Determine and sketch the voltage $V_R(t)$ for t > 0. (15%)

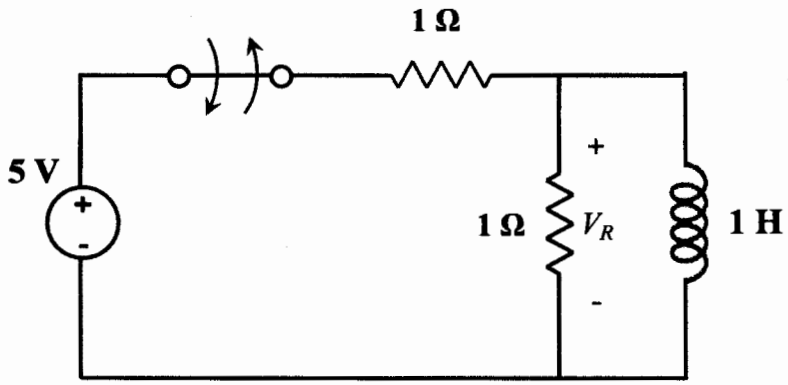

Fig. 3

6. A load is connected to an ac voltage source of 460 Vrms and 60 Hz. The load consumes a power of 12 kW at a power factor of 0.75. To improve the power factor to 0.9, a capacitor is connected in parallel with the load. What is the capacitance needed? Draw a phasor diagram to indicate how this works. ($\cos^{-1}0.75$=41.4°, $\cos^{-1}0.9$=25.8°) (15%)