

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：0307，節次：2

※ 考生請注意：本試題 可 不可 使用計算機

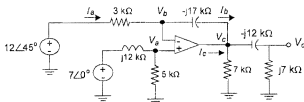
請勿在本試題紙上作答，否則不予計分

Problem #1: (20 points, 2 pts each) Write either *True* or *False* on the answer sheet

- We use Phasor analysis because it enables us to apply Kirchhoff's laws and our standard analysis techniques by converting differential equations into algebraic relationships. **True False**
- The energy stored in an inductor can change instantaneously. **True False**
- The current passing through a capacitor can change instantaneously. **True False**
- Ideal models of operational amplifiers assume the output resistance is infinite. **True False**
- If two independent sinusoidal sources are operating at different frequencies in a circuit, one must use superposition to apply phasor analysis. **True False**
- The time constant is a measure of how quickly the voltages and currents in a first-order circuit settle to their final values. **True False**
- For linear transformers, if current leaves a dotted terminal, it induces a positive voltage at the dotted terminal of the other coil. **True False**
- Phasor analysis only enables us to solve for the transient component of circuits operating in a sinusoidal steady-state. **True False**
- The energy stored in a pair of magnetically coupled coils must be non-negative. **True False**
- The charge stored in a capacitor is directly proportional to the current. **True False**

Problem #2: (14 points, 2 pts each)

Assuming the op amp is ideal in the circuit below. Find V_a , V_b , V_c , I_a , I_b , I_c , and V_o . Please express all values in polar form (e.g., $13.1\angle 45^\circ$) and include units with each answer.

**Problem #3: (15 points, 3 pts each)**

A 60 Hz single-phase source of $1400\angle 0^\circ$ V-rms is connected to three loads in parallel. Load 1 draws 125 kVA at a power factor of 0.28 lagging. Load 2 is a capacitive load drawing 10 kW and 40 kVAR. Load 3 draws 15 kW at a unity power factor. Determine

- the total complex power delivered by the source (magnitude and phase).
- the phasor current drawn from the source.
- the source power factor.
- the instantaneous current in load 2.
- the value of capacitance that, when placed in parallel with the three loads, will produce a power factor of 0.8 lagging.

(背面仍有題目,請繼續作答)

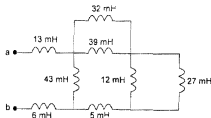
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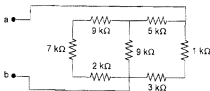
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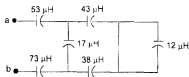
(a) (3 pts) Find the equivalent inductance and the DC resistance of the circuit below.



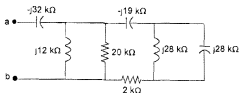
(b) (2 pts) Find the equivalent resistance of the circuit below.



(c) (3 pts) Find the equivalent capacitance and the DC resistance of the circuit below.



(d) (2 pts) Find the equivalent impedance of the circuit below.



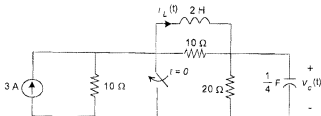
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※ 考生請注意：本試題 可 不可 使用計算機**Problem #5: (17 points)**Assume that the switch is open for $t < 0$ and close for $t > 0$. If the circuit is in the DC steady state at $t = 0$

- (a) (8 pts) find $i_L(0^-)$ and $v_C(0^+)$.
- (b) (9 pts) Write an integro-differential equation for the voltage $v_C(t)$ for all $t > 0$. Insert all numerical values and indicate the initial condition for any derivative in the equation.

**Problem #6: (24 points, 3 pts each)** For the circuit shown below. Find

- (a) the values of V_I and V_o
- (b) what is the open circuit voltage between the terminals a and b?
- (c) Solve for the current that flows from terminal a to b when the load is replaced with a direct connection (short circuit current)
- (d) what is the Thevenin equivalent impedance seen at the terminals a and b?
- (e) what is the load impedance that will maximize the power dissipated in the load?
- (f) how much power is dissipated in the load when Z_L has the value specified in part e?
- (g) what are the values of the voltage and current across the load when it has the value specified in part e?
- (h) what is the reactive power dissipated in the load when Z_L has the value specified in part e?

