

國立臺灣科技大學 106 學年度碩士班招生試題

系所組別：電子工程系碩士班乙二組

科目：電路學

(總分為 100 分)

1. The voltage $v(t)$ and current, $i(t)$, of a 1-H inductor adhere to passive convention. Also $v(0) = 0$ V and $i(0) = 3$ A.

(a) Determine $v(t)$ when $i(t) = x(t)$, where $x(t)$ is shown in Fig. 1 and $i(t)$ has unit of ampere (A) (4%)

(b) Determine $i(t)$ when $v(t) = x(t)$, where $x(t)$ is shown in Fig. 1 and $v(t)$ has unit of volt (V) (6%)

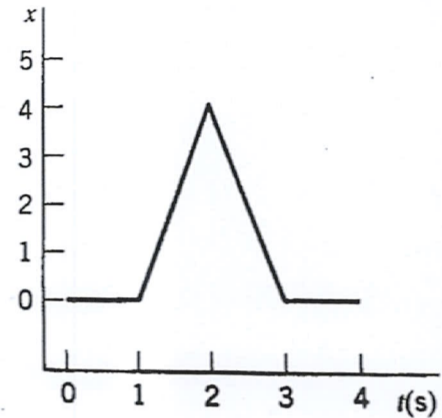
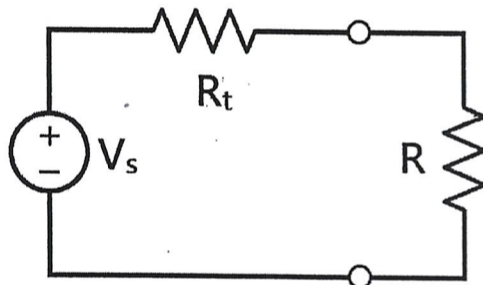


Fig. 1

2.

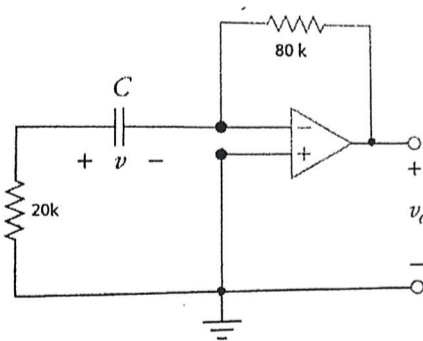


For the circuit as left, the load R is adjustable

(a) Given V_s and R_t , express the power P delivered to the load R as a function of R (5%)

(b) Use your answer in (a) to find the maximum power P . Detailed steps must be provided (10%)

3. For the following op-amp circuit where $C = 5\mu\text{F}$ and the units of resistance are both ohm (Ω),



(a) For the voltage across the capacitor $v(t)$, what is the differential equation it satisfies? (4%)

(b) With initial condition $v(0) = 2$ V, find $v(t)$, $t > 0$ (3%)

(c) Use your answer in (b), find the output voltage $v_o(t)$, $t > 0$ (8%)

4. The current $i(t)$ in a 10-mH inductor changes according to

$$i(t) = \begin{cases} 0 & t \leq 0 \\ 4t & 0 \leq t \leq 1 \\ 4 & t \geq 1 \end{cases}$$

where units of time are seconds and the units of current are amperes. Determine the power $p(t)$ absorbed by the inductor and the energy $w(t)$ stored in the inductor. (10%)



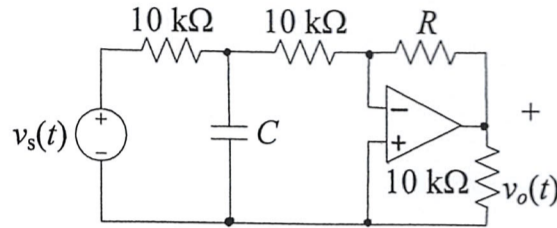
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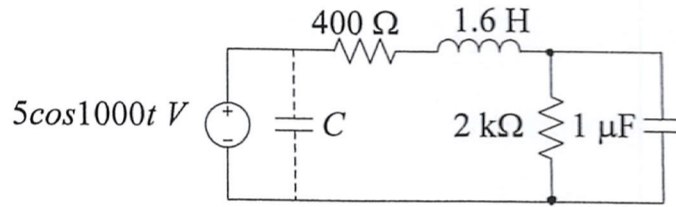
科 目：電路學

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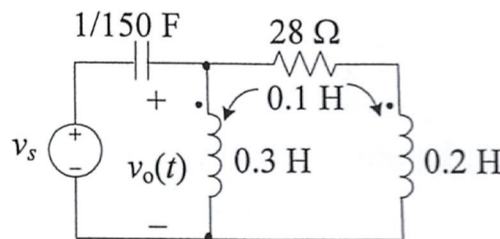
5. In the following figure, if $v_s(t) = 4\cos(100t)$ V, and $v_o(t) = 8\cos(100t+135^\circ)$ V. determine the values of C and R . (12%)



6. In the following figure, (a) Please calculate the power factor for the voltage source (without C).
 (b) If a shunt capacitor C is added to achieve unity power factor, find the value of C . (a:7%; b:7%)



7. Determine $v_o(t)$ for the circuit in the following figure when $v_s = 30\cos30t$ V. (12%)
 (Note: $24 + j5 = 24.5\angle 11.8^\circ$)



8. (a) Find the transfer function $V_o(s)/V_i(s)$ of the circuit in the following figure, where $R = 100$ kΩ, $C = 0.1$ μF.
 (b) What kind of filter this circuit is? (a: 8%; b: 4%)

