

# 國立臺北科技大學

## 九十四學年度電機工程系碩士班入學考試

### 電路學試題

填准考證號碼

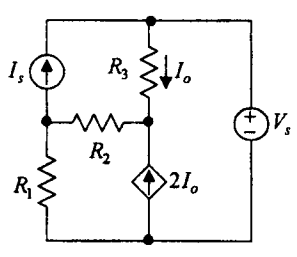
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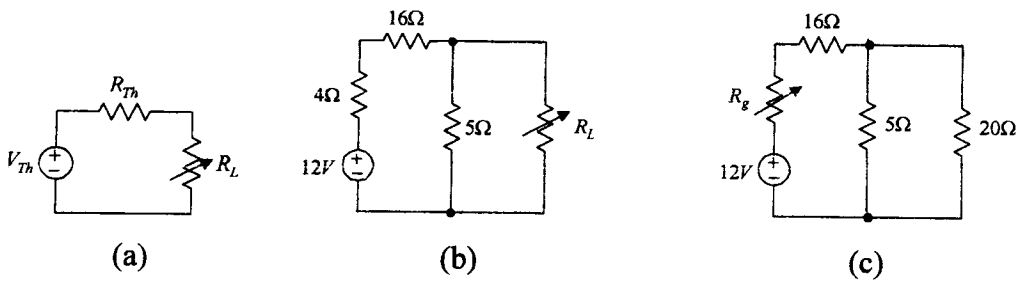
#### 注意事項：

1. 本試題共 8 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

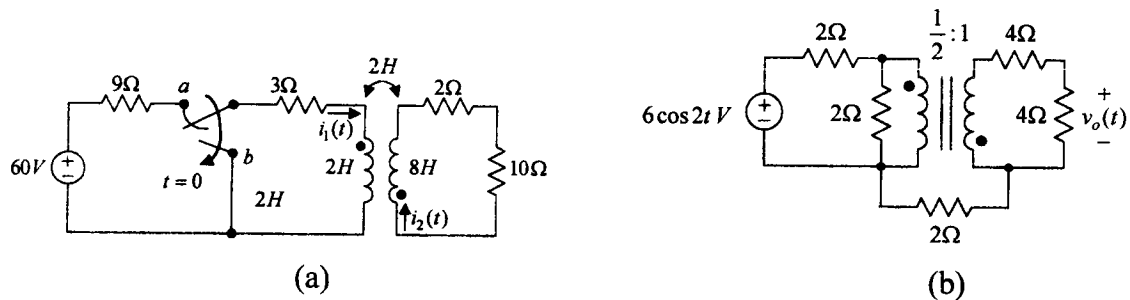
1. Consider the following linear time-invariant network. If  $V_s = 12V$  and  $I_s = -2A$ , then  $I_o = 3A$ , and if  $V_s = -6V$  and  $I_s = 4A$ , then  $I_o = -3A$ . Find  $I_o$  when  $V_s = 30V$  and  $I_s = 6A$ . (5%)



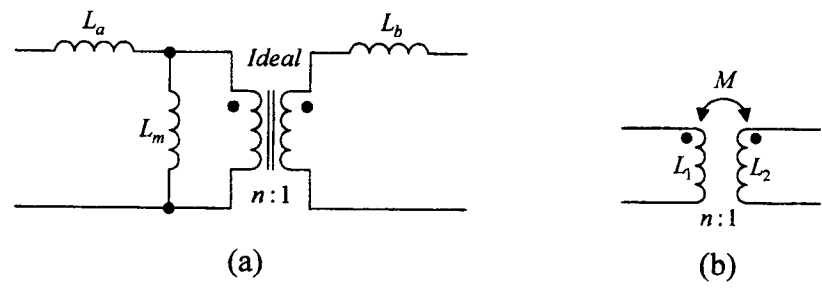
2. (1) Prove the maximum power transfer  $p_{max} = \frac{V_{Th}^2}{4R_{Th}}$  under  $R_L = R_{Th}$ , as in the following circuit of (a); (2) Find the maximum power transfer to the load  $R_L$  in the following circuit of (b); (3) Find the value of  $R_g$  under the maximum power transfer to the load of  $20\Omega$  in the following circuit of (c). (10%, 5%, 5%)



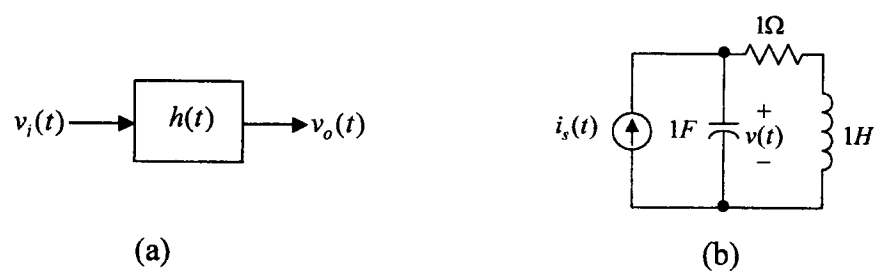
3. (1) Find  $i_1(t)$  for  $t \geq 0$  in the following circuit of (a); (2) Find  $v_o(t)$  in the following circuit of (b). (10%, 5%)



4. Without considering the copper and core losses in the linear transformer, describe the transformer parameters  $L_a$ ,  $L_m$  and  $L_b$ , as in the following figure of (a) in terms of the transformer parameter  $L_1$ ,  $L_2$ ,  $M$  and  $n$ , as in the following figure of (b), where  $L_1$ ,  $L_2$ ,  $M$  and  $n$  denote self-inductance on the primary, self-inductance on the secondary, mutual inductance and turn ratio, respectively. (10%)

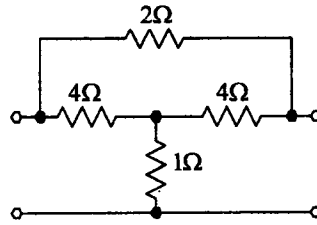


5. (1) For the linear system in the following figure of (a), when the input voltage is  $v_i(t) = 2\delta(t)$  V, the output is  $v_o(t) = 10e^{-2t} - 6e^{-4t}$  V. Find  $v_o(t)$  when  $v_i(t) = 4e^{-t}u(t)$  V; (2) A band-limited signal has the following Fourier series representation:  $i_s(t) = 10 + \cos(t - 150^\circ)$  A. If the signal is applied to the following circuit of (b), then find  $v(t)$ . (5%, 5%)



注意：背面尚有試題

6. (1) Find  $z$  parameters of the following network; (2) Find the corresponding  $y$  parameters.  
(10%, 5%)



7. A factory is supplied with a three-phase  $\frac{10}{3}$  KV, 60Hz transmission line. The factory has the following balanced loads as follows. Load1:  $20\pi$  MVA at 0.8 lagging pf, Load2:  $2\sqrt{2}\pi$  MVA at  $\frac{1}{\sqrt{2}}$  leading pf and Load3:  $2\pi$  MW at unity pf. (1) To correct the overall pf to 1 at full load requires a  $\Delta$  - connected capacitor bank. Determine the capacitance per phase of the bank; (2) By using the results of (1), if  $Y$  - connected capacitor bank is used, determine the capacitance per phase of the bank. (5%, 5%)
8. (1) What is the physical meaning of the natural response of a linear time-invariant circuit from the point of view of the circuit behavior? (3%)
- (2) Why does not  $y$  parameters exist in the idea transformer? (3%)
- (3) Under what conditions can we apply the phasor to solving the circuit parameters? (3%)
- (4) If  $H(s) = \frac{V_o(s)}{V_i(s)}$  and the radian frequency of the excitation source  $v_i(t)$  is equal to one of zeroes of  $H(s)$ . How about  $v_o(t)$  in the steady state? (2%)
- (5) For a linear transformer to be concerned, when the radian frequency approaches to infinity, what is the feature of the load impedance reflected to the primary? (2%)
- (6) What is the physical meaning of the quality factor  $Q$  of the second-order circuit? (2%)