

# 國立臺北科技大學 107 學年度碩士班招生考試

系所組別：2120 電機工程系碩士班乙組

## 第一節 電路學 試題

第一頁 共二頁

### 注意事項：

1. 本試題共 10 題，每題 10 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. In Fig. 1,  $R_1, R_2, R_3$  and  $R_4$  are resistors, and  $V_1$  and  $I_1$  are independent DC voltage and current sources, respectively. If  $(V_1, I_1, i_1) = (120V, 12A, 36A)$ , and  $(V_1, I_1, i_1) = (48V, 8A, 16A)$ , then  $(V_1, i_1) = (200V, 65A)$ , how about  $I_1$ ? (10%)

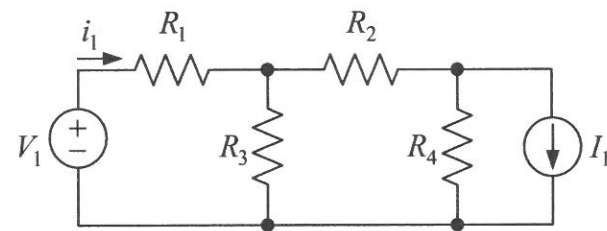


Fig. 1

2. In Fig. 2, please work out the  $y$  and  $z$  parameters of the two-port circuit. (5%, 5%)

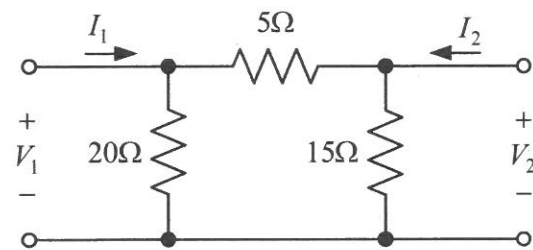


Fig. 2

3. In Fig. 3, please find the power dissipated in the  $1\Omega$  resistor using the mesh-current method. (10%)

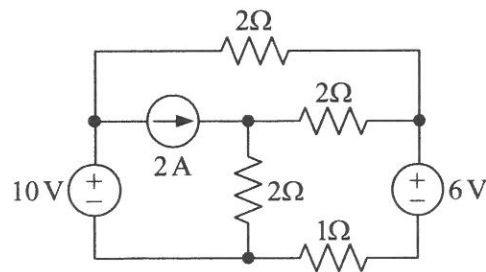


Fig. 3

4. In Fig. 4, please find the voltage  $v_o$  using the node-voltage method. (10%)

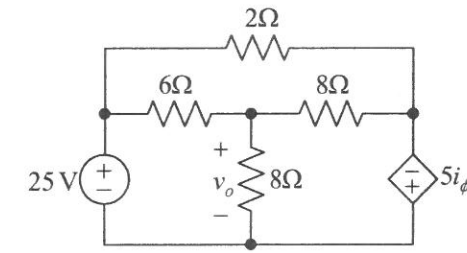


Fig. 4

5. (1) Please find the transfer function  $G(s) = \frac{V_o(s)}{V_i(s)}$  in the circuit shown in Fig. 5(a). (3%)

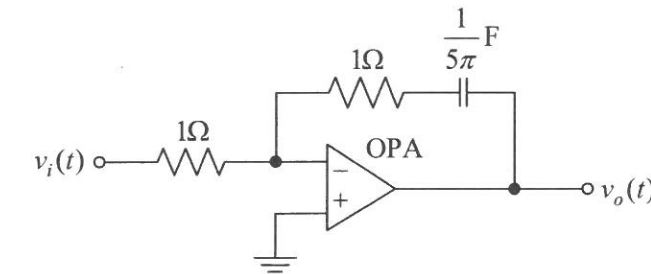


Fig. 5(a)

- (2) If  $v_i(t)$  is a periodic function as shown in Fig. 5(b), then how about the Fourier series of  $v_i(t)$ . (3%)

- (3) Based on (1) and (2), how about the output voltage  $v_{o_5}(t)$ , corresponding to the fifth harmonic of  $v_i(t)$ , namely,  $v_{i_5}(t)$ ? (4%)

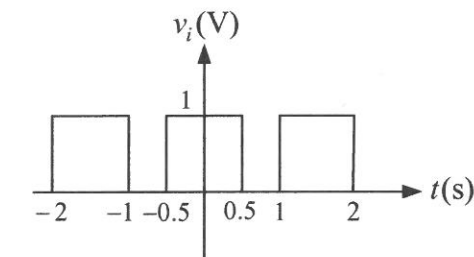


Fig. 5(b)

6. (1) The circuit shown in Fig. 6 transfers power from the primary side to the secondary side. If the maximum power transfer is needed, then how about the turns ratio of the ideal transformer  $T_1$ ? (5%)

- (2) Based on (1), What is the percentage of two sources's power delivered to the  $1\Omega$  resistor? (5%)

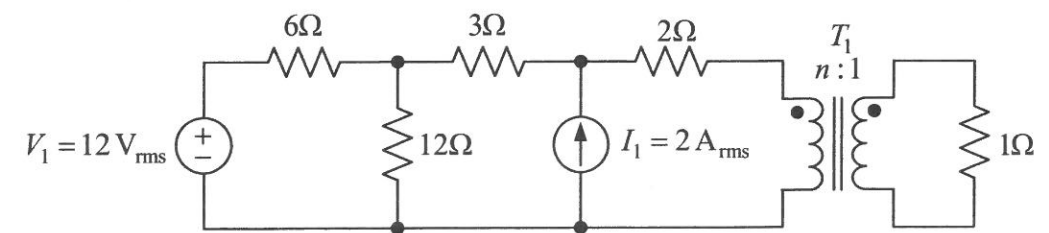


Fig. 6

注意：背面尚有試題

7. Based on the convolution integral, please find  $v_o(t)$  in the circuit shown in Fig. 7(a), with

$v_i(t)$  shown in Fig. 7(b). (10%)

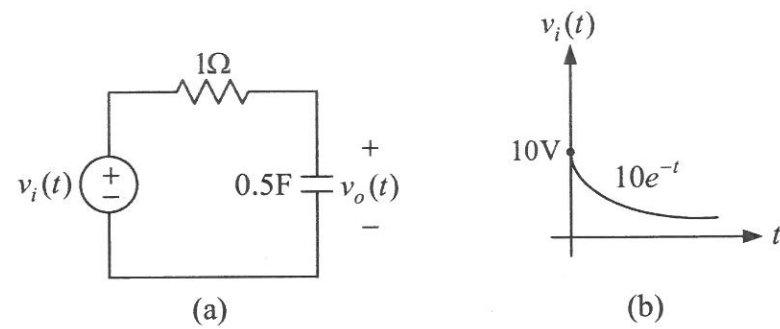


Fig. 7

8. The voltage and current at the terminals of a circuit are

$$v(t) = 80 + 120\cos(120\pi t - 10^\circ) + 60\cos(360\pi t - 30^\circ) \text{ V}$$

$$i(t) = 5\sin(120\pi t + 50^\circ) + 2\cos(360\pi t - 90^\circ) \text{ A}$$

Find the average power absorbed by the circuit. (10%)

9. When connected to  $120V_{\text{rms}}$ ,  $60\text{Hz}$  power line, a load absorbs  $4\text{kW}$  at a lagging power factor of  $0.8$ . Find the value of capacitance necessary to raise the power factor to  $0.95$ . (10%)

10. Answer the following questions: (10%)

- (1) What is the natural response?
- (2) What is a supernode?
- (3) How to obtain the frequency response based on measurements?
- (4) How to obtain a cascaded connection of two two-port circuits?
- (5) How to obtain the time constant of the first-order circuit based on measurements?