國立臺北科技大學

103學年度研究所碩士在職專班招生

電機工程系碩士班

乙組：電工原理(含基礎電學及電力電子專業實務)試題

填准考證號碼

注意事項：

1. 本試題共 [10] 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

1. A buck-boost converter operates in the continuous conduction mode (CCM). If the input voltage $V_i = 8 \sim 40\text{V}$, the output voltage $V_o = 15\text{V}$, the switching frequency $f_s = 20\text{kHz}$, the output power $P_o \geq 2\text{W}$, and all the elements are ideal, then please the minimum value of the inductor L_{min}. (10%)

2. (a) Please plot the circuit of the flyback converter. (5%)

   (b) Based on (a), if the magnetizing inductance is 0.5mH, the turn-on time is 20μs, and the input voltage is 20V, then how about the peak-to-peak value of the primary-side current ripple Δi_p? (5%)

3. Find the maximum power transfer in the circuit shown in Fig. 1, where $Z_L \in R$, that is, Z_L is a real number. (10%)

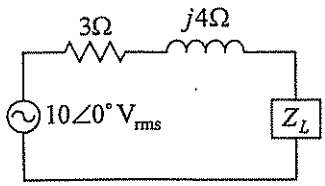

Fig. 1

4. If $H(s) = \dfrac{V_o(s)}{V_i(s)} = \dfrac{1}{s+1}$ and the input voltage $v_i(t)$ is equal to $\sqrt{2}\sin(t+30^\circ) + 5\cos\dfrac{3}{4}t$ V, then how about the output voltage $v_o(t)$ in the steady state? (10%)

5. In the circuit shown in Fig. 2, if $V_i = 12\text{V}$ and $I_s = -2\text{A}$, then $I_o = 3\text{A}$, and if $V_i = -6\text{V}$ and $I_s = 4\text{A}$, then $I_o = -3\text{A}$. Find I_o when $V_i = 30\text{V}$ and $I_s = 6\text{A}$. (10%)

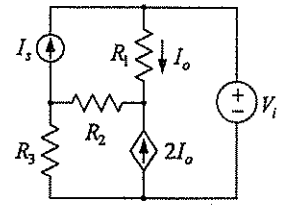

Fig. 2

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

7. The circuit shown in Fig. 3 is a high-pass filter with a load of R_L added, where $R = R_L = 1\Omega$ and $L = 1\text{H}$, how about the corner frequency ω_c? (10%)

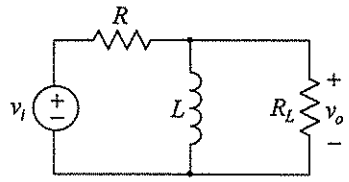

Fig. 3

8. Please find the Thevenin equivalent of the circuit shown in Fig. 4, to the left of the terminals a and b. (10%)

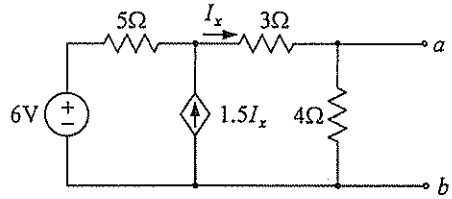

Fig. 4

9. Find the current I_x in the circuit shown in Fig. 5, using the node-voltage method. (10%)

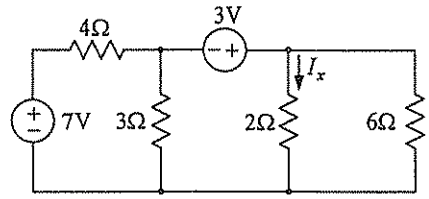

Fig. 5

10. Based on the convolution integral, please find $v_o(t)$ in the circuit shown in Fig. 6(a), with $v_i(t)$ shown in Fig. 6(b). (10%)

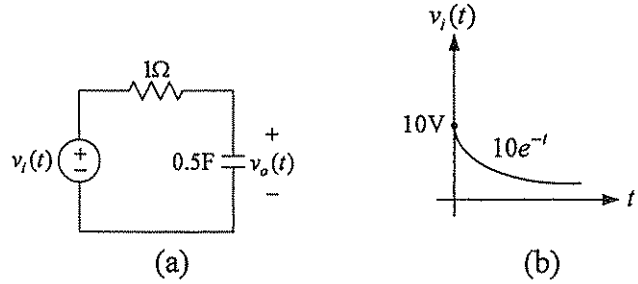

Fig. 6