編號： 179

國立成功大學 106 學年度碩士班招生考試試題

系　　所：電機工程學系

考試科目：電路學

考試日期：0213，節次：1

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please answer the following questions by filling out the blanks with correct values and corresponding units. All operational amplifiers are assumed to be ideal.

(a) For the circuit shown in Fig. 1(a), the capacitor voltage at $t = 0$ s is _____. (4%)

(b) If $v_s = 6$ V for the circuit shown in Fig. 1(b), the power absorbed by the output resistor 2 kΩ is _____. (4%)

(c) An RL circuit has $R = 4\ \Omega$ and $L = 8$ H. The time needed for the inductor current to reach 40 percent of its steady-state value is _____. (4%)

(d) The current through a branch in a linear network is 2 A when the input DC source voltage is 10 V. If the input DC source voltage is decreased to be 2 V and its polarity is reversed, the current through the branch is _____. (4%)

(e) A load is connected to the terminals of a network whose Thevenin equivalent circuit has the Thevenin equivalent resistor R_{th} of 5 Ω and the Thevenin equivalent voltage V_{th} of 20 V. The maximum power that can be supplied to the connected load is _____. (4%)

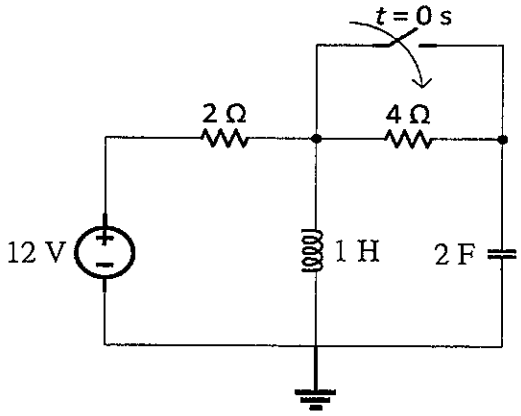

Fig. 1(a)

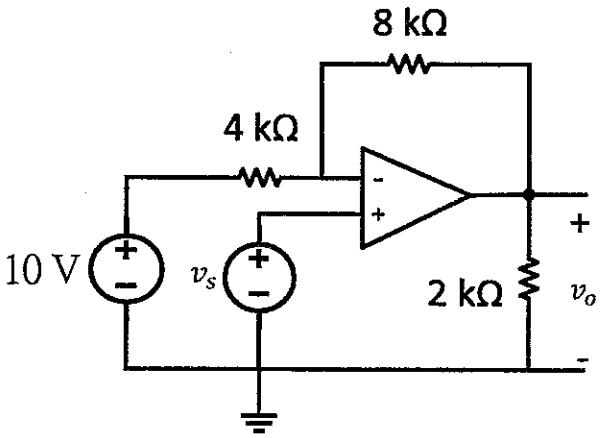

Fig. 1(b)

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2. The input waveform $v_i(t)$ shown in Fig. 2(a) is applied to the ideal operational amplifier circuit in Fig. 2(b), where $R = 20\ \text{k}\Omega$ and $C = 0.1\ \mu\text{F}$. Determine the output voltage $v_o(t)$ and plot its waveform. (15%)

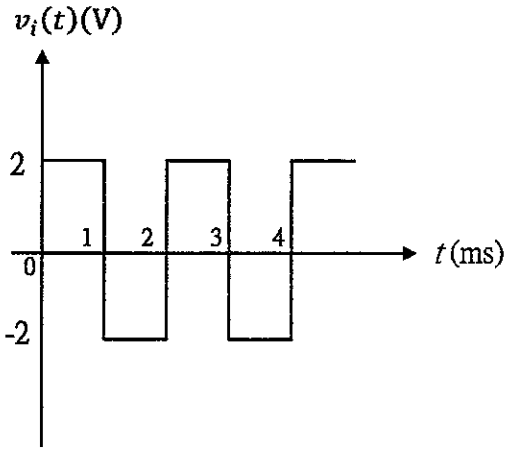

Fig. 2(a)

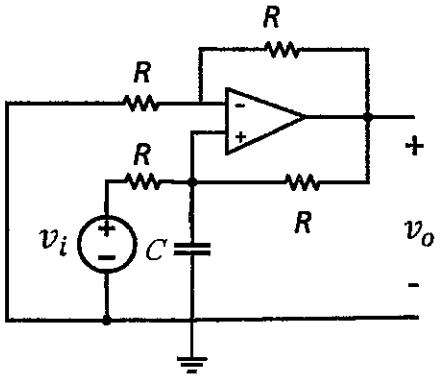

Fig. 2(b)

3. The switch in the circuit of Fig. 3 has been closed for a long time but is opened at $t = 0$ s. Calculate $v(t)$ for $t > 0$ s. (15%)

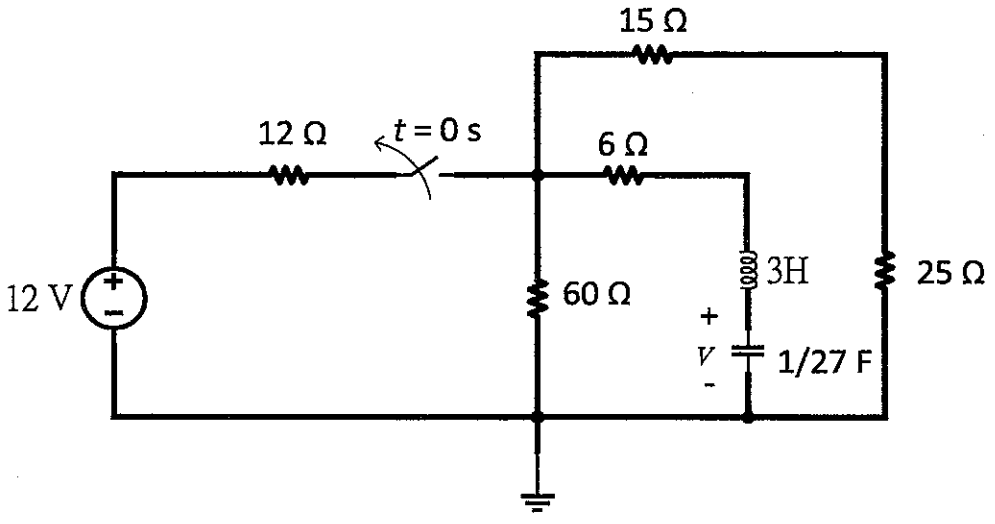

Fig. 3

4. The AC bridge circuit shown in Fig. 4 is utilized to precisely measure the equivalent inductance and the equivalent resistance of a coil or a winding in terms of a standard capacitance C_s. (30%)

(a) Derive the expression for the equivalent inductance L_x.

(b) Derive the expression for the equivalent resistance R_x.

(c) If the AC bridge has $R_1 = 40$ kΩ, $R_2 = 7$ kΩ, $R_3 = 8$ kΩ, and $C_s = 1$ μF, determine the values for L_x and R_x.

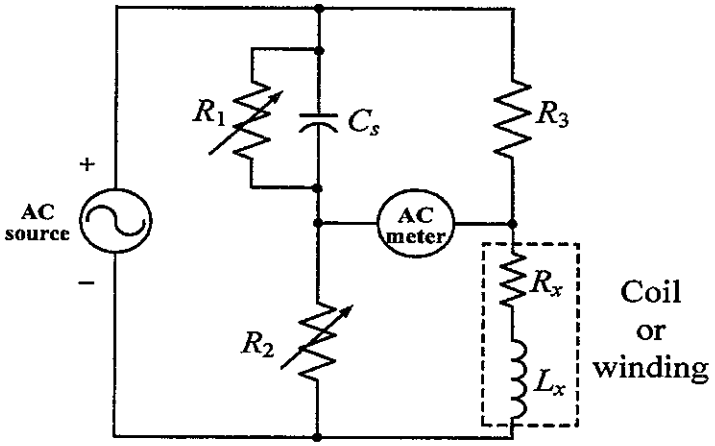

Fig. 4

5. The ideal autotransformer circuit shown in Fig. 5 has $N_1 = 190$ turns and $N_2 = 10$ turns. (20%)

(a) Determine the Thevenin equivalent circuit looking into terminals a and b.

(b) Calculate the value of the impedance $\boldsymbol{Z}_L$ that can be connected at terminals a and b to absorb the maximum average power.

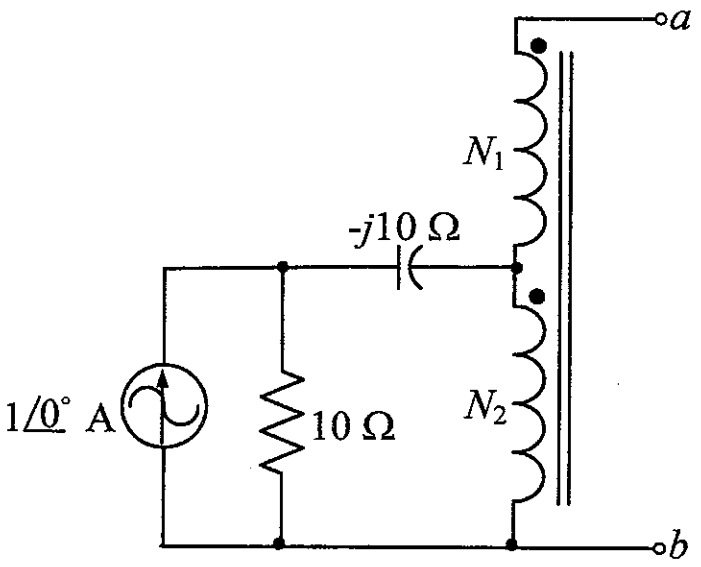

Fig. 5