科目：電路學(5006)　　校系所組：清大電機工程學系甲組、動力機械工程學系乙組

一、Please fill in the following blanks with appropriate theorems that best-match the corresponding descriptions for the theorem. (8%) (Hint: Millman's, Maximum Power Transfer, Norton's, Reciprocity, Substitution, Thevenin's)

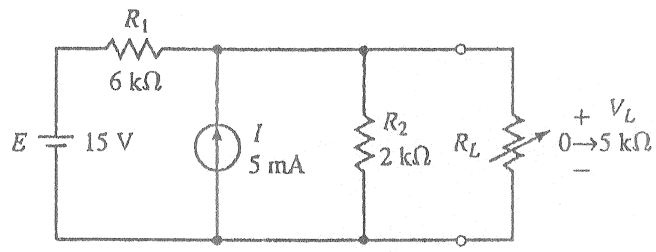
(一) _____ : any linear two-terminal bilateral network may be reduced to a simplified two-terminal circuit consisting of single voltage source in series with a single resistor.

(二) _____ : any linear two-terminal bilateral network may be reduced to a simplified two-terminal circuit consisting of a single current source and a single shunt resistor.

(三) _____ : any branch within a circuit may be replaced by an equivalent branch, provided the replacement branch has the same current through it and voltage across it as the original branch.

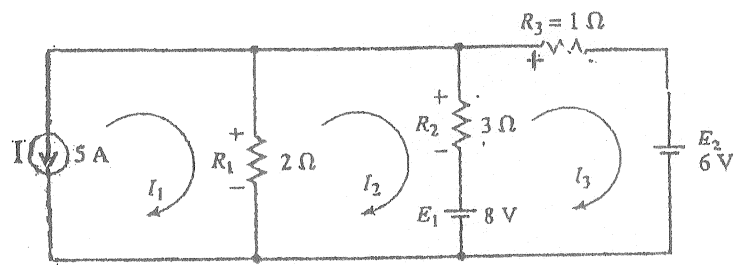
(四) _____ : any circuit consisting of several parallel real batteries may be replaced by a single equivalent voltage source in series of equivalent resistor.

二、Consider the circuit given as follows, please determine the value of R_L required to ensure the maximum of power can be obtained on R_L. (7%)

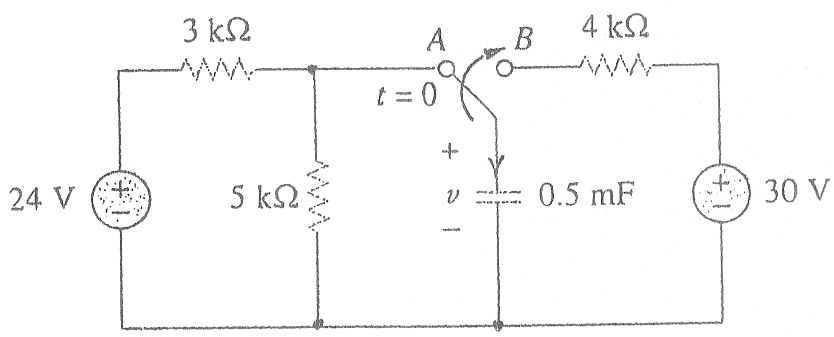


三、(一) By using the Loop Analysis, determine the current through R_1 for the circuit shown as bellows. (5 %)

(二) By using the Nodal Analysis, determine the voltage through R_3 for the same circuit. Then, check the result by using the solved current I_3 in part (一). (5 %)



四、The switch in the following figure has been in position A for a long time. At $t=0$, it is moved to position B. Determine the capacitor voltage $v(t)$ and the corresponding capacitor current for $t>0$. (10%)



注意：背面有試題

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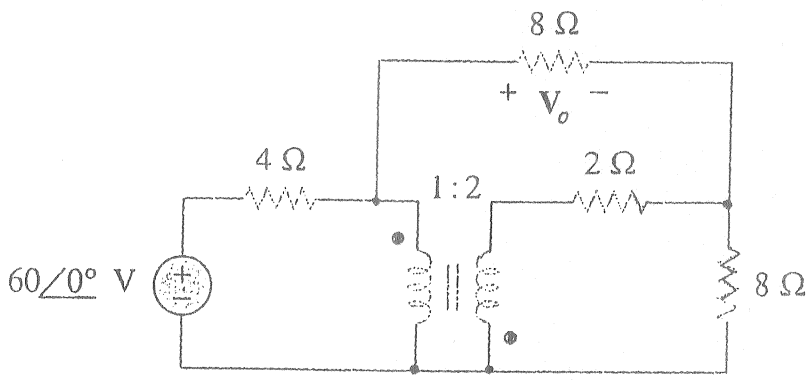
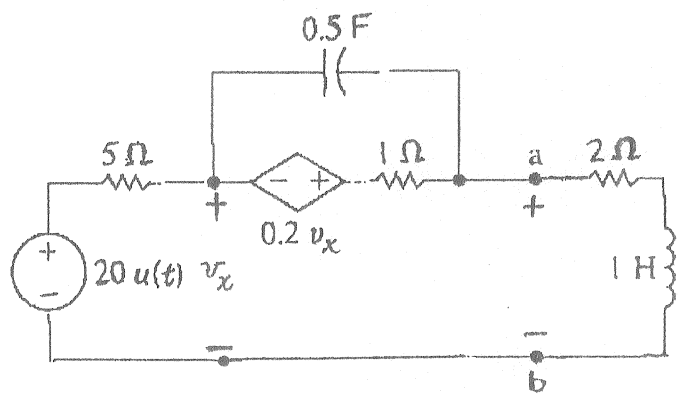
五、Find the voltage phasor V_o in the following AC circuit containing an ideal transformer. (15%)



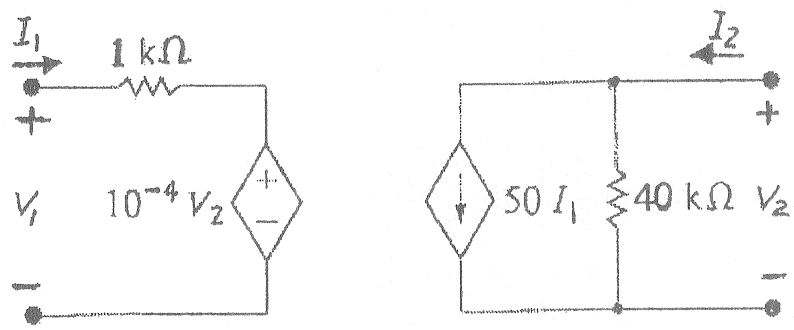
六、The initial charge on the capacitor in the circuit shown is zero.

(一) Find the s-domain Thevenin equivalent circuit with respect to the left side of the terminals a and b. (10%)

(二) Find the s-domain expression for the current delivered to the load. (5 %)



七、 Find the a parameters for the circuit, $V_1=a_{11}V_2-a_{12}I_2$, $I_1=a_{21}V_2-a_{22}I_2$. (10%)



注意：背面有試題

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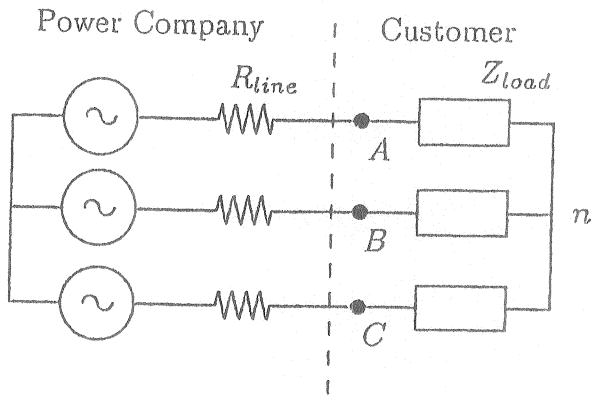
八、The line-to-neutral load voltages V_{An}, V_{Bn}, and V_{Cn} are three-phase balanced positive sequence voltages. Their magnitude is 100VRMS, and their frequency is 100 rad/sec. . The three-phase load of the customer consumes 3kW with a power factor of 0.6 (lagging).

(一). Please calculate the equivalent impedance Z_{load} and the current phasors of all three phases. Assume the phase angle of V_{An} is zero degrees. (5%)

(二). R_{line} represents the equivalent resistance of the transmission line. For the given circuit, what can the power company do to reduce the transmission losses when electricity is delivered to the customer's load? Please justify your design by comprehensive analysis (10%).



九、(一) Assuming a circuit containing energy storage component is excited by a sinusoidal source which starts at $t=0$. You can calculate a certain node voltage by analyzing this circuit in the time domain (solving all the KCL or KVL differential equations). Or you can calculate the same node voltage in the phasor domain (solving all the KCL or KVL complex equations), and then convert the phasor solution back to the time domain. Will these two approaches provide the same answer at $t>0$ (Yes/No)? Please give reasons (5%).

(二) An advertisement reads "this heater will heat up a 6 m^3 room from 18 degrees to 25 degrees in 5 minutes, and it consumes only 5 kVAR during this time span". As an electrical engineer, could you design a heater like this (Yes/No)? Please give reasons (5%).