Homework 6

Due data: May.25th

Turn in your homework in class

Rules:

- Please work on your own. Discussion is permissible, but extremely similar submissions will be judged as plagiarism!
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please submit on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.

1

[14 points]The circuit is shown in **Fig.1** with $Z_1 = j5\Omega$. Determine the following:
(a). The average power $\boldsymbol{P_1}$ absorbed by the 2Ω resistor.
(b). The complex power $\boldsymbol{S_1}$ delivered to the $-6j\Omega$ impedence and its corresponding power factor.
(c). The apparent power S_a delivered to the $25j\Omega$ impedence.

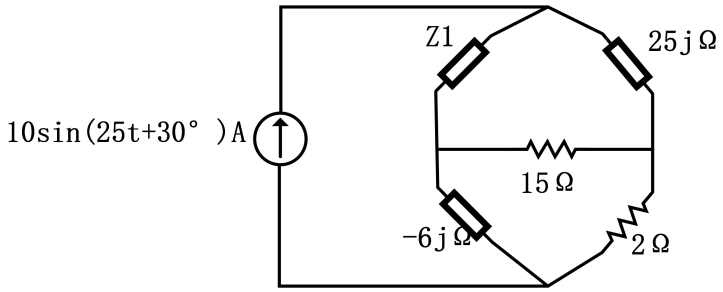

Figure 1:

2

[14 points]The circuit is shown in **Fig.2**. Assume the circuit is under sinusoidal steady state with $i(t) = 5sin(t) + 10cos(10t)$ A. Determine the following:

(a). The rms value of the current source.

(b). The maximum instataneous value of the current through the $1F$ capacitor.

(c). The average power absorbed by the 4Ω resistor.

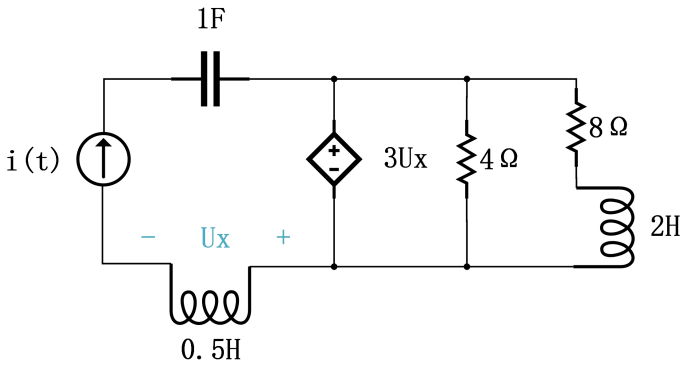

Figure 2:

3

[14 points]The circuit is shown in **Fig.3**. Assume the circuit is under sinusoidal steady state.
(a). Determine the Thevenin equivalent circuit at terminals **a** and **b**.
(b). Now there is a load with impedence Z_L at terminals **a** and **b**. Find the load impedence that maximize the average power of the load and the corresponding average power.

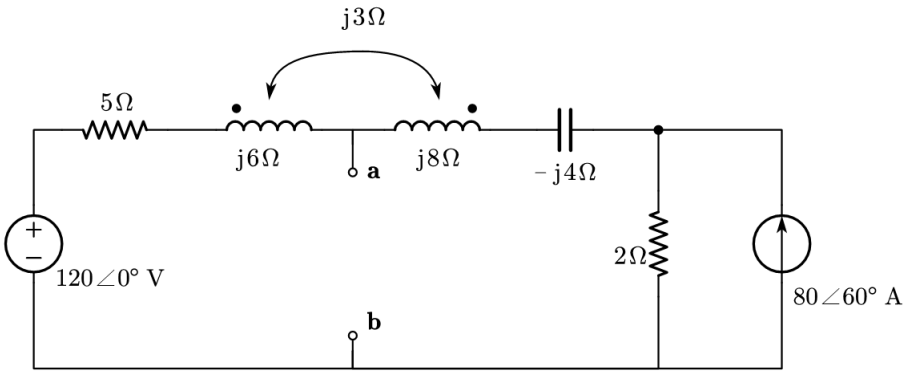

Figure 3:

4

[14 points]The circuit is shown in **Fig.4**.
(a). Determine the current $\boldsymbol{I_1}$,$\boldsymbol{I_2}$ and $\boldsymbol{V_x}$ as a function of **n** in phasor domain.
(b). Find the **n** that maximize the average power of the 8 Ω load resistor.

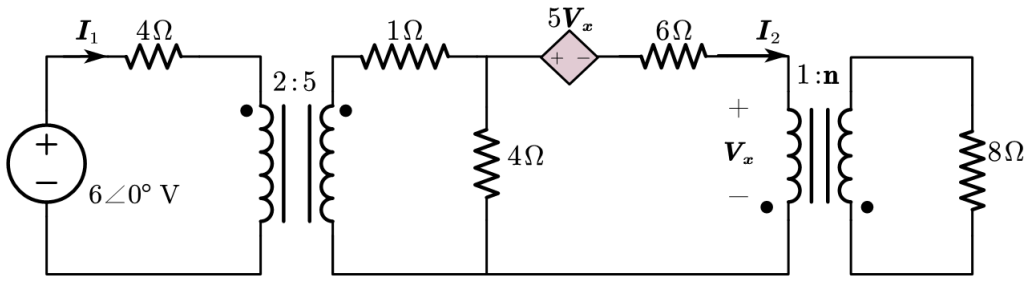

Figure 4:

5

[15 points]The circuit is shown in **Fig.5**.
(a). Determine the current $\boldsymbol{I_1}$,$\boldsymbol{I_2}$ in phasor domain.
(b). Determine the input impedence at terminals **a** and **b**.

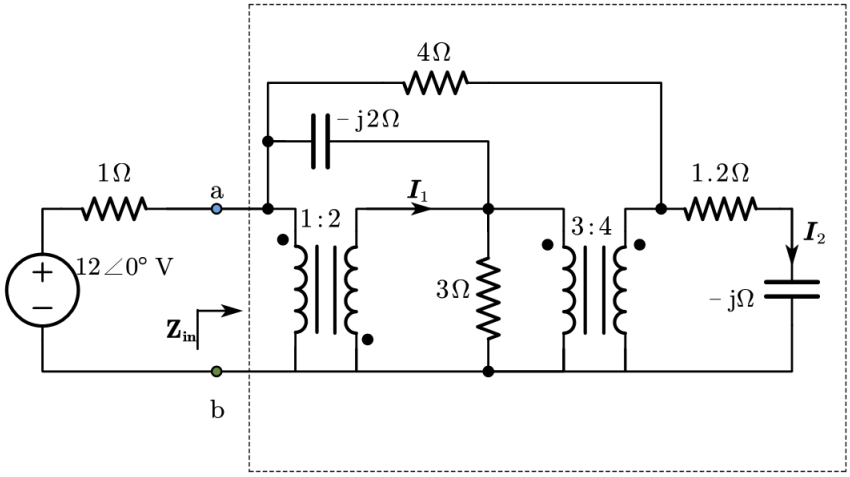

Figure 5:

6

[14 points]The circuit is shown in **Fig.6**. Known that $Z_\Delta = (48 - j30)\Omega$,$Z_l = (1 + j2)\Omega$. Determine the value of Z_Y so that the total average power delivered to the impedences enclosed by the dotted line is maximal. Then determine the phase current $\boldsymbol{I_{BC}}$ and the line voltage $\boldsymbol{V_{AB}}$.

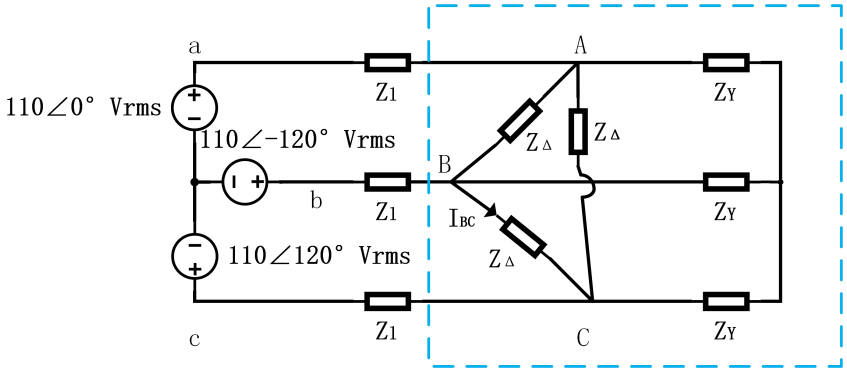

Figure 6:

7

[15 points]The circuit is shown in **Fig.7**. The angular frequency of the sources are $\omega = 50\ rad/s$.

(a). Determine whether the system is a 3-phase balanced system, and caculate the current on the neutral line $\boldsymbol{I_N}$.

(b). Given five 10Ω resistors, four $1mF$ capacitors and two $8mF$ capacitors, modify the circuit with those components so that the current on the neutral line is zero. You should write out the total load impedence of each phase and your adjusted circuit.

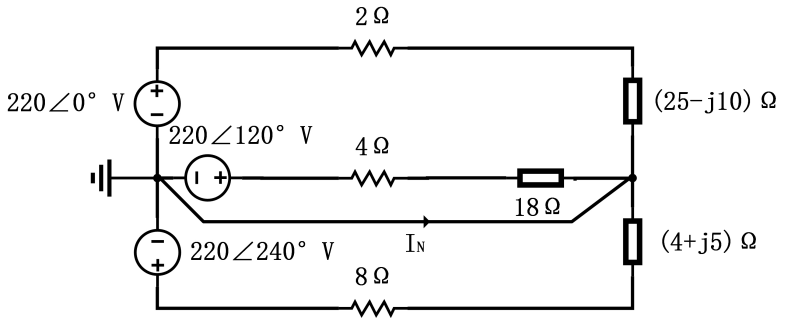

Figure 7: