Department of Electrical Engineering, IIT Madras

EE1100 @ IIT Palakkad – Basics of Electrical Engineering

KG/IITM **Assignment #3** Oct.21, 2016

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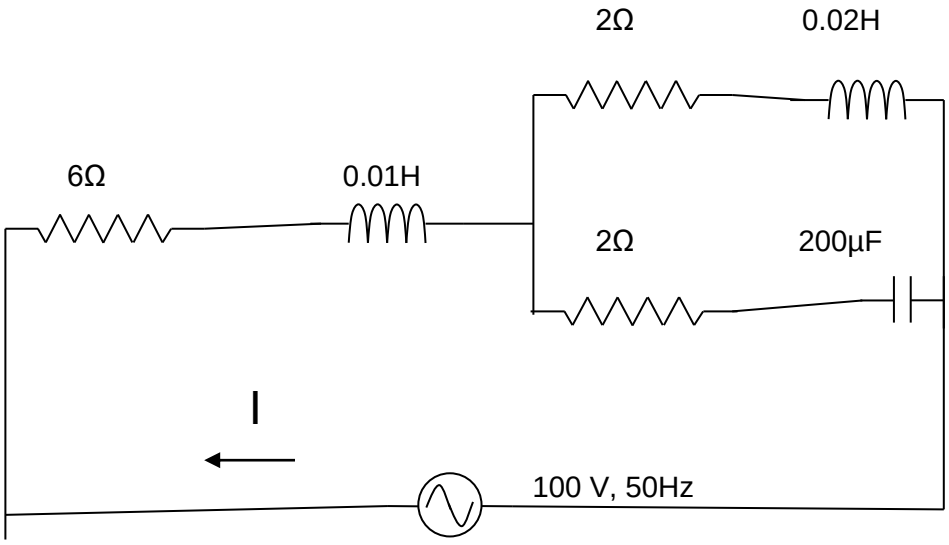
1. A two-element series circuit is connected across an AC source given by E= 282.842sin ($314t+20^0$).The current in the circuit then is found to be i=14.142cos($314t-25^0$) .Determine the parameters of the circuit.

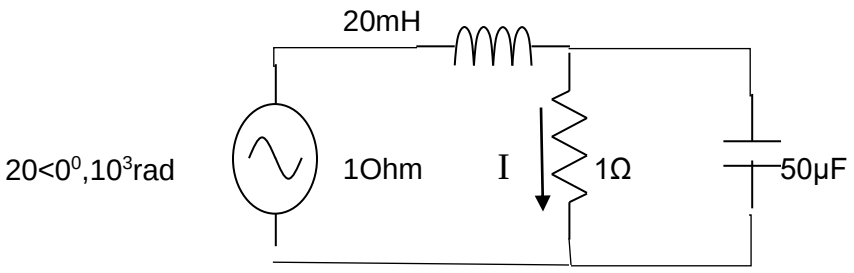
2. Determine the current in the circuit given below .Also, find the power consumed by the circuit as well as power factor. Also, find power consumed by each and every element in the circuit**.**



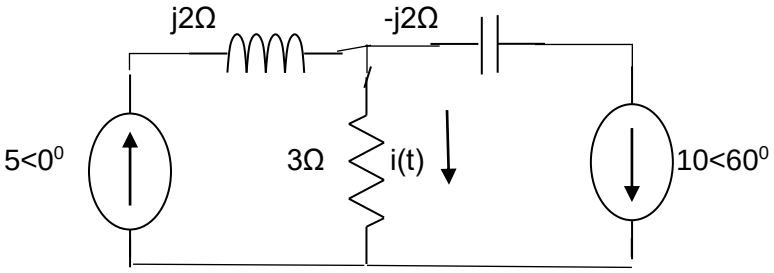
3. An R-L-C series circuit with a resistance 10Ω, inductance of 0.2H and a capacitance of 40μF is supplied with a 100V supply at variable frequency. Find the following

a) Power
b) Power factor
c) Voltage across R-L-C at that time

4. Find the current I in the circuit shown below

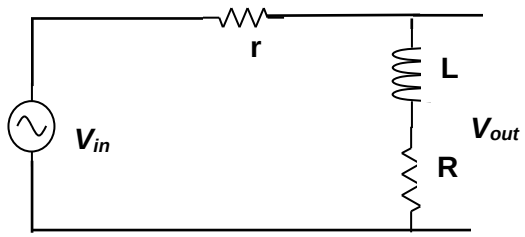


5. For the circuit given below determine the instantaneous current i(t)



6. Power factor Correction: Find the value of the capacitance needed to correct a load of 140 kVAR at 0.85 lagging power factor to unity power factor. The load is supplied by a 110 Volt (rms), 60 Hz line.

7. A high-pass RL filter can be represented by the circuit in the figure below, with r being the internal resistance of the inductor.

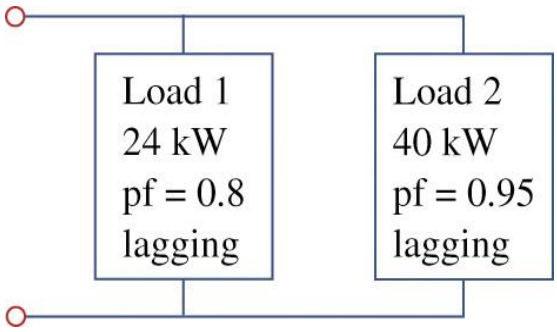


a) Find $\frac{V_{out,0}}{V_{in,0}}$, the ratio of the maximum output voltage $V_{out,0}$ to the maximum input voltage $V_{in,0}$

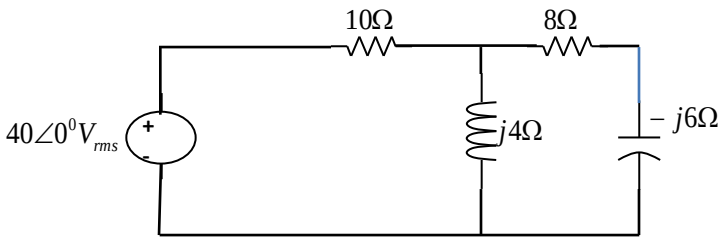
b) Let r =20.0 Ω, R=5.0 Ω, and L=250 mH. What is the frequency if $\frac{V_{out,0}}{V_{in,0}} = \frac{1}{2}$

c) Plot $\frac{V_{out,0}}{V_{in,0}}$ verses frequency by varying the frequency from 0 to α (infinity).

8. Two loads are connected in parallel. Load 1 has 2 kW, power factor, pf=0.75 leading and Load 2 has 4 kW, power factor, pf=0.95 lagging. Calculate the overall power factor.



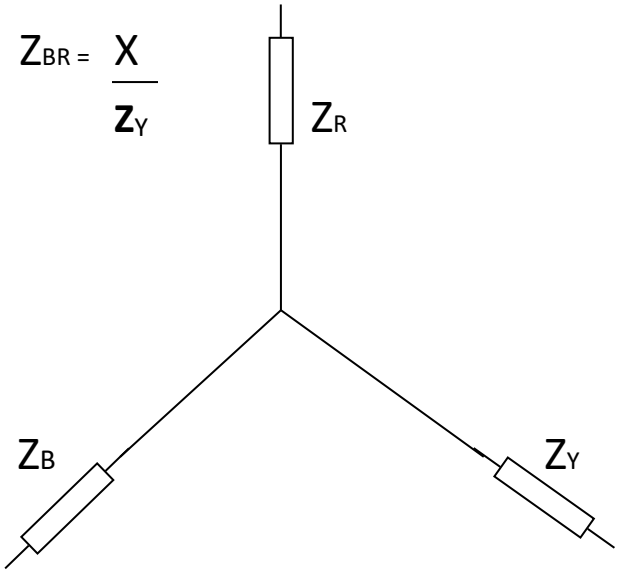
9. Calculate the power factor seen by the source and the average power supplied by the source.



10. In the Star connection circuit given below, redraw it into delta connection circuit by calculating all the required parameters
(Hint: Using Z_R, Z_Y, Z_Y calculate Z_{RY}, Z_{YB}, Z_{BR} and redraw it in star connection using the calculated parameters) Z_R= 150 Z_Y= 160 Z_B= 180

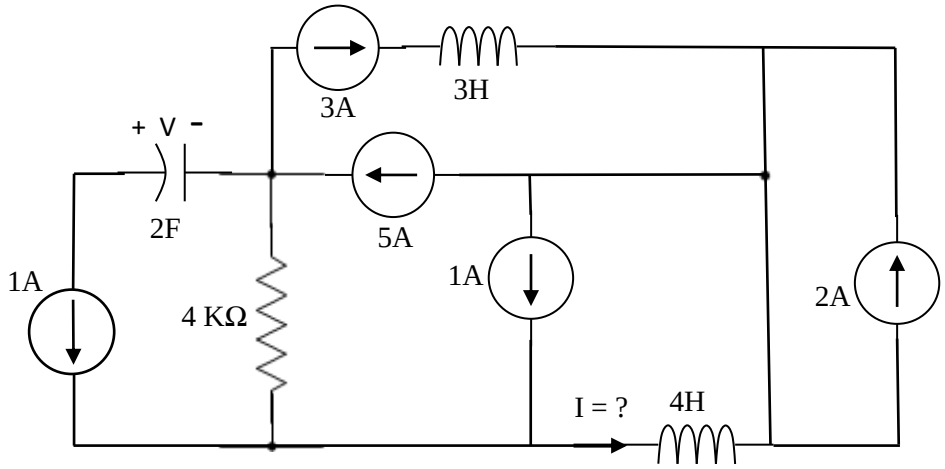
$$X = Z_R Z_Y + Z_Y Z_B + Z_B Z_R$$

$$Z_{RY} = \frac{X}{Z_B} \quad Z_{YB} = \frac{X}{Z_R} \quad Z_{BR} = \frac{X}{Z_Y}$$



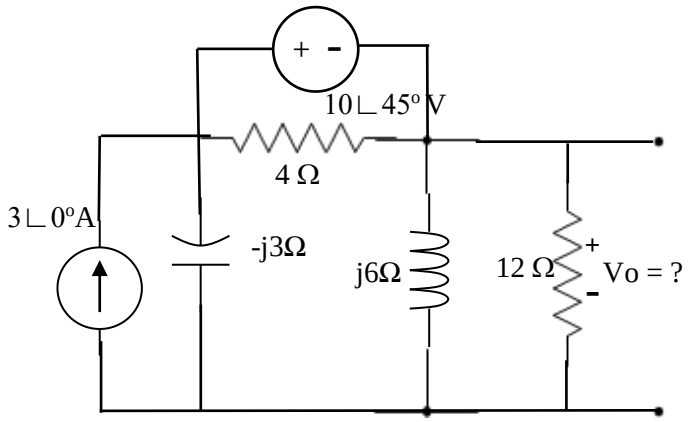
11. Suppose In the above question all the impedance are combination of a resistance and inductor Z_A = 3+4j Z_B = 5+12j Z_C= 6+8j find the delta connection circuit**.**

12. Consider the circuit below with five independent, direct current sources.
(a) What is the current, I, through the 4H inductor?
(b) What is the voltage, V, across the 2F capacitor?



13. The voltage across a load Z is given by $v(t) = 40\cos(\omega t - 30^o)$ V, and the corresponding current through it is measured to be $i(t) = 2\cos(\omega t + 30^o)$ A. Find the following: (a) Complex power and apparent power, (b) Power Factor, and the (c) Load impedance Z.

14. For the circuit shown on the left (below), determine the output voltage Vo. (*Hint*: Use nodal analysis).



(Figure for Q-14)