ELEC2070 2023 Assignment 3 Questions
(Solve at Home and Submit to iLearn by Due Date)

Total 70 marks. PLEASE USE NEAT HANDWRITING. Assignments with poor handwriting will not be marked.

You are able to check your answers using PSpice or Matlab but you are advised to do that after doing the full solution by yourself. Majority of the marks will be given to the hand written method and explanations.

1. (10 marks) Consider the circuit in Fig. 1 is in steady state. (a) Redraw the circuit in the frequency domain labelling appropriate phasor quantities and (b) determine expresssions for the three time domain mesh currents.

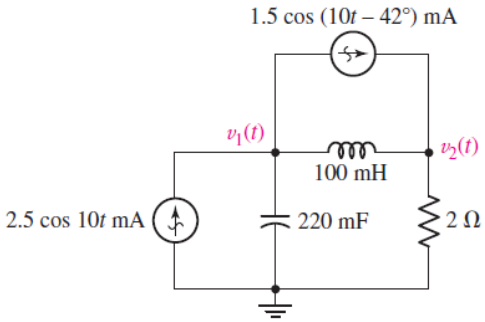

Figure 1

2. (20 marks) For the circuit shown in Fig. 2 below:
    a. Employ phasor analysis techniques to obtain expressions for the two mesh currents i_1 and i_2. Express these currents in polar form.
    b. Represent the mesh currents in the time domain.
    c. What is the frequency and period of the voltage $v_o(t)$ across the 2 Ω resistor that would be measured using an oscilloscope?
    d. What is the peak-to-peak value of this voltage on the oscilloscope? Make an approximate sketch of $v_o(t)$ and $v_s(t)$ (i.e., independent voltage source) together that would appear on the oscilloscope if they were measured on two channels. Use an appropriate time scale.
    e. Show the phase of $v_o(t)$ relative to $v_s(t)$ in seconds, as it would appear on the oscilloscope.

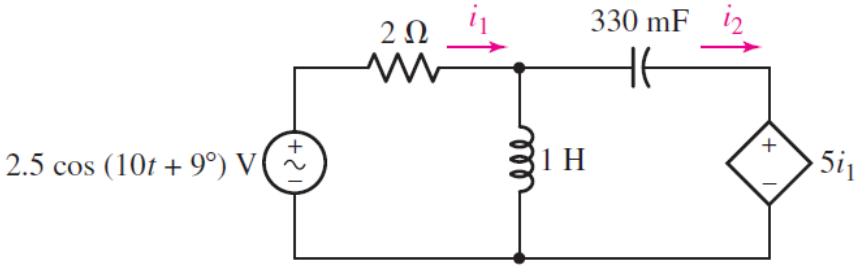

Figure 2

3. (10 marks) With regard to Fig. 3
    a. Calculate the Thevenin equivalent seen looking into the terminals *a* and *b*. Draw the circuit.
    b. Determine the Norton equivalent seen looking into the terminals marked *a* and *b*. Draw the circuit.
    c. Compute the current flowing from *a* to *b* if a 7-j2 Ω impedance is connected across them.

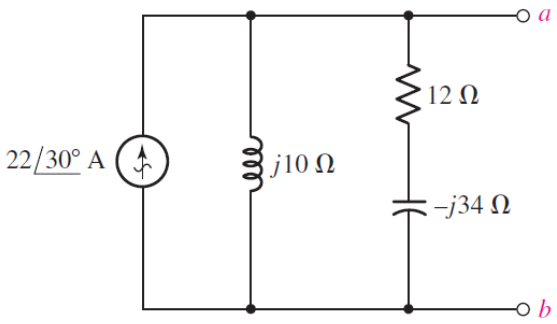

Figure 3

4. (10 marks) With regard to Fig. 4. Calculate the average power absorbed by each passive element in the circuit and verify that it equals the average power supplied by the source.

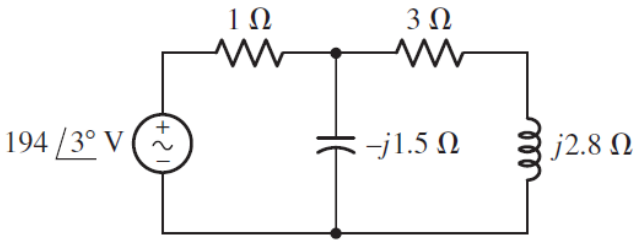

Figure 4

5. (10 marks) Calculate the power factor at which the source in Fig. 5 is operating if the load is
   a. Purely resistive
   b. 1000 + j900 Ω
   c. $500/\underline{-5^\circ}$ Ω.

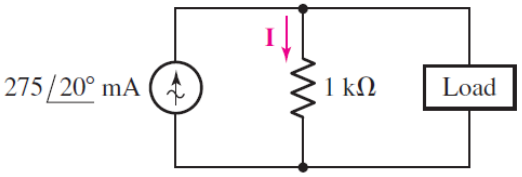

Figure 5

6. (10 marks) Calculate the complex power delivered to each passive element in the circuit shown in Fig. 6.

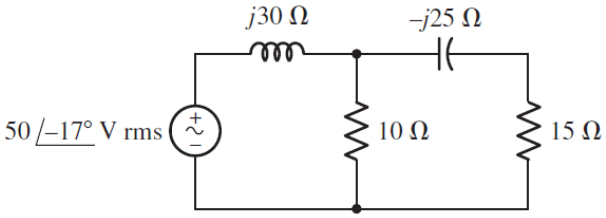

Figure 6