ENGR142 Engineering Physics
Assignment Eight

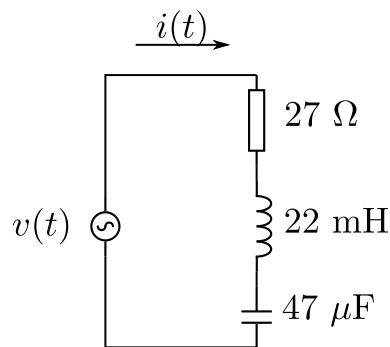Due 11:59pm, 12$^{\text{th}}$ of October 2018

Figure 1: A series RLC circuit.

1. (a) [5 marks] What is the overall impedance of the circuit in figure 1 if the frequency is 50 Hz?

   (b) [5 marks] If the voltage of the 50 Hz source can be described by

   $$v(t) = 50\cos(\omega t + 30°) \ ,$$

   what current will flow into the circuit?

   (c) [5 marks] What would the impedance of the circuit be if the frequency were changed to 400 Hz?

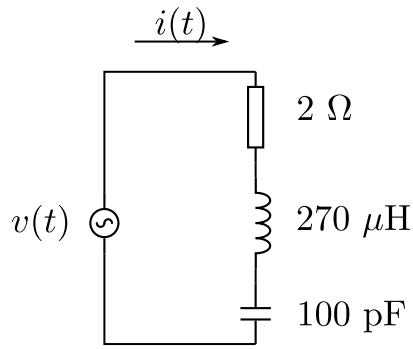   (d) [5 marks] What are the apparent and real power in the circuit?

Figure 2: A series RLC circuit.

2. (a) [4 marks] At what frequency do the capacitor and inductor in figure 2 have the same magnitude of their impedance (ie have the same reactance)?

   (b) [4 marks] What is the impedance of the total circuit at this frequency?

   (c) [4 marks] What is the impedance of the circuit at a frequency ten times lower than that you found in part a)?

   (d) [4 marks] What is the impedance of the circuit at a frequency ten times higher than that found in part a)?

   (e) [4 marks] Does the phase of the current lead, lag or equal that of the applied voltage at each of the three different frequencies?

3. A load consumes 88 kW with a power factor of 0.707 from a 230 V power line. The resistance of the power system from the generator to the load is 0.08 Ω.

   (a) [10 marks] How much power needs to be supplied by the electricity company?

   Hint: Don't forget the losses in the power lines.

   (b) [10 marks] If the power factor were improved to 0.9 (and everthing else remained constant), how much power would the company now need to supply?