ECE 398GG Electric Vehicles
Quiz 4 Spring 2023
April 11, 9:30 a.m.
TIME 20 minutes

1. We examine a linear *RLC* circuit that supplies electricity to an unknown device. The voltage across and the current into the device are given by the following two waveforms, respectively:

$$v(t) = 30\ cos(\omega t + 25^o)$$
$$i(t) = 2\ sin(\omega t - 10^o) \quad .$$

   a. **Determine** the average values of each of the waveforms.
   b. **Calculate** the apparent power and **state** your answer in both the rectangular and the polar forms.
   c. **Discuss** your understanding of the real and reactive power terms and **characterize** their nature.

2. For the statements below, **circle** each correct statement. To receive full marks for each answer, we not only discourage guesses, but you **must** provide a justification of why you chose to circle or not circle each statement.
   a. Power Conversion
      i. The DC to AC power conversion can be performed only with a nonlinear circuit.
      ii. The Bipolar Junction Transistor is the most common active switch used for power conversion.
      iii. A US level one charger uses approximately a 12-*A* current at 240 *V*.
      iv. In a DC-DC converter circuit with ideal switches and *RLC* components, the average voltage across an inductor is 0 *V* and the average current through a capacitor is 0 *A*.

b. *EV* Integration into Today's Grids

   i. At a specified time, the reserves margin at the load at that time is simply the difference between the total capacity of the resources that supplies the generated output and the load.

   ii. DRRs reduce their loads in response to incentives the grid operator provides to curtail electricity consumption at specific times.

   iii. Generally speaking, an *EV* can act as either a supply-side resource or a demand-side resource when its battery has a *s.o.c.* in the 50 – 70 % range.

   iv. We compare the emissions of two *EV*s with different efficiencies to make an identical trip concurrently. During this trip, the more efficient *EV* emits less GHG emissions than the less efficient *EV*, independent of the sources of electricity generated and used to charge the *EV*s.