

*Please post your answers electronically on bCourses. As a rule, we do not accept e-mailed homework assignments except in extraordinary circumstances with prior arrangement.*

**1. Introduce yourself**

Prepare a PowerPoint slide with a one-paragraph biographical summary of yourself and a photo. This should be similar in format to a “speaker bio” for a conference and can be written either in the first or third person. Tell us who you are and why you’re here in this class. You might include things about electric power systems that you hope to learn, and some fun or memorable personal facts to help us get to know you. Upload the ppt slide separately; it will be shared with everyone in the class. Use widescreen (16:9) format.

**2. Back to the future**

Imagine that Thomas Edison, George Westinghouse or Nikola Tesla could come visit us here in 2017. Some of the electric grid would look familiar to them, and they’d understand how it works – but what aspect do you imagine they would find most surprising, and why? Write one paragraph.

**3. Line Losses**

A 10-km long power distribution line serves a single-phase a.c. load of 0.60 MVA at a power factor of 0.90 lagging (0.54 MW). Consult the product specifications table at

<http://www.southwire.com/ProductCatalog/XTEInterfaceServlet?contentKey=prodcatsheet16>

*State answers to two significant figures.*

- If the distribution line is operated at 4.0 kV (at the load end), what is the line current?
- If the distribution line is operated at 12 kV instead, what is the line current?
- What is the resistance of the 10-km line if 1/0 (pronounced “one aught”) ACSR conductor (“Raven”) is used?
- What is the resistance of the 10-km line if 2/0 ACSR (“Quail”) is used instead?
- If the line is operated at 4.0 kV and 1/0 ACSR is used, what are the line losses in kW, and expressed as a percentage of the load served?
- What are the losses (kW and %) at 4.0 kV, if 2/0 ACSR is used instead?
- What are the losses (kW and %) for 1/0 ACSR if the circuit is operated at 12 kV instead?
- What general insight about the design of electric power systems do you think this exercise is intended to convey?

**4. Energy and Power Units**

Suppose a battery can deliver 100 amp-hours (Ah) at 12V.

- How much stored energy does it contain, in kilowatt-hours? In joules?
- How much power in kW would be required to fully charge the battery in twenty minutes?
- If the battery were charged at 120V at this rate, what is the current required? Ignore losses.
- What is the energy storage capacity in kWh of a Tesla Model S battery?

**5. Orders of magnitude**

Find out an approximate magnitude of electric power consumption in watts (or kW, MW, GW) for the following. Indicate whether your values represent peak or average quantities.

- |                      |                          |
|----------------------|--------------------------|
| (a) Laptop           | (b) Typical refrigerator |
| (c) PHEV car         | (d) Single-family home   |
| (e) Cory Hall        | (f) Berkeley Campus      |
| (g) City of Berkeley | (h) State of California  |
| (i) USA              | (j) World                |