

Concept & Think-Pair-Share Discussion Questions for EI by class meeting:

1. (Exp 1) Background and interests info

For the following, come to class having thought about the question and discuss it briefly with your partner. Then share your ideas with another group. Write down your ideas on the question and response sheet you are given in class. You only need to fill out one sheet for the two groups and only students in attendance should sign this sheet. Be sure to include the station numbers for both groups. (~5 min total)

2. (Exp 1) Hand-drawn circuit diagram ... one of the key tasks for every experiment and simulation you do involving a circuit is to draw the circuit diagram by hand before you begin building it or setting up the simulation. Give two reasons why this will be helpful for you and your team.
3. (Exp 1) What is a resistor ... what is an inductor ... what is a capacitor? Describe at least two of the three devices in some useful manner. Give a practical example of something that is not a typical circuit component, but electrically is one of these devices. (e.g. A person can be any of the three. In the winter, we are capacitors when we charge up walking across a carpeted floor and then give shocks to the people we touch.)
4. (Exp 2) What is meant by a low frequency or a high frequency when dealing with RC, RL or RLC circuits?
5. (Exp 2) In ideal circuit models, resistors are resistors, inductors are inductors and capacitors are capacitors. Is this also true for real devices? What examples can you think of that are at least two or maybe all three of these devices at the same time?
6. (Exp 3) What is the purpose of an ideal model for an inductor if the analytical formula we can derive from it does not provide a particularly accurate prediction of inductance? How can you make practical use of such models?
7. (Exp 3) We investigate two different ways of measuring inductance in Experiment 2. What other techniques can you think of? Can you think of an application of an inductance measurement as a sensor of some kind?
8. (Exp 3/Proj 1) When is a transformer a transformer? What is it when it is not a transformer? Is this a really strange question? Note that this is an electrical question and has nothing to do with the toys or animated characters.
9. (Proj 1) Pick a moving object of interest to you and suggest two or three different techniques for determining its velocity.
10. (Exp 4) Describe 2 or 3 techniques for troubleshooting a circuit. Apply your ideas to one of the more complex circuits from this course.
11. (Exp 4) How and why do practical op-amp differentiators and integrators differ from their ideal counterparts? How do we verify that they are indeed integrating or differentiating?
12. (Exp 5) What is a damped harmonic oscillator? What real-world examples of such harmonic oscillators can you identify?

13. (Exp 5) What is the Thevenin equivalent circuit and why is it useful? What is the Thevenin equivalent circuit for a standard 9V battery?
14. (Proj 2) Why is AC coupling generally a bad idea when making measurements with an oscilloscope, especially the Mobile Studio scope? *Hint: In what documents available on the course website would you expect to find this addressed?*
15. (Proj 2) Why is it better to build and test each functional part of a circuit rather than building it all at once? Why is it often the case that this advice is ignored?
16. (Proj 2/Exp 6) Why are transistors used as switches instead of mechanical switches? What advantages do mechanical switches have over transistors?
17. (Exp 6) A transistor switch operates in a sense like a voltage or current controlled valve. For the NPN transistors we use in class, which part of the transistor works like the control and which parts act like the pipe with a valve in it?
18. (Exp 6/Exp 7) What is hysteresis and why is it an important property for a comparator circuit?
19. (Exp 7) What is the difference between combinational and sequential logic? What is a multiplexer and is it a combinational or sequential device?
20. (Exp 7) What is a monostable multivibrator? Give an example of how it can be used in a practical system.
21. (Proj 3) How would you make a switch with a great deal of bounce to test your debouncer?
22. (Exp 8) Why does using the higher voltage ranges for Mobile Studio (1V per division and larger) make it necessary to apply additional analysis to find diode I-V curves?
23. (Exp 8) What is ripple? What is the ripple frequency for the light produced by typical incandescent, CFL, and LED bulbs? Where does the ripple come from in LED bulbs?
24. (Exp 8) What are the primary differences in the I-V curves for LEDs and Zener Diodes when compared to standard diodes like the 1N4148?
25. (Proj 4) What are Pulse Width Modulation and Pulse Position Modulation? How are they similar? How are they different?
26. (Proj 4) **Identify a problem you have had with your transmitter or receiver circuit and how you solved it. (or do the same for Exp 8)**