Lecture 1 Key Concepts

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KC: Key Concepts. **BK:** Background material.

1 Lecture 1, Module 1

1.1 Slide 5

Please make sure you are confident with the material listed here. We are assuming you mastered this material in 16A. If not, seek help and we're happy to help you catch up.

1.2 Slide 6

In particular, make sure you know how to find Thevenin and Norton equivalent circuits, especially with dependent sources.

1.3 Slide 7-8

BK: Definition of capacitance.

1.4 Slide 9

KC: Voltage is energy normalized to charge.

KC: For a capacitor, the charge $q = CV$ where V is the voltage applied to the capacitor and C is the capacitance.

1.5 Slide 10

KC: The energy stored in a capacitor is given by

$$E_C = \frac{1}{2}CV^2$$

1.6 Slide 11

KC: The water tank analog. The tank is filled from the bottom to correctly account for the required energy to fill the tank.

1.7 Slide 14

KC: Capacitance units are Farads but don't convey the true meaning of capacitance. Capacitance has a dimension of length because it conveys how much charge we can store in the structure. The bigger the structure, the more charge we can store.

1.8 Slide 15

KC: Our model of a conductor is a material that has many "free" carriers (such as electrons) which easily move around and respond to external fields.

1.9 Slide 16

KC: An insulator is a material that cannot easily conduct electricity. All the electrons are "bound" in bonds and cannot participate in current.

1.10 Slide 17

KC: A semi-conductor can be behave as an insulator or conductor, depending on other factors. One important factor is temperature as the vibrations in the crystal structure can knock loose some electrons, which participate in conduction.

BK: In general, the best way to make a semi-conductor a conductor is to either introduce "dopants" into the crystal, which results in free electrons (or "holes") or by introducing a very strong field, something we'll learn about later.

1.11 Slide 24

KC: How we build parallel plate capacitors and how the dimensions of the structure determine the capacitance.