

Blank Lesson Template

Yellow highlight = required component

Subject Area(s) Physics
Associated Unit Electric Circuits
Lesson Title Capacitor Circuits

Header

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Grade Level 12(10-12)

Lesson # 1 of 1

Lesson Dependency

Time Required 45 minutes

Summary

In this lesson, students will learn about the working principles behind capacitors. They will learn about series and parallel connection of capacitors and the formulas for calculating the equivalent capacitance. Finally, they will learn about RC circuits and how they work.

Engineering Connection

Capacitors represent one of the main building blocks of electronic circuits. Electrical engineers use capacitors to design circuits for various applications. For instance, the flash on cameras uses capacitor; the capacitor is charged by a battery and then releases its full charge almost instantly into the flash tube. In digital imaging, camera sensors or pixels are represented by capacitors; each camera sensor has a photo-electric converter and a capacitor associated with it. The photo-electric converter converts the incoming photons into electric charges that are then stored in the capacitors for further processing.

Engineering Category =

1. Relating science and/or math concept(s) to engineering

Keywords

Capacitors, parallel connection, series connection.

Educational Standards

National and State

Choose standards from <http://asn.jesandco.org/resources/ASNJurisdiction> or [browse educational standards](#) on TeachEngineering.

State/national science/math/technology (provide source, year, number[s] and text):

ITEEA Educational Standard(s)

[ITEEA](#) (provide standard number, grade band, benchmark letter and text):

Pre-Requisite Knowledge

Learning Objectives

After this lesson, students should be able to:

- Parallel plate capacitors
- Series connection of capacitors
- Parallel connection of capacitors

Introduction / Motivation

You are an electrical engineer who works for a famous car-making company. The company is in the process of upgrading the audio systems in their cars. In typical car audio systems, capacitors are used to as a temporarily electric energy storage device while the batteries are being changed. You and your team are asked to design a new circuit that has a better storage capability of the audio system. How do you plan to achieve that i.e. would you connect the capacitors in parallel or in series? How many capacitors will you need to use in your circuit?

Lesson Background & Concepts for Teachers

Capacitance:

Capacitors store charge and energy. One of the most common designs of capacitors is the parallel plate capacitor. Parallel plate capacitors consist of two oppositely charged plates separated by a distance. The formula used for capacitance is:

$$C = \frac{Q}{V}$$

Where C represents the capacitance in *Farads*, Q represents the charge accumulated on the parallel plate of the capacitor in *Coulomb* and V represents the voltage difference between the plates in *Volts*.

Capacitors in Series:

When connected in series, capacitors will have the same charge Q . However, the potential difference adds up. Therefore, the effective capacitance can be found as follows:

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \dots + \frac{1}{C_n}$$

The equivalent capacitance also called “effective” capacitance is smaller than that of any of the individual capacitors.

Capacitors in Parallel:

In a parallel connection setting, the capacitors will share the same potential difference. On the other hand, the charge of the effective capacitance will be the sum of the individual charges. The effective capacitance can be determined using the following equation:

$$C = C_1 + C_2 + \dots + C_n$$

In this case, the effective capacitance adds up.

Image Insert Image # or Figure # here [use Figure # if referenced in text]

Figure 1
Image file: ___?
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Caption: Figure 1. ___?

Vocabulary / Definitions

Word	Definition

Associated Activities

Build Your Own Capacitor

Lesson Closure

Assessment

Capacitor Worksheet.doc

Lesson Extension Activities

Additional Multimedia Support

References

Attachments

Other

Redirect URL

Contributors

Roberto Dimaliwat, Amin Merouane

Supporting Program

National Science Foundation GK-12 Program, University of Houston

Acknowledgements