BEE1133 Circuit Analysis

Chapter 4
Capacitors and Inductors

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Chapter Description

Aims

This chapter is aimed to:

1. Introduce various type of capacitor and inductor in the circuit.

Expected Outcomes

Student should be able to

1. Identify the type of capacitor and inductor
2. Calculate the equivalent capacitors and inductors
3. Draw the equivalent circuit for capacitor and inductors

References

1. C. Alexander and M. Sadiku, “Fundamentals of Electric Circuits”, 4th ed., McGraw-Hill, 2008.
2. J. Nilsson and S. Riedel, “Electric Circuits”, 8th ed., Prentice Hall, 2008.

BASIC CONCEPT

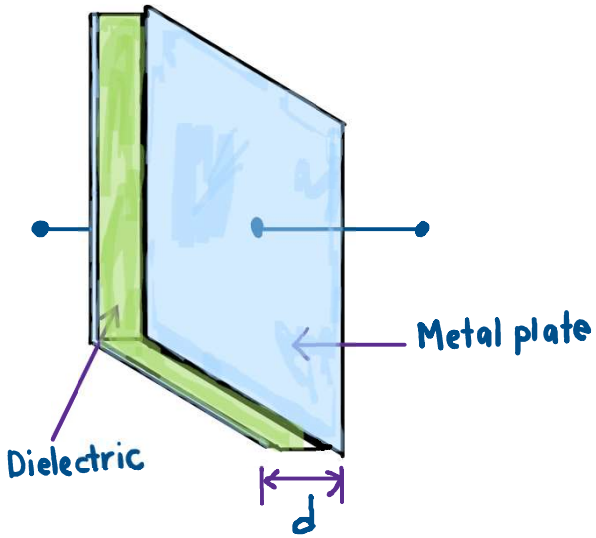
7.1 Series and Parallel Capacitors

7.2 Series and Parallel Inductors

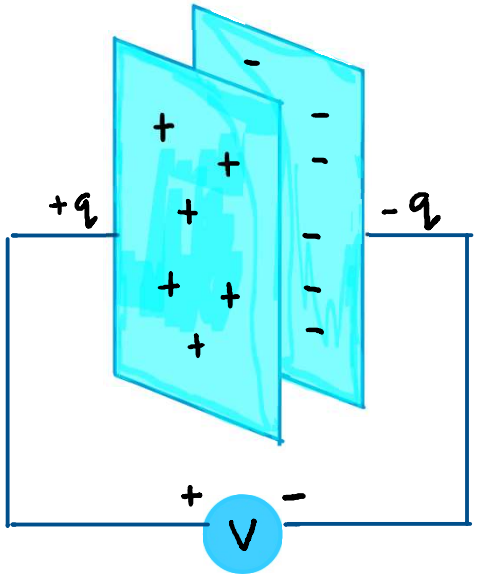
Basics of a Capacitor

- Ability to store energy in its electric field.
- A large capacitance means that more charge can be stored.
- Capacitance is measured in farads, symbol F

Capacitor Construction



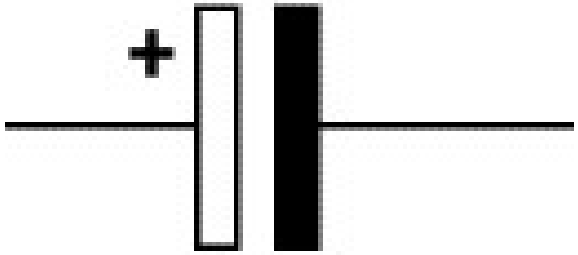
A capacitor consist of two conduction plates separated by an insulator



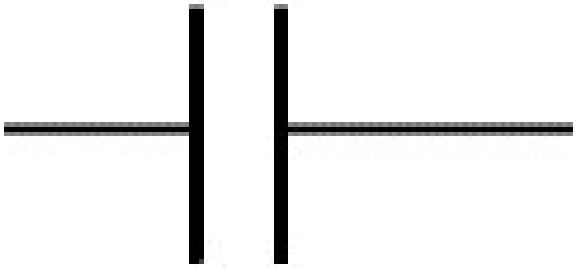
Basics of a Capacitor

- When the supply is removed from the capacitor, the capacitor retains the stored charge.
- The amount of charge that a capacitor can store per volt across the plates is its capacitance (C).

Symbol



Polarised

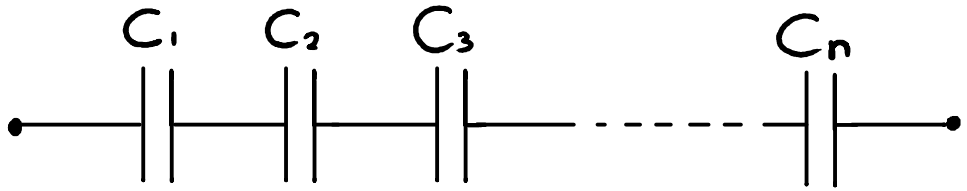


Unpolarised

Series Capacitor

- When capacitors are connected in series, the total capacitance can be calculated by using formula as state below:

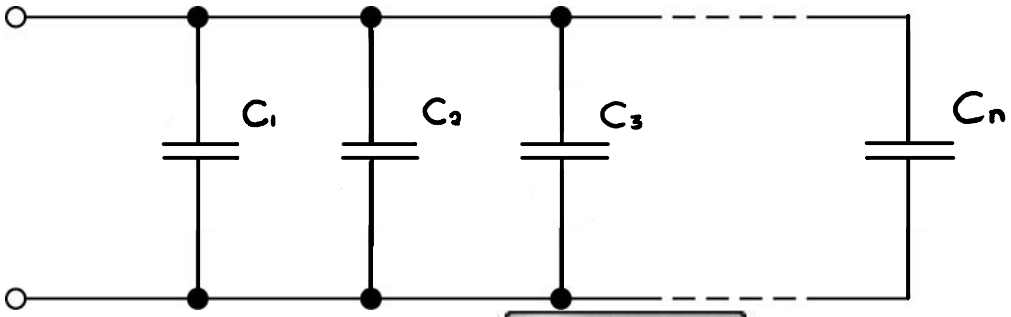
$$1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3 + \ldots + 1/C_n$$



Parallel Capacitor

- When capacitors are connected in parallel, the total parallel capacitance is the sum of all capacitors in parallel.

$$C_{eq} = C_1 + C_2 + C_3 + \ldots + C_n$$



Resistor vs Capacitor

Resistor

- Total resistance in series;
- $R_{eq} = R_1 + R_2 + R_3 + \ldots + R_n$

- Total resistance in parallel;
- $1/R_{eq} = 1/R_1 + 1/R_2 + 1/R_3 + \ldots + 1/R_n$

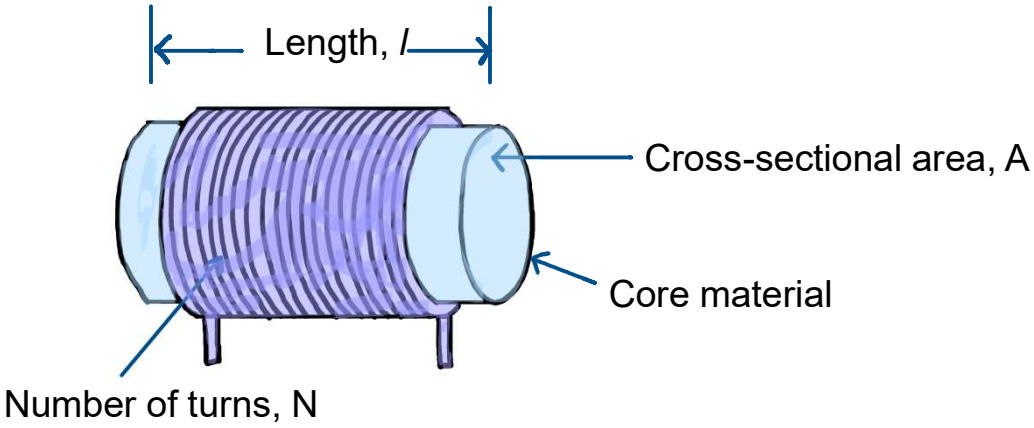
Capacitor

- Total capacitance in series;
- $1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3 + \ldots + 1/C_n$

- Total capacitance in parallel;
- $C_{eq} = C_1 + C_2 + C_3 + \ldots + C_n$

Basic of Inductors

- Ability to store energy in its magnetic field.
- Inductance is measured in Henry, symbol H

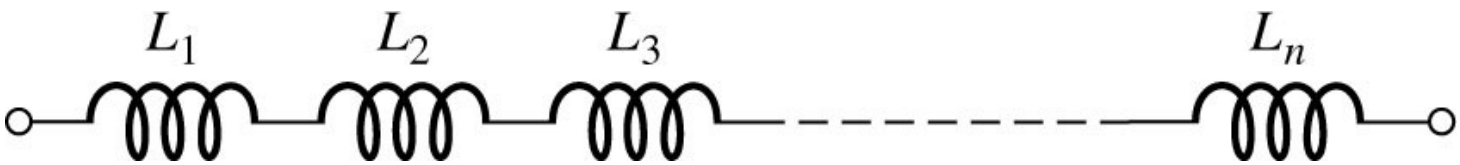


A inductor consist of a coil of conducting wire.

Series Inductor

- When inductors are connected in series, the total inductance is;

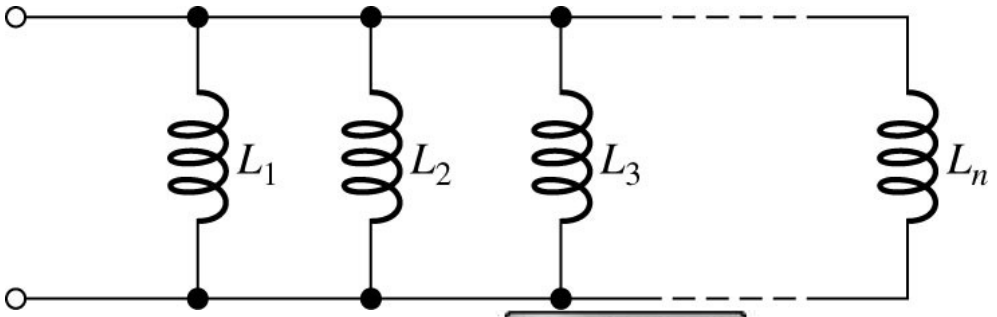
$$L_{eq} = L_1 + L_2 + L_3 + \ldots + L_n$$



Parallel Inductors

- When inductors are connected in parallel, the total inductance is;

$$1/L_{eq} = 1/L_1 + 1/L_2 + 1/L_3 + \ldots + 1/L_n$$



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