

# Guided Practice

By Ha Le

This is the guide for the flip lesson “Introduction to 3-phase AC circuits and analysis”.

**Course:** ECE 3810 Introduction to Power Engineering

## Overview / Introduction:

- To understand basic concepts of 3-phase AC power source and 3-phase AC load, methods of connection, and methods to calculate voltage, current and power for basic 3-phase circuit.
- You will participate in in-class discussions and take a quiz at the end of the class. The discussions will help you understand the lesson content and give you a chance to share your ideas with your classmates. The end-of-class quiz will help you measure your understanding of the learned materials.

## Learning objectives:

### Basic objectives:

1. To understand a definition of a 3-phase power source and a 3-phase load.
2. To give three examples on where a 3-phase power source is used.

### Advanced objectives:

3. To learn two methods to create a 3-phase power source and a 3-phase load: Y-connection and delta-connection.
4. To learn two methods to connect a 3-phase power source to a 3-phase load to make a 3-phase circuit: Y-Y and Y- $\Delta$ .
5. To learn basic concepts of 3-phase power.

## Pre-class assignment and resources:

1. Read the PowerPoint handouts posted on Black Board.
2. Answer the pre-class questions posted for the lesson.
3. For help with answering the pre-class questions, you can read the textbook, chapter 1, or relevant content in References 2 and 3 (defined in the course syllabus), or search for resources online.
4. All course materials are posted on Blackboard at <https://blackboard.cpp.edu/webapps/login/>
5. Time estimate to complete this preparation assignment: 1 – 2 hours

## Post-class assignment:

- Complete the homework assignment after the class and submit it by the due date.

## For help with any difficulty you may have:

- Please come to my office hours or email me. My office hours and other information about the course are provided in the syllabus.

Have fun with this Flip lesson.



# Lesson Plan

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**Lesson to flip:** Introduction to 3-phase AC circuits and analysis

**Course to flip:** ECE 3810 Introduction to Power Engineering

**Timeframe:**

Pre-class: 1-2 hours

Post-class: 2-3 hours

**Materials needed:**

Textbooks, PowerPoint lecture slides, and online resources.

**Learning Objectives (LO):**

*Basic objectives:*

1. To understand a definition of a 3-phase power source and a 3-phase load.
2. To give three examples on where a 3-phase power source is used.

*Advanced objectives:*

3. To learn two methods to create a 3-phase power source and a 3-phase load: Y-connection and delta-connection.
4. To learn two methods to connect a 3-phase power source to a 3-phase load to make a 3-phase circuit: Y-Y and Y- $\Delta$ .
5. To learn basic concepts of 3-phase power.

**Background / Situation:**

- ECE 3810 is the first course that introduces the basic concepts in the power engineering area.
- Students find it very difficult to understand the new concepts of AC electric machines and 3-phase power system.
- Students may have weak background in AC circuit analysis and calculation with complex numbers, which are required for the course.

**Introduction to Lesson:**

- *Lesson content:* To understand basic concepts of 3-phase AC power source and 3-phase AC load, methods of connection, and methods to calculate voltage, current and power for basic 3-phase circuit.
- *Overview of flip lesson:* The lesson is a combination of student activities and professor short explanation of key content. The student activities include brainstorming of ideas, sharing of ideas and group discussion.
- *Resources:* Textbooks, PowerPoint lecture slides, and relevant online resources. Students are free to perform internet search for the information they need.

**Procedure:**

**Pre-class individual space activities and resources:**

The steps for preparing for the flip lesson are described below. The instructor will provide PowerPoint handouts. Students can also use the textbooks and any relevant online resources.

Steps	Purpose	Estimated time	Learning objective
Read instructor handouts	To understand basic concepts	40-50 min	LO1, LO2, LO3
Read textbooks and search for information online	To find examples of 3-phase source and 3-phase load; To reinforce understanding of basic concepts.	30-40 min	LO2 and LO3

**In-class group space activities and resources:** The total class time is 75 min

Steps	Purpose	Estimated time	Learning objective
Group discussion: Students work in small groups of 3-5 people	To discuss the materials on 3-phase source and 3-phase load. To answer instructor questions on the materials	15 min	LO1, LO2, and LO3
Short lecture by instructor	To explain the content related to LO4 and LO5	20 min	LO4 and LO5
Group work of 3-5 people	To discuss solutions for 2 small practice problems on the content of LO4 and LO5	20 min	LO4 and LO5
Short quiz	To measure student understanding of lesson materials	10 min	LO1 through LO5
Reflection by entire class	Instructor summarizes the lesson key content; Students reflect on the materials and ask questions.	10 min	LO1 through LO5

**Post-class individual space activities and resources:**

Steps	Purpose	Estimated time	Learning objective
To do homework assignment	To practice how to apply the lesson theories to solve related problems	2-3 hours	To reinforce understanding

**Evaluation:**

**Analysis:**

- *Advantages:* Based on in-class discussion and homework assignment, I can measure the student understanding and identify difficulties that they may have. I can also identify the content that is most challenging for students.
- *Challenges:* Some students may rely on their classmates for in-class group work. Some students may also rely on their classmates for doing the homework assignment. Some students may dominate the in-class discussion and some may be too timid to participate in the discussion.

**Connections to future lessons:**

- This lesson helps students jump start their study in the field of power engineering.
- It connects seamlessly with the next lecture, which teaches students how to calculate voltage, current and power for 3-phase Y-Y and Y- $\Delta$  circuits.