



Electrical Engineering Department

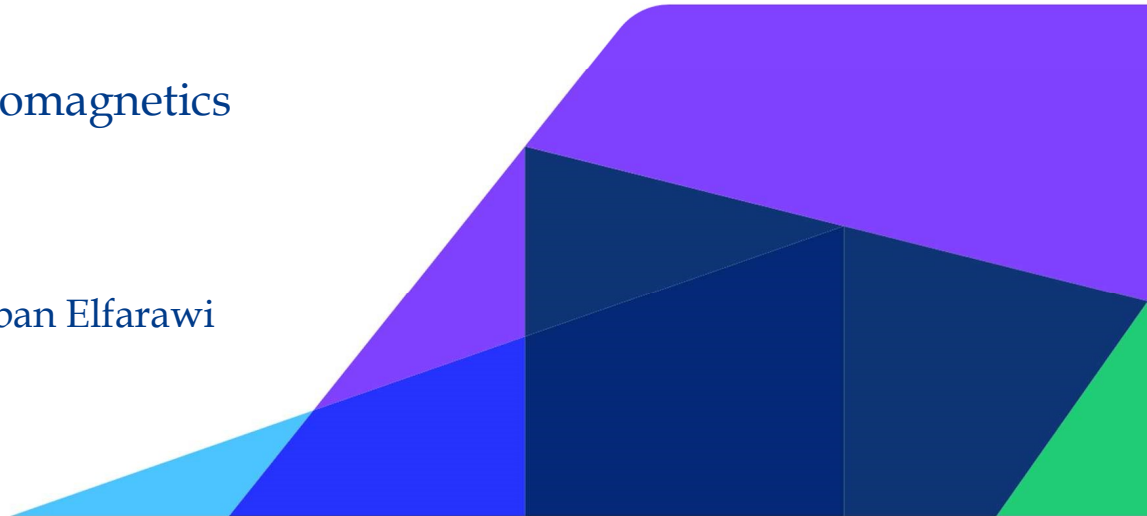
EEN 315: Electric Machines

Introduction

Chapter 1. Electromagnetics

Semester: 481 (2026)

Instructor: Mr. Shaaban Elfarawi



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Course Objectives



This course covers a wide range of machines such as,

1. Single-phase and three-phase transformer.
2. Autotransformer, instrument transformer.
3. DC machines.
4. AC single phase & three-phase induction machines and synchronous machines.
topics to be discussed including,
 1. Principles of operation
 2. Construction and applications of different electrical machines.
 3. Torque-speed characteristic, power flow, efficiency and speed control techniques for DC & AC motors.
 4. Solving analytical and design problems.

Text Books

1. *Electric Machinery Fundamentals, 5th edition, Stephen J. Chapman*
2. *Electrical Machines, S. K. Sahdev*
3. *Hand outs*

Course Learning Outcomes (CLOs)



1. Identify the techniques for torque production as well as AC voltage generation and DC conversion.
2. Describe the construction and operation principles of DC machines, AC machines and transformers.
3. Analyze the operation of DC motors, AC induction motor and Synchronous generator.
4. Calculate the electrical quantities for different types of electrical machines.
5. Design a model of an electric machine using appropriate software tools.
6. Act effectively as a team player in solving an engineering problem or research work.

Course Assessments

• Quiz 1	15%
• Quiz 2	15%
• Assignments	10%
• Midterm Exam	25%
• Final Exam	35%

Electric Machines



Electrical Machines

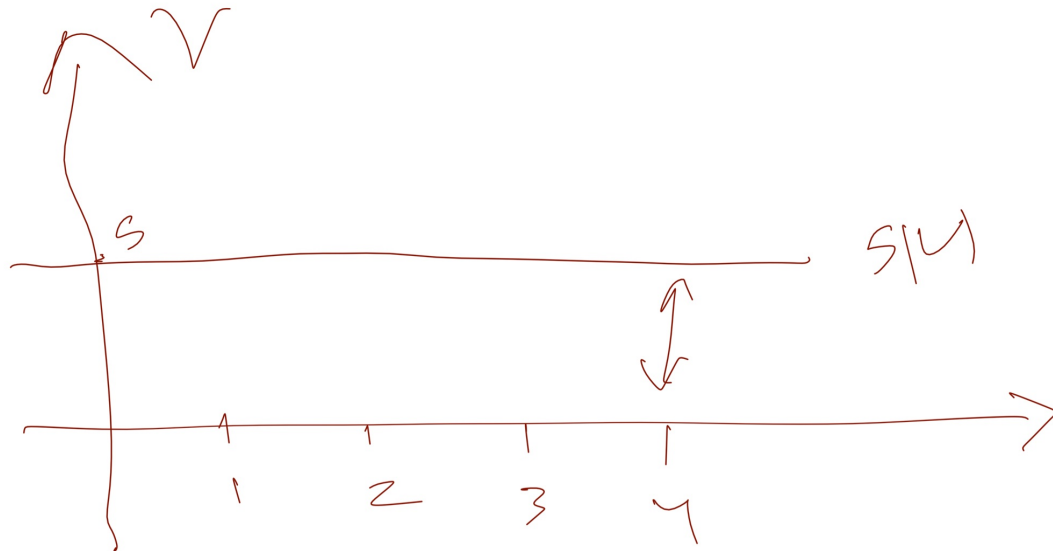
An electrical machine is *a device that can convert either mechanical energy to electrical energy (generator) or electrical energy to mechanical energy (motor), it also converts ac electrical energy at one voltage level to ac electrical energy at another voltage level (transformer).*

All machines depending on the *action of a magnetic field* to accomplish the change.

These three types of electric devices are universal in modern daily life;

- Generators are used to produce power required by so many applications.
- Electric motors used in home to run refrigerators, freezers, vacuum cleaners, blenders, air conditioners, fans, and many similar appliances.
- Transformers aid this process by reducing the energy loss between the point of electric power generation and the point of its use.

Handwritten notes: *motors*, *generators*, *Transformers*

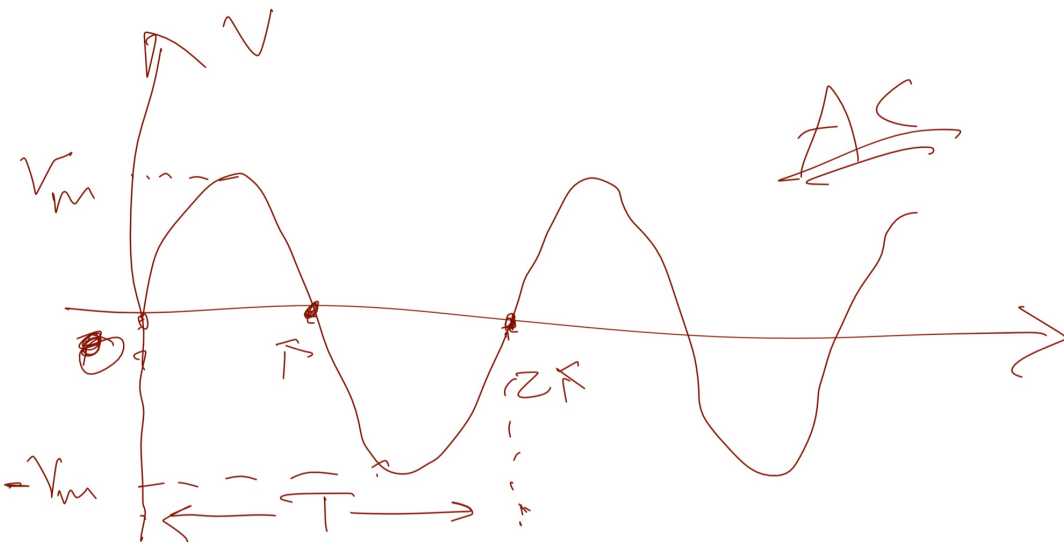


DC

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$$f = \frac{1}{T}$$

Frequency



AC

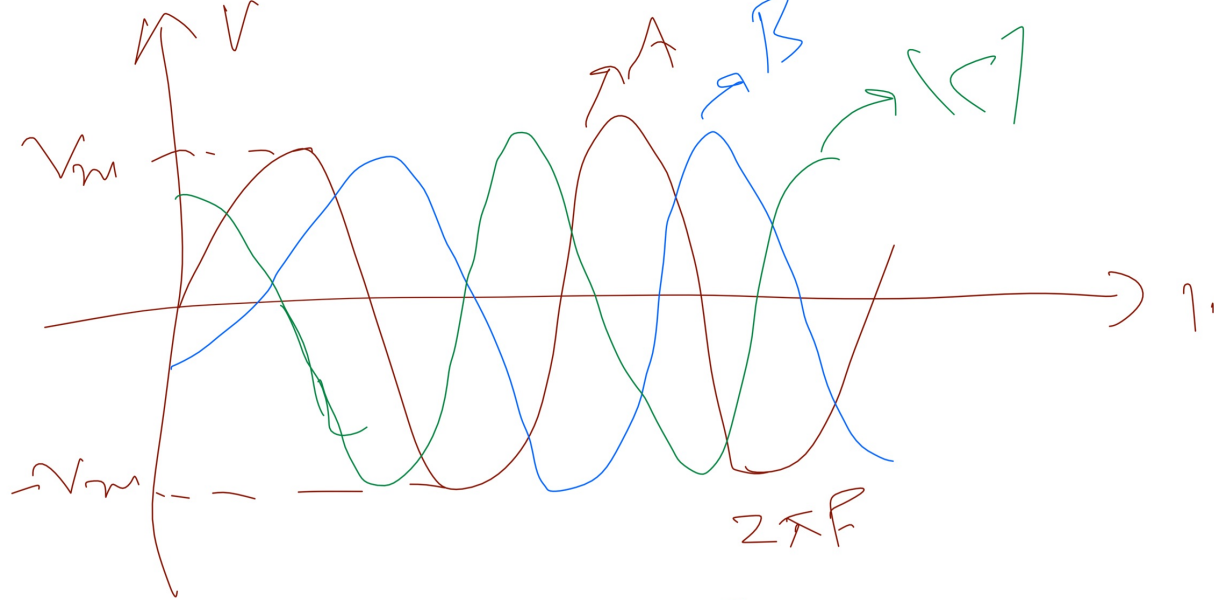


Electrical Machines

Electric motors and generators are so common because electric power is a clean and efficient energy source that is easy to transmit over long distances, and easy to control.

The electric machines are classified based on the electrical system that operate them,

1. DC electrical system.
2. AC electrical system.
 1. Three-phase system.
 2. Single-phase system.

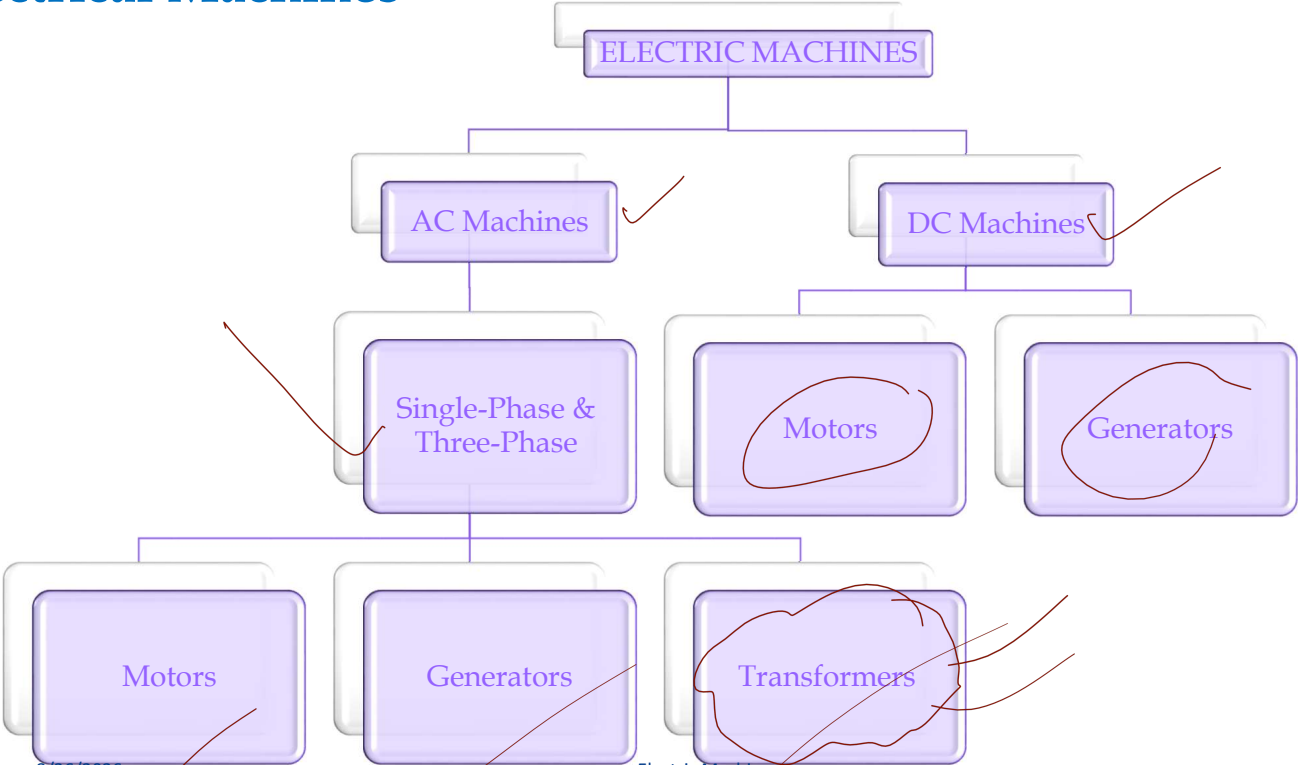


$$V_A = V_m \sin(\omega t)$$

$$V_B = V_m \sin(\omega t + \underline{\underline{-120^\circ}})$$

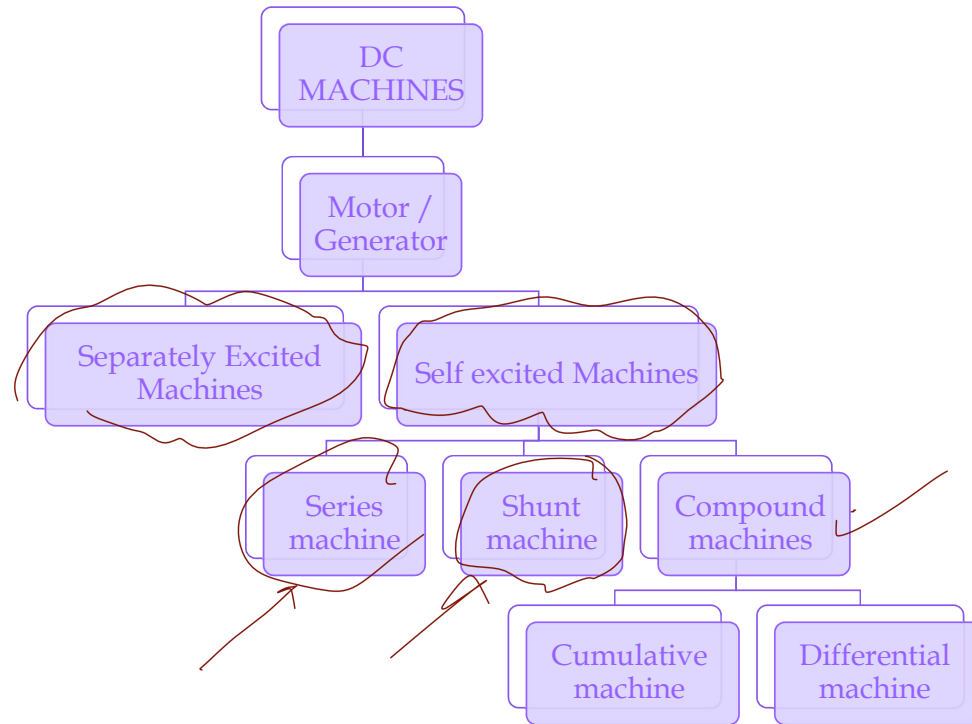
$$V_C = V_m \sin(\omega t + \underline{\underline{120^\circ}})$$

Electrical Machines



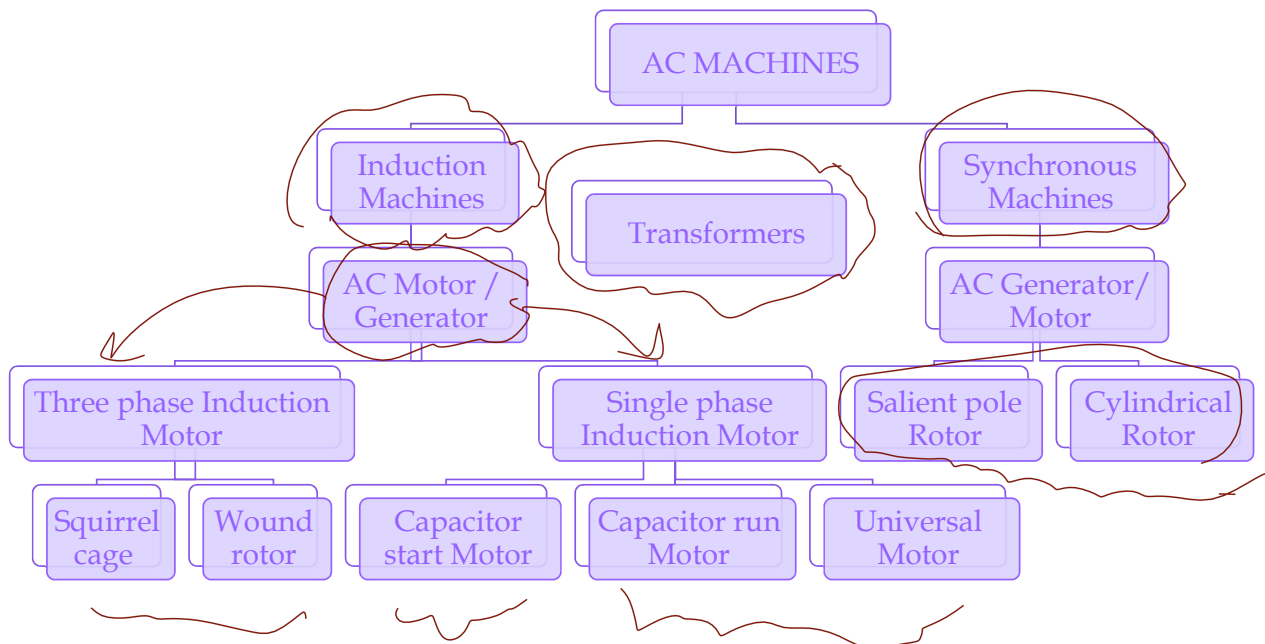


Electrical Machines





Electrical Machines



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