

## ELEG 3304 – ENERGY SYSTEMS

### Credits and Contact Hours

Four credit hours, 45 hours of instructor contact

### Instructor's Name

Robert Saunders

### Textbook

Electric Machinery Fundamentals 5<sup>th</sup> edition, Stephen Chapman, McGraw Hill, 2004

Lab material provided

### Specific Course Information

- a. Catalog Description:  
This course covers steady state analysis of DC machines, transformers, induction machines and synchronous machines with an introduction to speed control of electric machines using power electronics.
- b. Co-requisite: Lab component  
Prerequisite: ELEG 2114
- c. Required

### Specific Goals for the Course

1. Specific outcomes of instructions:  
After completing this course, electrical engineering students should:
  - Be able to determine the electrical terminal characteristics, efficiency and voltage regulation of electric machines and transformers.
  - Understand speed regulation and torque characteristics of electric machines.
  - Understand difference between motor and generator operation.
  - Understand different motor types and controls.
  - Understand the basic operating principles of power electronics converters.
2. Indicate the student outcomes listed in Criterion 3 addressed by the course:

OUTCOME	HOW IT WAS ADDRESSED
(a)	Students make use of complex arithmetic, Kirchhoff's current and voltage laws and rules, and other math and science concepts.
(b)	Students collect data during lab experiments to determine characteristics of motors and generators.
(e)	Students solve electric circuits throughout the course problems by developing a step-by-step approach based on the information given in the problem statements; such an approach is enabled by their background knowledge.
(f)	Students are given an assignment pertaining to ethics and answer a quiz.
(g)	Students are assigned lab reports
(j)	Students are given an assignment to view or read material pertaining to current research and answer a quiz pertaining to the material.

**Lecture Topics:**

- Sinusoidal Steady-State Circuits (3 classes)
- Magnetic Circuits and Energy Conversion (3 class)
- Transformers (Single phase and three phase) (4 classes)
- Synchronous Generators ( 5 classes)
- Induction Motors (Single phase and three phase) (7 classes)
- DC Machines (2 classes)
- Various other motors (5 classes)
- Power electronics (4 classes)

**Lab Experiments & Objectives:**

- Introduction to safety in the lab and when working with AC systems. The objective is to make sure the students understands the safety aspects of the lab and issues working with AC power systems.
- Introduction to single phase and three phase power measurements: The students performs experiments designed to help the student understand real and reactive power measurements in single phase and three phase systems.
- Introduction to synchronous generators: The students perform experiments designed to help the student understand and develop models for synchronous generators.
- Introduction to three phase induction motors: The students perform experiments designed to help the student understand induction motors operation and models.
- Introduction to power electronics and high frequency transformers: The students perform experiments designed to help the student get a basis for high frequency transformers and power electronics.

**Computer Usage**

Using MATALB programming as an assignment to complete various homework assignments.

**Oral/Written Communications**

Students write a 1-page report on “Half-Life of Knowledge” in engineering and lab reports.