

**ELEC 154 Course Outline as of Fall 2020****CATALOG INFORMATION**

Dept and Nbr: ELEC 154      Title: ROTATING MACHINERY  
 Full Title: Rotating Machinery  
 Last Reviewed: 4/22/2019

| Units   |      | Course Hours per Week |      | Nbr of Weeks | Course Hours Total |       |
|---------|------|-----------------------|------|--------------|--------------------|-------|
| Maximum | 3.00 | Lecture Scheduled     | 2.50 | 17.5         | Lecture Scheduled  | 43.75 |
| Minimum | 3.00 | Lab Scheduled         | 1.50 | 8            | Lab Scheduled      | 26.25 |
|         |      | Contact DHR           | 0    |              | Contact DHR        | 0     |
|         |      | Contact Total         | 4.00 |              | Contact Total      | 70.00 |
|         |      | Non-contact DHR       | 0    |              | Non-contact DHR    | 0     |

Total Out of Class Hours: 87.50

Total Student Learning Hours: 157.50

Title 5 Category: AA Degree Applicable

Grading: Grade or P/NP

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly:

**Catalog Description:**

Fundamentals of three-phase and single-phase rotating machinery. Includes the operation and maintenance of Direct Current (DC) and Alternating Current (AC) motors, generators, and controllers.

**Prerequisites/Corequisites:****Recommended Preparation:****Limits on Enrollment:****Schedule of Classes Information:**

Description: Fundamentals of three-phase and single-phase rotating machinery. Includes the operation and maintenance of Direct Current (DC) and Alternating Current (AC) motors, generators, and controllers. (Grade or P/NP)

Prerequisites/Corequisites:

Recommended:

Limits on Enrollment:

Transfer Credit:

Repeatability: Two Repeats if Grade was D, F, NC, or NP

## **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

|                   |                      |            |           |
|-------------------|----------------------|------------|-----------|
| <b>AS Degree:</b> | <b>Area</b>          | Effective: | Inactive: |
| <b>CSU GE:</b>    | <b>Transfer Area</b> | Effective: | Inactive: |

|               |                      |            |           |
|---------------|----------------------|------------|-----------|
| <b>IGETC:</b> | <b>Transfer Area</b> | Effective: | Inactive: |
|---------------|----------------------|------------|-----------|

|                      |            |           |
|----------------------|------------|-----------|
| <b>CSU Transfer:</b> | Effective: | Inactive: |
|----------------------|------------|-----------|

|                     |            |           |
|---------------------|------------|-----------|
| <b>UC Transfer:</b> | Effective: | Inactive: |
|---------------------|------------|-----------|

**CID:**

**Certificate/Major Applicable:**

Certificate Applicable Course

## **COURSE CONTENT**

### **Student Learning Outcomes:**

At the conclusion of this course, the student should be able to:

1. Operate and maintain alternating current (AC) and direct current (DC) motors and controllers.
2. Operate and maintain AC and DC generators.
3. Install and maintain motor controllers.
4. Implement safety and tag-out procedures.

### **Objectives:**

At the conclusion of this course, the student should be able to:

1. Analyze the operating principles of AC and DC motors.
2. Apply proper safety procedures for working around motors and rotating machinery.
3. Apply proper tag-out procedures when working on electrical equipment.
4. Diagnose and repair AC and DC motor starters and controllers.
5. Diagnose and repair AC and DC generator controllers.
6. Evaluate and repair defective rectifiers in alternators.
7. Interpret name plate information found on motors and generators.
8. Test for the correct installation of rotating machinery, including proper alignment and belt tensions.
9. Design predictive and ordinary maintenance routines using common rotating machinery test equipment.

### **Topics and Scope:**

- I. Safety in the Workplace
- II. Magnetism & Electromagnetism
- III. Single- and Three-Phase AC Generators (Alternators)
  - A. Slip rings and brushes
  - B. Rotating armature with stationary fields
  - C. Rotating fields with stationary armature
  - D. Self-excitation

- E. External excitation
- F. Rectifiers
- IV. Basic Motor Operating Principles
  - A. Attraction-repulsion
  - B. Effect of generating current to line current
  - C. Starting current
  - D. Running current
  - E. Effect of load on the motor
- V. DC Motors
  - A. Series motors
  - B. Shunt motors
  - C. Compound motors
- VI. Series-Wound AC Motors
  - A. Characteristics
  - B. Comparison to DC motors
- VII. AC Induction Motors
  - A. Rotating magnetic fields
  - B. Single-phase rotating fields
  - C. Three-phase rotating fields
  - D. Eddy currents
  - E. Stators
  - F. Rotors
  - G. Squirrel cage rotors
- VIII. Stepper Motors
- IX. Servo Motors
- X. Motor Controllers - AC and DC Tachometers
- XI. Predictive Maintenance Procedures
  - A. Vibration analysis
  - B. EMI evaluations and analysis of rotating machinery
  - C. Megohmmeters and their uses
  - D. Belt slippage and adjustments
  - E. Alignment and installation procedures of rotating machinery
- XII. Rotating Machinery Name Plate Information and Usage in Maintenance and Installation
- XIII. Motor Safety and 440 V three Phase Circuits
- XIV. Very large motor precautions (10 Hp and greater)
- XV. Laboratory Topics
  - A. Lab safety procedures
  - B. Using test equipment for analysis
  - C. Magnetic and electromagnetic properties
  - D. DC motors
  - E. Generators
  - F. AC motors
  - G. Motor controllers
  - H. Maintenance procedures

### **Assignment:**

#### Lecture-Related Assignments:

1. Weekly reading assignments (10-20 pages)
2. Homework assignments (10-15) including writing a maintenance or safety procedure
3. Quizzes (2-5)
4. Midterm exam

## 5. Final exam

### Lab-Related Assignments:

1. Lab assignments (5-10)
2. Lab practicum

### Methods of Evaluation/Basis of Grade:

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because skill demonstrations are more appropriate for this course.

Writing  
0 - 0%

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems

Problem solving  
20 - 40%

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Lab assignments, lab practicum

Skill Demonstrations  
25 - 40%

**Exams:** All forms of formal testing, other than skill performance exams.

Quizzes, midterm, and final exam

Exams  
25 - 40%

**Other:** Includes any assessment tools that do not logically fit into the above categories.

Participation

Other Category  
0 - 10%

### Representative Textbooks and Materials:

Electric Motors and Control Systems. 2nd ed. Petruzella, Frank. McGraw-Hill. 2017