Course Title: ELECTROMECHANICAL ENERGY CONVERSION

Course Prefix: ELEG **Course No.: 4013** **Section No.: 01**

Department of | Electrical and Computer Engr | College of | Engineering

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Office Hours: | **9:00am – 11:00am, MW and 9:30 – 11:00 TTH**

Virtual Office Hours: |

Course Location: | ***Electrical Engineering Building, Room 139***

Class Meeting Days & Times: | MWF 8:00 am – 8:50 am

Catalog Description: | **ELEG 4013. Electromechanical Energy Conversion.** (3-0) Credit 3 semester hours. Electric and magnetic devices, force and torque measurements, iron core transformers, single phase and polyphase power circuit analysis. Introduction to per unit system.

Prerequisites: | ELEG 3013 Network Theory II,
MATH 3685 Math for Engineers or MATH 4173 Advanced Math for Engineers

Co-requisites: |

Required Text: | Stephen J. Chapman, Electric Machinery and Power System Fundamentals," 1st Edition, McGraw Hill. ISBN: 978-0-07-229135-3

Recommended Text/Readings: | Investigations in Electric Power Technology by Wildi T and Devito M. J. 4th Edition, Buck Engineering Co. NJ 1998.

Fundamentals of Electric circuits by
Matthew Sadiku, McGraw Hill

Electric Machinery by Fitzgerald,
Kingsley and Umans. Mc Graw Hill

Access to Learning Resources: | PVAMU Library: phone: (936) 261-1500;
web: http://www.tamu.edu/pvamu/library/
University Bookstore: phone: (936) 261-1990;
web: https://www.bkstr.com/Home/10001-10734-1?demoKey=d

Course Goals or Overview:

This course introduces the basic theory of electromechanical energy conversion devices. The course details the characteristics, selection, applications, and practical use limitations of Transformers, motors and power transmission devices. Most of these devices rely on solid-state power electronics in modern-applications. The course will therefore survey this aspect of device application. Class lectures, discussions, and problem-solving sessions will provide students taking this course with the knowledge, understanding, and skills necessary to analyze, design and apply these power system devices. Group projects, laboratory demonstrations and other assigned problems will reinforce knowledge gained from class sessions.

Course Outcomes/Objectives

1- Teach students the fundamental concepts of electrical power and electrical machines (DC and AC machines and transformers)

Anticipated Outcome: Student will have an understanding of electrical power systems and the design and operation of electrical machines (Relevant to ABET Criterion- Outcome (a)

2- To teach students how to analyze different type of machines.

Anticipated Outcome: Student will acquire the ability to select the appropriate machine to be used for a specific operation and how to apply this knowledge on a global level. (Relevant to ABET Criteria- Outcome (h)

3- To teach students the use of modern engineering tools such as Matlab and FPGA programming. (Relevant to ABET Criterion- Outcome (j)

Anticipated Outcome: Student will be able to use modern engineering tools and exhibit a competency in the use of simulation tools.

Course Requirements & Evaluation Methods

This course will utilize the following instruments to determine student grades and proficiency of the learning outcomes for the course.

Exams – written tests designed to measure knowledge of presented course material
Lab Reports – real hands on laboratory demonstrations to supplement and reinforce course material
Projects – assignments designed to introduce students to various power components and how they are used in industry and consumer usage.

Grading Matrix

Instrument	Value (percentages)
Exams (2 exams)	30%
Midterm Exam	20%
Quizzes/Homework	10 %
Lab reports and Projects	10%
Final Exam (Comprehensive)	30%
Total:	**100%**

Final percentages may vary depending on number of assignments

Grade Determination:

A = 90% or better

B = 80 – 89 %

C = 70 – 79 %

D = 60 – 69 %

F = Less than 60%

Course Procedures

Submission of Assignments:
All assignments should be submitted by the due date. Late assignments will not be accepted.

Formatting Documents:
Microsoft Word is the standard word processing tool used at PVAMU. If you're using other word processors, be sure to use the "save as" tool and save the document in either the Microsoft Word, Rich-Text, or plain text format.

Exam Policy
Exams should be taken as scheduled. Exams will be announced one week in advance. No makeup examinations will be allowed except for students on official university leave or documented emergencies (See Student Handbook).

16 WEEK CALENDAR

Week One: Topic	Course overview; Syllabus review, Introduction, review of circuit theory (power)
Week Two: Topic	Magnetic Circuits, Faraday's and Lenz's Law
Week Three: Topic	Voltage on a conductor moving in a magnetic field Force on a conductor carrying current in a magnetic field.
Week Four: Topic	3-phase circuits
Week Five: Topic	Three Phase Analysis
Week Six: Topic	Transformers
Week Seven: Topic	Transformers and Per Unit System Midterm Exam
Week Eight: Topic	Generators & Motors, Introduction
Week Nine: Topic	AC Machine Fundamentals
Week Ten: Topic	Synchronous Machines
Week Eleven: Topic	Induction Motors
Week Twelve: Topic	DC Motors
Week Thirteen: Topic	Power Transmission
Week Fourteen: Topic	Power Applications
Week Fifteen Topic	Project presentations and review
Week Sixteen Topic	Final Exam

University Rules and Procedures

Disability statement (See Student Handbook):
Students with disabilities, including learning disabilities, who wish to request accommodations in class, should register with the Services for Students with Disabilities (SSD) early in the semester so that appropriate arrangements may be made. In accordance with federal laws, a student requesting special accommodations must provide documentation of their disability to the SSD coordinator.

Academic misconduct (See Student Handbook):
You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct. Students who engage in academic misconduct are subject to university disciplinary procedures.

Forms of academic dishonesty:

1. Cheating: deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.

2. Academic misconduct: tampering with grades or taking part in obtaining or distributing any part of a scheduled test.

3. Fabrication: use of invented information or falsified research.

4. Plagiarism: unacknowledged quotation and/or paraphrase of someone else's words, ideas, or data as one's own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one's own work also constitutes plagiarism.

Nonacademic misconduct (See Student Handbook)
The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or

(3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under nonacademic procedures.

Sexual misconduct (See Student Handbook):
Sexual harassment of students and employers at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action.

Attendance Policy:
Prairie View A&M University requires regular class attendance. Excessive absences will result in lowered grades. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or an assignment of a grade of "F". Absences are accumulated beginning with the first day of class.

Student Academic Appeals Process
Authority and responsibility for assigning grades to students rests with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the Undergraduate Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.

Detailed Syllabus

Chapter 1

1. **Rotational Motion**, Newton's Law and Power **2 wks**
2. **Magnetic Fields and Circuits**. Energy losses in a Ferromagnetic Core
3. **Faraday's** and **Lenz's** Laws.
4. **Voltage** on a conductor moving in a magnetic field.
5. **Force** on a current carrying conductor in a magnetic field.
6. **Real, Reactive, and Apparent Power**

LAST DAY for late Registration (August 29)
Last Day for Add/Drop (August 31)
LABOR DAY: (Monday, September 3) University Closed

12th CLASS DAY: Wednesday, September 12 Pay Fees
LATE DEADLINE TO APPLY FOR FALL 2018 GRADUATION (October 31)
LAST DAY TO DROP COURSE WITHOUT RECORD Sept 12)
20th CLASS DAY: September 24

Chapter 2 **2 wks**
Three-Phase Circuits

7. **Generation of Three-Phase Voltages and Currents**
8. **Power in Three Phase**
9. **Three Phase Analysis**

First Exam

Chapter 3 **2 wks**
Transformers

10. **Ideal Transformers**
11. **Transformers**, single phase and three phase, rating, regulation; special types e.g. Current transformers. Problems involving transformer use in power transmission systems. (2 weeks)
12. **Equivalent Transformer Circuits**
13. **Per Unit System**
14. **Voltage Regulation**

MID- SEMESTER EXAMINATION: Friday, October 19

Chapter 4 **2 wks**
AC Machine Fundamentals

15. **Rotating Magnetic field**
16. **Force and Flux**
17. **Induced Voltage**

LAST DAY TO WITHDRAW FROM COURSE WITH AUTOMATIC "W" (Monday, Nov 2)

THANKSGIVING HOLIDAY: November 22-24, Thursday - Saturday

Chapter 5

Synchronous Machines **2 ½ wks**

18. Basic Principles
19. Synchronous Generators
20. Synchronous Motors
21. Starting Synchronous Motors
22. Generator and Motor Principles-The rectangular rotation loop**.**

Chapter 7

Induction Motors **1 ½ wks**

23. Basic Induction Motor
24. Equivalent circuit
25. Power and Torque

Third Exam

Chapter 8
DC Motors **1 ½**
26. Fundamentals of DC Motors
27. Force, Induced Voltage and Torque
28. Commutation
29. Shunt and Series Motors

Power Electronics **1 ½ wks**

30. Power Electronics - Introduction. The Diode, Thyristor (PNPN, SCR, GTO etc.) **Converters, Inverters**, and **Choppers**. Use of these in motor drives. (1 week)

LAST CLASS DAY FOR FALL 2018 SEMESTER: Tuesday, Dec 4
LAST DAY TO WITHDRAW FROM THE UNIVERSITY : Tuesday, Dec 4

FINAL EXAM PERIOD: December 5 - 11, Wednesday- Tuesday

FINAL GRADES DUE FOR GRADUATION CANDIDATES
Tuesday, December 13

Goals: Upon successful completion, students will be able to understand the working principles of electromechanical energy conversion devices.

- Select and appropriately size devices for use in electric power systems
- Design systems involving the use of these devices
- Read with understanding developments relating to this course in technical journals

Expected ABET Outcome

a) an ability to design and conduct experiments as well as to analyze and interpret data
h) a broad education necessary to understand the impact of engineering solutions in a global and societal context
j) a knowledge of contemporary issues