**EENG 350: Energy Systems**

**Instructor:** Thomas R. Walsh, Ph.D.

**Text (recommended, but not required):** *Electric Machines, Drives, and Power Systems*, Sixth Edition, Theodore Wildi, Pearson, Prentice Hall. My lecture notes were initially based on this textbook.

**Lectures:** 9:00-9:50 MW and 1:00-2:30 F, CEB 231

**Lab:** 3:00-4:50 R, Cheney 109

3:00-4:50 R, NSC, (See Mr. Frank Jump)

**Prerequisites :** EENG 210 Circuit Theory II and MATH 163 Calculus III, both with a minimum grade >= 2.0.

**Office:** CEB 335

**Office Hours:** 2:00-3:30 PM MW and 2:00-3:00 R and 2:30-3:30 F or by appointment.

**Office Phone:** (509) 359-6490

**Email:** twalsh@ewu.edu

**Canvas:** The Syllabus (this document), Lecture Notes, Prelabs, Labs, Sample Problems, Review Material (if applicable) and Announcements for this course are all on Canvas.

**Course Description:** This course provides an introduction to the different energy sources, methods of electric energy conversion, the electric power system, transformers and electrical machines.

**Course Topics:**

* Units
* Fundamentals of Electricity, Magnetism, and Circuits
* Fundamentals of Mechanics and Heat
* **Exam #1 (L1-L8Pg73) (SP Ch #1-Ch#3)**
* ~~Direct-Current Generators~~ (SKIP)
* ~~Direct-Current Motors~~ (SKIP)
* Active, Reactive and Apparent Power
* **Exam #2 (L20Pg191-L28Pg271) (SP Ch#7)**
* Three-Phase Circuits
* **Exam #3 (L28Pg272-L35Pg342) (SP Ch#8)**
* Ideal Transformer
* Practical Transformer
* AC Induction Motors (if time permits)

**Grading:** The total points for the course will be broken down as follows:

Exams (3): 300 pts (3 @ 100 pts each)

Labs (9): 45 pts (9 @ 5 pts each)

PreLabs (9): 45 pts (9 @ 5 pts each)

Homework (~3-5): 15-25 pts (3-5 @ 5 pts each)

Final Exam 200 pts (1 @ 200 pts each)

Quizzes TBD

The total number of points will be normalized to 100 points. The following grading scale will be used:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Grade** | **Min %** | **Grade** | **Min %** | **Grade** | **Min %** | **Grade** | **Min %** | **Grade** | **Min %** |
| **4.0** | 99% | **3.4** | 89% | **2.9** | 79% | **1.9** | 69% | **0.9** | 59% |
| **4.0** | 98 | **3.4** | 88 | **2.8** | 78 | **1.8** | 68 | **0.8** | 58 |
| **4.0** | 97 | **3.3** | 87 | **2.7** | 77 | **1.7** | 67 | **0.7** | 57 |
| **4.0** | 96 | **3.3** | 86 | **2.6** | 76 | **1.6** | 66 | **0.0** |  |
| **4.0** | 95 | **3.2** | 85 | **2.5** | 75 | **1.5** | 65 |  |  |
| **3.9** | 94 | **3.2** | 84 | **2.4** | 74 | **1.4** | 64 |  |  |
| **3.8** | 93 | **3.1** | 83 | **2.3** | 73 | **1.3** | 63 |  |  |
| **3.7** | 92 | **3.1** | 82 | **2.2** | 72 | **1.2** | 62 |  |  |
| **3.6** | 91 | **3.0** | 81 | **2.1** | 71 | **1.1** | 61 |  |  |
| **3.5** | 90 | **3.0** | 80 | **2.0** | 70 | **1.0** | 60 |  |  |

|  |  |  |
| --- | --- | --- |
| **Numerical Grade** | **Grade** | **Description** |
| **4.0** | **A** | **Excellent** |
| **3.7** | **A-** |  |
| **3.3** | **B+** |  |
| **3.0** | **B** | **Good** |
| **2.7** | **B-** |  |
| **2.3** | **C+** |  |
| **2.0** | **C** | **Satisfactory** |
| **1.7** | **C-** |  |
| **1.3** | **D+** |  |
| **1.0** | **D** |  |
| **0.7** | **D-** |  |
| **0.0** | **F** | **Failing** |

**Exams:** There will be three in-class exams. The exams will be given during class time. The exams will contain questions similar to the sample problems on Canvas, Labs, Homework, Programs and material covered in class. The exams will be closed book and I will provide any equations or tables you may need. You may use a calculator. I do not give makeup exams. ***If you miss an exam, you will receive a 0. Exceptions for emergencies beyond your control will be made.***

Exams will not be returned. If you have questions about the exam, you need to come by my office during office hours and I will go over the exam with you.

**Labs:** The Lab will use the Lab-Volt equipment ([www.labvolt.com](http://www.labvolt.com)) in the Power Lab. Each lab will consist of a PreLab and a Lab exercise.

The Labs and PreLabs are posted on Canvas.

*Prelab:*

* The Prelab is due at the beginning of lab.
* Late Prelabs will be penalized 50% and not accepted after one week.
* Each student will turn in their own Prelab.

*Lab Exercises:*

* Each student should ***print out the Lab exercise*** and bring it to lab.
* Each student should fill out their own lab exercise.
* You are NOT required to do the review questions at the end of each experiment.
* The completed lab exercises are due at the end of lab.

**Missed Lab Policy:**

If you miss one lab, you will be allowed to makeup it up during the last week of the quarter at the end of the regularly scheduled lab time. If you miss two or more labs, you will receive a zero on the missed labs. Exceptions for extreme emergencies will be made.

**Homework:** There will be several homework assignments announced during the quarter. Late homework will be penalized 50% per day and not accepted one week after it is due. Homework consisting of plots should use commercial software or a ruler and template.

**Sample Problems:**

There are sample problems which are available on Canvas and ***it is expected that you are studying these problems as we proceed through the course***.

**Quizzes:**

I reserve the right to give quizzes during class time over the material discussed in class.

**Final Exam: There is a Final Exam and it will be comprehensive (covers all the material). Tuesday 8-10 AM of Finals Week.**

**Attendance:** After the first week of the quarter, attendance is not required, however, you will be responsible for everything that I say in class and it is your responsibility to find out what you missed.

If you miss one or more classes during the first week of the quarter and there is a wait-list you may be dropped from the class as per university attendance policy.

If you miss more than five classes and your grades are low, I reserve the right to drop you from the class.

**Academic Dishonesty:** Violations of academic dishonesty will not be tolerated, and will result in failure of the class. Violations of academic integrity involve the use of any method or technique enabling a student to misrepresent the quality and integrity of his or her own academic work or the work of a fellow student. Students committing academic dishonesty will be reported to the appropriate university official and an XF grade for this course will be recorded on the student’s transcript. In cases where a student has an existing record of academic dishonesty, a more severe penalty, e.g. involving suspension or dismissal from the university, may be sought.

# ABET Learning Objectives and Corresponding Mapping to ABET Criteria 3: Upon completion of this course, students will be able to:

1. Derive the circuit model and physical design of the DC motor and generator: shunt, series and compound designs. (*ABET EAC Criterion 3a,b, e, k*)
2. Describe the fundamentals of 3-phase power theory: generation, Delta- and Y-configurations and 3-phase loads. (*ABET EAC Criterion 3a,b, e, k*)
3. Examine the transformer model and physical design of the Induction motor and generator, and their torque-speed parameters. (*ABET EAC Criterion 3a,b, e, k*)
4. Work with other students in performing Energy Systems experiments. (*ABET EAC Criterion 3d*)
5. Understand contemporary issues associated with renewable energy sources. (*ABET EAC Criterion 3j*)