

WEST VIRGINIA UNIVERSITY

Lane Department of Computer Science & Electrical Engineering

*EE 335 Electromechanical Energy Conversion and Energy Systems*

Fall 2019

3 Lecture Credit Hours

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- Instructor:** Dr. Jignesh Solanki  
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Phone: 304-293-5071  
Email: [jmsolanki@csee.wvu.edu](mailto:jmsolanki@csee.wvu.edu)
- Office Hours:** Scheduled: MW 01:00 - 02:00 PM or by appointment.
- Class Time:** MWF 03:00 - 03:50 PM Class Location: AER-E 135
- Prerequisites:** EE 223, EE 224, PHYS 112.
- Co-requisite:** Electromechanical Energy Conversion and Energy Systems Laboratory (EE 336). If you drop EE 335 you must also drop EE 336.
- Required Text:** *Electric Machinery and Power System Fundamentals*, by Stephen J. Chapman, McGraw Hill.
- Ref:** *Electric Energy System*, by Syed A. Nasar, Prentice-Hall, Inc.
- Course website:** ECampus. Instructor is not responsible for lack of access to the website. Please DO NOT wait to the last minute to download course materials.
- Recommended Software:** Excel Spreadsheet, and MATLAB or MATHCAD. You may be required to submit assignments using MATLAB and/or industry leading software such as PSCAD/EMTDC.
- Expected Learning Outcomes:** At the end of this course, a student should be able to:
- Solve three-phase balanced circuits.
  - Know voltage-current characteristics of different energy sources.
  - Analyze magnetic circuits.
  - Analyze circuits containing single-phase and three-phase transformers.
  - Use force and torque equations in electromechanical systems.
  - Calculate steady state values of current, voltage, torque, and power for dc machines.
  - Calculate steady state values of current, voltage, torque, and power for synchronous machine.
  - Calculate steady state values of current, voltage, torque, and power for motor.
  - Use MATLAB programming, MATLAB SimScape or SimPowerSystem Blocksets for solving homework problems
  - You may know PSCAD Package for Power System simulation

### Tentative Lecture Topics:

<u>Subject</u>	<u>Chapter</u>
Introduction	
Mechanical and Electromagnetic Fundamentals	1
Three Phase Circuits	2
Transformers	3
AC Machinery Fundamentals	4
Synchronous Machines	5
Parallel Operation of Synchronous Generators	6
DC Motors (if time permits)	8

### **Exam Dates:**

**Exam 1: 30<sup>th</sup> September**

**Exam 2: 11<sup>th</sup> November**

**Final Exam: Wednesday, December 18 11:00 AM- 01:00 PM – Please check university final exam schedule for any modifications**

### Grading Policy:

Homework	05%
Software Simulations	05%
Quizzes	10%
In Class Problems	15%
Research Reports (Online Submission)	05%
Exam I	15%
Exam II	15%
Final Exam	<u>30%</u> (Comprehensive)
	100%

**Make-up Exam:** As a general policy, make-up exams will not be given. You must submit a letter from University for excused absence. If there is an extenuating circumstance, you must contact your instructor before the exam and seek approval for granting a make-up exam. Usually the make-up will be a comprehensive exam to accommodate all students.

**QUIZ** – On the day of homework submission, you will be given a QUIZ based on homework or class material.

You have **ONE WEEK** after an assignment or test or in-class is returned to discuss changes in your grade.

<b><u>Semester Grade:</u></b>	$90 \leq A \leq 100$
	$80 \leq B < 90$
	$70 \leq C < 80$
	$60 \leq D < 70$
	$F < 60$

Homework will be due at the **beginning** of class on the assigned date. Homework problems will be assigned may not be from the text. You are encouraged to discuss the homework problems with other students in the class; however, the discussion must end when you write your solution. Thus, the work on the paper must be your work. Late homework will not be graded and will not count.

**Other Policies:** Please bring your own calculators every day. Please make sure you switch off laptops, cellphones and be considerate to your fellow class mates by maintaining silence. Failure to adhere to these policies will result in loss of grade without notice. During exams scramble the usual positions you sit in and keep the bags near the blackboard. You can bring one A4 formula sheet without figures, texts, tables and numbers and make sure you attach the sheet to the exam. Cellphones, smart watches or smart devices that communicate outside or inside of classroom will not be allowed during exams. If caught, University cheating policy will be enforced. Do your own honest work.

**You are responsible for all material assigned in text and covered in class:** All students are responsible for all material covered in class as well as all announcements. Private lectures will not be given over class material missed by absence. Let the instructor know in advance of any excused absences.

**Do work we can all be proud of:** As a student in engineering, you are preparing for a professional career. You should be developing attitudes and skills appropriate for the profession while you are in school. The quality of work you submit for evaluation reflects on you and your professional status. In particular, homework submissions should be considered as professional work. Each page should have your name, course, and date at the top with the pages stapled together. Except for very short problems, each problem should begin on a new page. Use only one side of the paper. The problem number and parts of a problem should be clearly indicated. The problem answers should be clearly marked with a box. Units must be indicated.

Above all, your work should be well organized and easy to follow. The evaluator should quickly understand your procedure and find the results in a logical location. Documentation of the process using comments is appropriate, but should be direct and terse. Mundane details of intermediate calculations can be omitted without loss of clarity. Unprofessional, sloppy, poorly organized, or poorly presented work will be downgraded.

### **Figure Orientation:**

The proper orientation is to have the bottom of the figure at the bottom of the page for portrait layout, or to the right of the page for landscape layout. Be certain to follow this standard.

*All of this discussion about professional work and presentation may sound picky, but there are very practical reasons to practice these skills now. First, it is good training for your professional career. Good presentation and professional work is not something you suddenly "turn on" when you take a job. Career advancement can be held hostage to poor communications. Second, similar to your supervisor in industry, your instructor has much better things to do than to try to figure out sloppy handwriting and obscure results. You should want to make sure your instructor understands what you mean rather than hope the interpretation is in your favor. With hundreds of papers to grade, your grader simply does not have the time to interpret sloppy work. If the grader can't see clearly that your solution is correct, then it is wrong. Finally, rightly or wrongly, neat and well presented work is almost always judged to be better than similar but sloppily presented or poorly documented work.*

### **Computer Usage:**

You are encouraged to use your computer as a tool to help you understand the course material and also to help present your results in a professional manner. There are many computer applications programs available, many in low-cost student versions, and many available in the public domain. Probably the most useful are:

- Circuit and Logic Simulation
- Math Equation Solver and Graph Drawing
- Spread Sheet
- Word Processing
- Drawing/Drafting
- Data Base

When you enter the work force, you will find a personal computer sitting on your desk and be expected to know how to use it. Since you cannot instantly learn all these tools, you should develop at least a minimal skill in each one over the next few semesters.

Note that the computer application programs do not take the place of learning course material, but rather are tools to help:

- make complex mathematical manipulations easier
- reduce tedium of numerous similar calculations
- simulate the system to verify your results
- present the results clearly.

In some cases, your assignment will be to use the computer to develop a result. But in most cases, you will be expected to produce the results in a conventional analytical manner. In these latter cases, computer simulation is appropriate to verify your results, but not as a substitute for the calculations of mathematical analysis.

In this class design problems are sometimes assigned. In these problems, analysis methods are rarely specified. Hence, proof of performance can be carried out in any appropriate manner; by analysis or by computer simulation. Where computer results are presented for evaluation, care must be taken to present the results in a manner that can be easily understood. For example, some circuit simulators will plot the results with very little documentation of what the plot shows. In fact, most of the time the plot must be **interpreted** to show the desired result and it is necessary to provide that interpretation for the evaluator. For example, if the plot shows a voltage on a capacitor as a function of time, and the problem requires that you determine the time required for the capacitor voltage to reach a certain voltage, you must point out that time and voltage on the computer plot. This interpretation is usually handwritten, often in a different color. In general, undocumented and uninterpreted computer plots will be ignored.

Most computer applications programs have a facility for you to put a title directly on the plot or printout. This title should include your name, course number, problem number, and the date. There should always be a descriptive title that describes what the plot is about. If you cannot put it in a printed title, you must hand write it.

#### **STUDENTS WITH DISABILITY:**

If you have a disability and anticipate needing any type of accommodation in order to participate in this class, please advise the instructor and make appropriate arrangements with Disability Services (293-6700). The student should notify the instructor during the first week of class regarding the accommodation needed.

#### **SOCIAL JUSTICE STATEMENT:**

*West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment, based upon open communication, mutual respect, and non-discrimination. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with Disability Services (293-6700). If you feel that you are being treated inappropriately or unfairly in any way, please feel free to bring your concerns to my attention. Please be assured that doing so will not prejudice the grading process. In return, I expect you to behave professionally and ethically. Grades will be based on performance, but will be lowered for unethical or unprofessional conduct.*

#### **RELIGIOUS OBSERVANCES:**

*WVU recognizes the diversity of its students, some of whom must be absent from class to participate in religious observances. You must, however, notify me in writing by the end of the third class meeting regarding religious observances that will affect your attendance. I will make reasonable accommodation for tests or quizzes that you will miss as a result of religious observance, provided I am informed at least one week in advance.*

#### **ACADEMIC DISHONESTY:**

WVU expects that every member of its academic community shares the historic and traditional commitment to honesty, integrity, and the search for truth. Academic dishonesty is defined to include but is not limited to any of the following: **cheating and dishonest practices** in connection with examinations, papers, and projects; **forgery, misrepresentation, or fraud; and plagiarism**. If we are able to document that you have been dishonest academically in any of the ways described, you will be subject to procedures and penalties as prescribed in the WVU Student Code of Conduct <http://www.arc.wvu.edu/admissions/integrity.html>

Grades assigned during the semester on exams, quizzes, reports, or homework assignments are considered final and are not subject to negotiation for any reason other than an indisputable mistake in grading.

Use of cell phones, smart wearable devices, or possession of other external communication devices are strictly prohibited during exams, tests, or quizzes administered inside the classroom. Departments may specify acceptable calculators and additional restrictions.

**General:** You are expected to attend the class lectures. If you miss a class, you are responsible for all assignments and material covered. You are required to participate in all class discussions. You will be required to answer questions or discuss your solutions in class. You must maintain good class notes and should review all past materials covered before attending a class.

**Homework Assignments:** Problems will be assigned in class to test your understanding of the material covered in class and immediate feedback will be provided to the whole class. These exercises are to help you determine your level of mastery of fundamental knowledge presented in class.

**Exams:** Exams are designed to test your application of the knowledge learned. The questions will be more complex and challenging. All exams are closed book and closed notes. The final exam is comprehensive.

**Make-up Exam:** As a general policy, make-up exams will not be given. If there is an extenuating circumstance, you must contact your instructor before the exam and seek approval for granting a make-up exam. Usually the make-up will be a comprehensive exam to accommodate all students.

**Help in Learning:** If you attended the lectures and did not understand the material, see your instructor before the next lecture. If you did not attend the class, first obtain the notes from your classmates, review the material, and then promptly see your instructor.

**Class Learning Environment:** Cell phones must be turned off during class. Do not be late to class. Do not talk in class or read newspapers or do homework assignments from other classes. These activities disturb students and it is important to respect their right to a good learning environment in class.

**Plagiarism:** Plagiarism will be severely penalized and may result in an F grade for the course or receive no credit for a specific exam. Students are expected to exhibit the same level of professionalism and integrity that will distinguish them in their professional careers. Both the student who copied the work and the student who allowed the work to be copied will be penalized. Consequences and procedures for dealing with cases of academic dishonesty are outlined in the WVU Student Code of Rights and Responsibilities.

**Students with Disability:** If you have a disability and anticipate needing any type of accommodation in order to participate in this class, please advise your instructor and make appropriate arrangements with Disability Services (304-293-6700). The student should notify the instructor during the first week of class regarding the accommodation needed.

*Note: The content of this syllabus may be changed anytime according to the instructor's discretion.*