ECE342 Energy Conversion

Instructor:

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Textbook:

Electrical machinery Fundamentals (Fifth edition) by Stephen J Chapman.
ISBN: 9780073529547 MHID: 0073529540

Reference Books:

1. ***Electrical Machines With Matlab***

by Toran Gunen, Second Edition
ISBN-13: 978-1439877999
ISBN-10: 1439877998
Publisher: CRC Press

2. ***Electric Machinery** by Fitzgerald and Kingsley*

Course Description:

The course introduces energy conversion principles of converting various forms of energy to electrical energy and working principle of electric machines to convert electrical energy to mechanical energy. The course integrates lab experiments to teach and analyze steady state performance of transformers, motors and generators.

Pre-Requisite:

ECE231, ECE291

Specific Course Learning Outcomes (CLOs):

The student will be able to:

1. Able to calculate AC power absorbed by 1-ph and 3-ph circuits and apply it for power factor correction.
2. Understand the of single and multiple-excited magnetic circuits and convert them into equivalent electrical circuits to study their applications in electrical machines.
3. Analyze the electro-mechanical energy conversions through equations and apply it to calculate the steady-state performance characteristics of AC and DC machines.
4. Perform experiments to collect data and use it to calculate and plot the steady state performance characteristics of AC/DC machines
5. Research on their own on trending topics and share information with people by making presentations.

Relevant Student outcomes:

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics (CLOs 1, 2, 3).
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
(CLOs 1, 2, 3, 4).
3. an ability to communicate effectively with a range of audiences (CLO 5)

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives (CLOs 4,5)
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLOs 1-4).
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (CLOs 1-5).

Tentative Course Schedule:

Module	Topics	Labs	Ch/sections
1	AC Power: Power equations and complex (Active, reactive and apparent) power, concept of phase angle power factor and power triangles with different types of loads.	Measurement of 1-phase power	Section 1.1 to 1.5(T) Section 1.9(C)
2	"Y" and "delta" connected three phase ideal sources and balanced three phase loads. Power factor correction. Power equations and calculation of power in three phase circuits.	Measurement of 3 phase power	Appendix A(C) 2.1-2.2 2.4-2.5(T)
3	Magnetic circuits: Electrical equivalent of magnetic circuits, Magnetic behavior of ferromagnetic materials as core. Magnetic core losses,		Sec 1.4-1.5(C) 3.1- 3.8(T)
4	Transformers: Single phase transformer: Theory of ideal and real transformers. Equivalent circuit of transformer, transformer voltage regulation and efficiency. Testing of transformers Three Phase transformers: different three phase configurations.	O.C. and S.C. Test	Sec 2.1-2.5;2.7;2.10(C) 4.1-4.11(T)
	Midterm1		

6	Electro-mechanical Energy Conversion Principles		Sec 3.1-3.7(C)
7	Induction Motors: Construction and working principle, equivalent circuit, power and induced torque equations, Torque-speed curve, starting torque and maximum torque, starting of induction motor, speed control of induction motor.	1. Load Test of Induction Machines 2. Analyzing the torque speed curve of Induction motor.	6.1-6.6; 6.8-6.9(C)
8	Synchronous Generators: Construction, working principle, equivalent circuit, phasor diagram, power and torque equations, OCC and SC characteristic, measurement of model parameters and Short circuit ratio, alone operation of synchronous generator, Synchronous generator ratings	1.Parallel operation of Synchronous Generator 2. Load test of Synchronous Generators	4.7 to 4.11(excluding sec4.10)(C) 7.13-7.15(T)
	Midterm2		
9	Synchronous motors: working principle, steady state operation, equivalent circuit, synchronous motor "v" curves, synchronous condenser, starting of synchronous motor.	Load test of Synchronous Motors	5.1-5.6
9	Dc Machines: Generator (if time permits)	Load Test of DC Generator	8.11-8.12(C) 8.1-8.19(T)

Grading :

Lab Part:

- Attendance and Participation: 20%
- Report: 30%
- Lab Exam: 50%

Theory Part

- Attendance-10%
- Midterm 1 - 20%
- Midterm 2 - 20%
- Homework - 10%
- Research Topic presentation -15%
- Final Exam- 25%

- The Final Letter Grade will be the average of the individual letter grade of the Lab part and Theory part.
- If you fail in one, you will fail the course

Make-up Policy:

Regular Attendance is expected. There will not be any make-up for missed labs. Any missed lab work and exam will be accommodated only after being approved by the *Office of Dean of Students.*

Course Policies:

1. There will be homework after each topic is completed. Students are expected to submit their work within 7 days .Late submissions might be accepted with a grade penalty.
2. Research Topic Presentation: This is a group assignment. Each group is expected to pick a topic from the listed topics, research on it and prepare a review report on the selected topic. Each group is also expected to make a 5-10 minutes presentation to the class. The aim of the presentation should be to teach the class the selected topic. The group will be graded on the quality of the material and presentation. Midterms will include the research topics presented in the class. So, the class is expected to learn from the presentation and ask relevant questions to understand the topic well.
   The students are free to form their own groups. The number of people allowed in each group will be decided by the instructor. The list of topics will be available on canvas.
3. Final Exam will be cumulative.

NJIT Honor Code:

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

Prepared by: Ratna Raj

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.