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 the working principles of machines converting electrical energy to mechanical energy and vice-versa. The course integrates lab experiments to teach and analyze the steady-state performance of transformers, motors, and generators.

Pre-Requisite:

ECE231, ECE291

Specific Course Learning Outcomes (CLOs):

The students will be able to:

1. Analyze and calculate complex power of single and three phase circuits.
2. Analyze power flow through various electrical machines.
3. Draw equivalent circuits, and calculate torque and complex power of generators motors, and transformers.
4. Perform experiments to plot performance characteristic curves of machines and draw conclusions.
5. Use experimental data to calculate machine parameters, output power, torque, and efficiency.

Relevant Student outcomes:

SO1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

SO1.1. an ability to identify and formulate complex engineering problems by applying principles of engineering, science, and mathematics
SO1.2. an ability to solve complex engineering problems by applying principles of engineering, science, and mathematics

SO3. an ability to communicate effectively with a range of audiences.

SO5. 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
SO5.1. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment,
SO5.2. an ability to establish goals, plan tasks, and meet objectives

SO6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
SO6.1. an ability to develop and conduct appropriate experimentation
SO6.2. an ability to analyze and interpret data
SO6.3. an ability to use engineering judgment to draw conclusions

SO7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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)
	Exam 1		
4	Transformers: Single phase transformer: Theory of ideal and real transformers. Equivalent circuit of transformer, transformer voltage regulation, and	O.C. and S.C. Test	Sec 2.1-2.5;2.7;2.10(C) 4.1-4.11(T)

	efficiency. Testing of transformers Three-phase transformers: different three-phase configurations.		
6	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)
	Exam2		
7	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)
8	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
	Exam 3		

Grading :

Lab Part:

- Attendance and Participation: 20%
- Report: 50%
- Lab Exam (quiz and term exams): 30%

Theory Part

- Attendance-10%
- Exam 1 - 25%
- Exam 2 - 25%
- Exam 3 - 25%
- Homework - 15%

- The Final Letter Grade will be the average of the individual letter grade of the Lab part and Theory part.
- To pass the course one has to get passing grades for both the sections.
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Make-up Policy:

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

Course Policies:

1. **Assignments & Late Policy**

Homework will be assigned following the completion of each topic. Assignments are due within **7 days** of the release date. Submissions received after the deadline will incur a **late penalty** but will be accepted until the solutions are posted.

2. **Exams**

The course includes **three exams**, each covering specific topics as outlined in the course schedule.

3. **Attendance**

Attendance will be recorded at the beginning of each class. Students arriving after attendance is taken will be marked as **absent**. It is the student's responsibility to speak with the instructor after class to change their attendance record to "late."

4. Lab Reports

Lab reports are due within **7 days** of the in-class discussion of the relevant material. The specific due date will be announced in class. Students will have one opportunity to revise and resubmit their lab report to improve their grade by correcting graded mistakes and incorrect calculations.

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 policies are subject to revision and changes by individual instructors.