Hellen and John C. Hartmann Department of Electrical and Computer Engineering

New Jersey Institute of Technology

Course number and name: ECE341: Energy Conversion, 3 credit hours, 3 contact hours

Instructor's or course coordinator's name: Dr. Walid Hubbi

Text book, title, author, etc.: "Electrical Machines with Matlab," by Turan Gonen, ISBN 978-1-4398-7799-9, CRC Press.

Catalog Description

This course covers fundamental concepts of Magnetic circuits and their applications, and the steady-state performance of dc and ac electromechanical energy converters.

Prerequisites: ECE 231; required course for EE majors.

Course Learning Outcomes

Students will be able to:

1. Perform three-phase circuit analysis.
2. Utilize fundamental laws of electromagnetism (Faraday's and Ampere's Laws) and their applications in the analysis and design of simple energy conversion devices and transformers.
3. Understand fundamentals of magnetic circuits and application to machine design.
4. Understand fundamentals of electromechanical energy conversion.
5. Understand and apply the fundamentals of direct-current generators and motors.
6. Understand and apply the fundamentals of alternating-current generators and motors.
7. Understand the importance of energy conversion to society.
8. Use Matlab to solve engineering problems

Relevant ABET Student Outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-8)
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 (CLO 7)
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1-8).

Grading Policy: Maximum points is 150 points divided as follows: two tests 35 points each; homework and class performance 30 points; and final 50 points. The letter grade will be as follows: A>90%, B+>80%, B>70%, C+>60%, C>50%.

Homework Policy: Late homework (HW) will not be accepted except for a valid reason. Your solutions to the HW problems must be neat and easily readable. Every HW must start with a cover sheet similar to the attached cover sheet.

Time Requirements:

On the average, a full-time student during the Fall or Spring semester takes courses having a total of 15 credits and study about 45 hours/week. This is equivalent to 2 hours of study for every hour in class. Therefore, you are expected to allocate 9 hours/week for this course (including time spent in class).

Other Policies

1. Students should be familiar with NJIT Honor Code. This code will be rigorously upheld, any violations will be brought to the immediate attention of the administration.
2. Students are expected to read the listed text sections prior to each lecture period. (See weekly outline below)
3. Students are expected to complete the assigned homework problems after each lecture period.
4. At the end of each chapter students should be prepared to discuss their solutions in class.

Assumed Knowledge

- complex number representation and arithmetic,
- basic DC and sinusoidal steady-state AC electrical circuit analysis: eg. Ohm’s law, Kirchhoff’s Voltage Law, Kirchhoff’s Current Law, phasor representation of sinusoidal AC signals, series and parallel impedances, Thevenin's theorem,
- concept of complex, real and reactive power, power triangle (Circuits and Systems I),
- basic Physics, Ampere's law, Faraday's law

Weekly Outline:

Week #	**Topics**	**Pages or sections**	**HW**
1	Review of 3-phase, real, reactive, and apparent power, power factors, phasors.	9-33	Read sec. 1.1 to 1.4. 1.2, 1.6 2-2,4,11,16
2	Power measurement, PF correction, Magnetic Field Relations Magnetic Circuits	37-72	2-7,8, 9,15, 28. 3-1,2, 3, 4
3	Hysteresis, Core loss	72-83	3- 21, 33
3	Ideal Transformer, Practical Transformer	93-113	4-1, 2, 4, 9,
4	Practical Transformer, Equivalent Circuit.	113-156	4-10,23,32, 33
4	Test 1, dot convention and polarity		
5	Induction Machines, RMF, slip	6.1 to 6.6	6- 3, 4, 6
5	Equivalent Circuits of IM and performance calculations	6.7 and 6.8	6- 8, 9, and 12
6	Operational Characteristics of IM	6.9 to 6.11	6- 16, 24, and 26
6	Synchronous Machine- constructions, OC and SC characteristics, equivalent circuit	7.1 to 7.6	7- 1,2, 3, 8, 13
7	P and T characteristics, effects of excitation, starting, operation as a synchronous reactance	7.7 to 7.14	7- 14, 17, 19
8	Test 2,		
8	Determining the parameters of Synchronous Machines, capability curve, parallel operation.	7.15 to 7.17	7- 25, 27
9	DC machine construction, voltage and torque	8.1 to 8.5	8.2 and 8.3
10-11	Field excitation, commutation, magnetization curve	8.6, 8.7, 8.8, 8.10,	8- 5, 11, 12, and 14
12-13	DC generators	8.11 to 8.19	