MECH3630 Electrical Technology

Course Code: MECH3630	**Course Title:** Electrical Technology
Terms Offered (Credits): Spring (3 credits)	**Pre/Co-Requisites:** NA

Course Structure: Lecture: 2 days per week, 3 hours; Lab: 1 day per week, 1 hour; Tutorial: 1 day per week, 1 hour

Textbook/Required Material:

P. C. Sen, Principles of Electric Machines and Power Electronics, second edition, John Wiley & Sons, Inc., 1997.

Course Description:

Theoretical and practical treatment of key elements in electrical technology with industrial applications. Main topics include magnetic circuits, transformers, electrical machines, and applications for industrial automation.

Course Topics:

1. Magnetic Circuits (1.5 weeks)
2. Hysteresis
3. Sinusoidal excitation
4. Permanent magnet

5. Transformers (2 weeks)
6. Construction and working principle
7. Equivalent circuit analysis
8. Autotransformers and three-phase transformers

9. Electromechanical Energy Conversion (0.5 week)
10. Energy conversion process
11. Field energy
12. Mechanical force in the electromagnetic system
13. Rotating machines

14. DC Machines (3 weeks)
15. Motor and generator principles
16. Speed-torque characteristics of series, shunt, and compound wound motors

17. Induction (asynchronous) Machines (3.5 weeks)
18. Construction and principle of action of squirrel cage motors
19. Speed control and starting method
20. Equivalent circuit analysis
21. Speed-torque characteristics

22. Synchronous Machines (0.5 week)
23. Construction and principle of action
24. Equivalent circuit analysis
25. Speed-torque characteristics

26. Single-Phase Motors (0.5 week)
27. Double revolving field theory

28. Equivalent circuit analysis
29. Speed-torque characteristics

30. Special Machines (0.5weeks)
31. Servomotors
32. Synchros
33. Stepper motors

34. Transients and Dynamics (0.5weeks)
35. DC machines
36. Synchronous machines
37. Induction machines
38. Transformer

39. Power Semiconductor Converters (0.5 week)
40. Power semiconductor devices
41. Controlled rectifiers
42. AC voltage controllers
43. Choppers
44. Inverters and cycloconverters

Course Objectives:	1. To equip students with fundamental theories and technologies in electromechanical energy conversion. 2. To introduce students structures, working principle, and load characteristics of key devices such as transformer, DC machine, and induction machine. 3. To provide students extensive training in development and use of equivalent circuit for magnetic circuit and device analysis for engineering design. 4. To introduce students practical issues that affect safety and energy efficiency.
Course Outcomes:	A. Ability to use basic knowledge in physics and mathematical tool to develop new analysis tools, concepts, and models . B. Ability to use electromechanical devices, such as transformers, DC machines, induction machines, and power devices for mechanical system design and development. C. Ability to conduct design analysis for products that involve electromechanical energy conversion. D. Awareness of safety issues in use of electromechanical devices and power devices.
Assessment Method:	● Homework ● Lab ● Mid Term and Final Exams