CRN: 22679 ECET 21100-01 Electrical Machines and Controls

Spring 2017

Professor Paul I-Hai Lin, P.E. (States of CA & IN)
Dept. of Computer, Electrical, and Information Technology
Indiana University-Purdue University Fort Wayne

Course Description:
Class 2-3, Lab 0-2, Cr. 3, P: MA 154
Lecture, demonstration, and laboratory experiments are combined to acquaint the student with the elements of electrical power circuits and machines.

Lecture and Lab Demos:
Lecture: 3:00-4:15 PM, Monday and Wednesday, in Room KT G49
Course Web site: http://www.etcs.ipfw.edu/~lin

Instructor Information
Paul I-Hai Lin, P.E., Professor of Electrical and Computer Engineering Technology
Office: ET 205C Phone: 260-481-6339 Email: lin@ipfw.edu
Course Web site: http://www.etcs.ipfw.edu/~lin
Office Hours:
** Monday 1:00-3:00 PM, 6:00-7:00 PM
** Tuesday 11:00-12:00 Noon, 5:00-6:00 PM
** Wednesday 2:00-3:00 PM, 6:00-7:00 PM
** Thursday 11:00-12:00 Noon

Text Book: Electric Motors and Control Systems, 2nd Edition, 2015, by Frank D. Petruzella, McGraw Hill, ISBN 978-0-07-337381-2; http://www.mhprofessional.com/product.php?isbn=0073373818

Reference Book: Electrical Power and Controls, 2nd Edition, 2004, Timothy L. Skvarenina and William E. DeWitt, Parson/Prentice Hall, ISBN 0-13-113045-5.

ECET 211 Course Outcomes:
This course provides non-EET majors with a "demo-base" experience in the experimental approach to electric circuits, electrical machines and controls. A student who successfully fulfills the course requirements will have demonstrated the ability to:

1. State and practice the principles of electric safety in workplace (Criterion 3, item i)
2. Able to search/learn related domain knowledge and standards from such sources Occupational Safety and Health Administration (OSHA), National Electrical Code (NEC), National Fire Protection Association (NFPA), National Electrical Manufacturers Association (NEMA), International Electrotechnical Commission (IEC), Institute of Electrical and Electronics Engineers (IEEE) (Criterion 3, items g, f)
3. Understand the operating principles of electric power systems: DC and AC (Criterion 3, items a, b, c, e)
4. Able to read circuit board schematic diagrams and identify proper electrical components (Criterion 3, items a, b, c, e)
5. Explain the operating principles of electrical machines (DC and AC motors) (Criterion 3, items a, b, c, e)
6. Explain types of semiconductor devices used in electrical machines control applications (Criterion 3, items a, b, c, e)
7. Connect basic electric machine control circuits (Criterion 3, items a, b, c, e)
8. Apply Ohm's law, KVL and KCL to solve electrical circuit problems (Criterion 3, items a, b, c, e)
9. Apply the principles of circuit analysis to calculate current, voltage, resistance, powers, and power factor (Criterion 3, items a, b, c, e)

ABET/TAC 2016-2017 Criteria for Accrediting Engineering Technology Program (Associate Degree Programs) Criterion 3. Student Outcomes (a through i), http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-technology-programs-2016-2017/#studentoutcomes
For associate degree programs, these student outcomes must include, but are not limited to, the following leaning capabilities

a) an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly-defined engineering technology activities;
b) an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge;
c) an ability to conduct standard tests and measurements, and to conduct, analyze and interpret experiments;
d) an ability to function effectively as a member of leader on a technical team;
e) an ability to identify, analyze and solve narrowly defined engineering technology problems;
f) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
g) an understanding of the need for and an ability to engage in self-directed continuing professional development;
h) an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
i) a commitment to quality, timeliness, and continuous improvement;

Computer Usage:

1. World Wide Web and Internet information search, and Web browser.
2. Excel spread sheet for data analysis
3. MATLAB for technical computation

Grading Policy

3 Tests (50 min each) - 30% Hw Assignments (evaluated through in-class quizzes) – 30%
One Team-based Course Project (maximum 3-students in one team) -10%
Final Exam (Comprehensive) - 25%
Class Engagement & Attendance – 5%

- No makeup exam/test will be given

Important Dates: http://www.ipfw.edu/academics/calendar/

- Monday, Jan. 16, Martin Luther King Jr. B.D. – No Class
- March 6 – March 12, Spring Break – Spring Break
- Final Exam – May 5, 1:00 p.m. to 3:00 p.m., https://www.ipfw.edu/academics/finals/

Disabilities Statement: If you have a disability and need assistance, special arrangements can be made to accommodate most needs. Contact the Director of Services for Students with Disabilities (Walb, room 113, telephone number 481-6658), as soon as possible to work out the details. Once the Director has provided you with a letter attesting to your needs for modification, bring the letter to me. For more information, please visit the web site for SSD at http://new.www.ipfw.edu/disabilities/

IPFW Academic Regulation:
9. Academic Honesty: It should be noted that the policy of the University that any student found to have engaged in any activity constituting academic dishonesty will receive an "F" for the course in which the activity occurred or a dismissal from the University. The following web page explains the policy in detail: http://bulletin.ipfw.edu/content.php?catoid=38&navoid=1019#Disciplinary

Code of Student Rights, Responsibilities, and Conduct"

- **Part II. Student Conduct Subject to Disciplinary Action,** http://bulletin.ipfw.edu/content.php?catoid=38&navoid=1019#Disciplinary

- **A. Academic misconduct**

Tentative Schedule/Activities

Week #	Chapters and Topics
Week 1: Jan. 9, 11	**Introduction to the Course** **Electricity Basics: Current, Voltage, Resistance, AC and DC Circuits,** **Demo: Electric Power Generation, Transmission and Distribution** **Chapter 1. Electrical Safety in Workplace** **Part 1: Protecting against Electric Shock** **Part 2: Grounding-Lockout-Codes**
Week 2: Jan. 18	**Chapter 2. Understanding Electrical Drawings** **Part 1: Symbols – Abbreviations – Ladder Diagrams** **Part 2: Wiring – Single Line – Block Diagrams** **Part 3: Motor Terminal Connections** **Part 4: Motor Nameplate and Terminology** **Part 5: Manual and Magnetic Motor Starters**
Week 3: Jan. 23, 25	**Chapter 2. Understanding Electrical Drawings** **Part 1: Symbols – Abbreviations – Ladder Diagrams** **Part 2: Wiring – Single Line – Block Diagrams** **Part 3: Motor Terminal Connections** **Part 4: Motor Nameplate and Terminology** **Part 5: Manual and Magnetic Motor Starters**
Week 4: Jan. 30, Feb. 1	**Chapter 3. Motor Transformers and Distribution Systems** **Part 1: Power Distribution Systems** **Part 2: Transformer Principles** **Part 3: Transformer Connections and Systems**
Week 5: Feb. 6, 8	**Exam 1 – Feb. 8** **Chapter 3. Motor Transformers and Distribution Systems** **Part 1: Power Distribution Systems** **Part 2: Transformer Principles** **Part 3: Transformer Connections and Systems**
Week 6: Feb. 13, 15	**Chapter 4. Motor Control Devices** **Part 1: Manually Operated Switches** **Part 2: Mechanically Operated Switches** **Part 3: Sensors** **Part 4: Actuators**
Week 7: Feb. 20, 22	**Chapter 5. Electric Motors** **Part 1: Motor Principle** **Part 2: Direct Current Motors** **Part 3: Three-Phase Alternating Current Motors** **Part 4: Single-Phase Alternating Current Motors** **Part 5: Alternating Current Motor Drives** **Part 6: Motor Selection** **Part 7: Motor Installation** **Part 8: Motor Maintenance and Trouble Shooting**
Week 8: Feb. 27, Mar. 1	**Chapter 5. Electric Motors** **Part 1: Motor Principle** **Part 2: Direct Current Motors** **Part 3: Three-Phase Alternating Current Motors** **Part 4: Single-Phase Alternating Current Motors** **Part 5: Alternating Current Motor Drives**

	Part 6: Motor Selection **Part 7: Motor Installation** **Part 8: Motor Maintenance and Trouble Shooting**
Week 9: Mar. 6, 8	**Spring Break**
Week 10: Mar. 13, 15	**Chapter 6. Contactors and Motor Starters** **Part 1: Magnetic Contactor** **Part 2: Contactor Rating, Enclosures, and Solid-State Types** **Part 3: Motor Starters**
Week 11: Mar. 20, 22	**Exam 2 – March 22** **Chapter 6. Contactors and Motor Starters** **Part 1: Magnetic Contactor** **Part 2: Contactor Rating, Enclosures, and Solid-State Types** **Part 3: Motor Starters**
Week 12: Mar. 27, Mar. 29	**Chapter 7. Relays** **Part 1: Electromechanical Control Relays** **Part 2: Solid-State Relays** **Part 3: Timing Relays** **Part 4: Latching Relays** **Part 5: Relay Control Logic**
Week 13: April 3, 5	**Chapter 8: Motor Control Circuits** **Part 1: NEC Motor Installation Requirements** **Part 2: Motor Starting** **Part 3: Motor Reversing and Jogging** **Part 4: Motor Stopping** **Part 5: Motor Speed**
Week 14: April 10, 12	**Chapter 9: Motor Control Electronics** **Part 1: Semiconductor Diodes** **Part 2: Transistors** **Part 3: Thyristors** **Part 4: Integrated Circuits (ICs)** **Exam 3 – April 12**
Week 15: April 17, 19	**Chapter 10: Adjustable-Speed Drives and PLC Installations** **Part 1: AC Motor Drive Fundamentals** **Part 2: VFD (Variable Frequency Drive) Installation and Programming Parameters** **Part 3: DC Motor Drives Fundamentals** **Part 4: Programmable Logic Controllers (PLCs)**
Week 16: April 24, 26	**Chapter 10: Adjustable-Speed Drives and PLC Installations** **Part 1: AC Motor Drive Fundamentals** **Part 2: VFD (Variable Frequency Drive) Installation and Programming Parameters** **Part 3: DC Motor Drives Fundamentals** **Part 4: Programmable Logic Controllers (PLCs** **End of class review**
Week 17: May 5	**Comprehensive Final Exam** May 5 Friday, 1:00 p.m to 3:00 p.m