Course Syllabus

Course No. & Title: EEL 4935/6935 – Industrial Power Distribution 2

Term & Meeting Info: Spring 2008, TR 11:00-12:15, ENC 1002

Instructor Info: Ralph Fehr, Ph.D., P.E., fehr@eng.usf.edu, Office: ENC 2502
Phone: (813) 760-7204, Fax: (813) 974-5250, Department Office Phone: (813) 974-6293
Office Hours: M 11:00-12:15, T 9:30-10:45, or by appointment
Website: http://web.tampabay.rr.com/usfpower/fehr.htm

Catalog Description: This course, along with Industrial Power Distribution 1, prepares the student to design electrical power systems for industrial applications. It focuses specifically on:

- industrial distribution equipment such as switchgear and motor control centers
- ladder logic as applied to process control and automation
- motor control, protection, and starting methods
- shunt capacitor banks for power factor correction
- power quality issues

In addition to benefiting students interested in studying power engineering, the Industrial Power Distribution sequence also serves as an excellent exposure to the electric power subdiscipline for students concentrating in other areas of electrical, mechanical, and industrial engineering.

Semesters Offered: Every Spring semester

Prerequisites: EGN 3375 (Electromechanical Systems), EEL 4705 (Logic Design)

Corequisites: none

Courses that require this course as a direct prerequisite: Power Engineering technical electives

Level: UG/Grad Credits: 3 Class Duration: 75 minutes, twice a week


Reference (supplemental reading): see references cited in required text

Course Outcomes:

1. Students will become familiar with the design, specification, and application of medium- and low-voltage power distribution components. Crit. 3(a)(c)(e)(k)(m)
2. Students will design control and interlock circuits using ladder logic. Crit. 3(a)(c)(e)(k)(m)
3. Students will understand various means of motor starting, including application and implementation. Crit. 3(a)(c)(e)(k)(m)
4. Students will learn methods of power factor correction using fixed and switchable shunt capacitors. Crit. 3(a)(c)(e)(k)(m)
5. Students will be introduced to power quality issues, including steady-state and transient voltage control, harmonics, and continuity of service. Crit. 3(a)(c)(e)(k)(m)
6. Students will complete a comprehensive design project, relying on technical standards, codes, and industry practices. Crit. 3(a)(c)(e)(f)(g)(i)(k)(m)

Note: For a definition of the components of ABET Criterion 3, please refer to the “Relation of Course to EE Dept. Program Outcomes” section later in this syllabus.
Test & Grading Info: Grading -- plus/minus grading will be used

Homework 15%
Exams (2) 20% each (open book/notes)
Project 25%
Final 20% (open book/notes)

Test conflicts due to illness, religious observances, or travel may be rescheduled by contacting the instructor as soon as possible.

Course Topics:

T 01/08/08 Course Overview
R 01/10/08 Ch. 6 – Overview, NEMA Enclosures, Switchgear
T 01/15/08 Ch. 6 – Switchgear
R 01/17/08 Ch. 6 – Motor Control Centers
T 01/22/08 Ch. 6 – Motor Control Centers
R 01/24/08 Ch. 7 – Ladder Logic
T 01/29/08 Ch. 7 – Ladder Logic, Design Considerations
R 01/31/08 Ch. 7 – Logic Implementation
T 02/05/08 Ch. 7 – Seal-in Circuits, Interlocks, Remote Control and Indication
R 02/07/08 Ch. 7 – Reversing Starters
T 02/12/08 Ch. 7 – Jogging and Plugging

PROJECT ASSIGNED

R 02/14/08 Exam 1
T 02/19/08 Ch. 8 – Motor Fundamentals
R 02/21/08 Ch. 8 – Cable Sizing, Circuit Protection
T 02/26/08 Ch. 8 – Winding Protection
R 02/28/08 Ch. 8 – Motor Starting Concepts
T 03/04/08 Ch. 8 – Starting Methods: Across-the-Line
R 03/06/08 Ch. 8 – Starting Methods: Reduced Voltage
T 03/11/08 Spring Break
R 03/13/08 Spring Break
T 03/18/08 Ch. 8 – Starting Methods: Autotransformer Starting
R 03/20/08 Ch. 8 – Starting Methods: Wye-Delta and Part-Winding Starting
T 03/25/08 Ch. 8 – Soft Starters and Variable-Frequency Drives
R 03/27/08 Exam 2
T 04/01/08 Ch. 9 – Capacitor Overview, Configuration, Sizing, and Placement
R 04/03/08 Ch. 9 – Harmonics and Switching Transients
T 04/08/08 Ch. 9 – Resonance and Protection
R 04/10/08 Ch. 10 – Power Quality Overview, Historical Perspective, Quantification
T 04/15/08 Ch. 10 – Continuity of Service, Voltage Requirements
R 04/17/08 Ch. 10 – Transients, Harmonics

PROJECT DUE

T 04/22/08 Ch. 10 – Harmonic Filters
R 04/24/08 Ch. 10 – Harmonics, Power Factor
T 04/29/08 Final Exam (10:30am-12:30pm)

Specialization: This course is useful for the engineer involved with industrial electrical system design -- particularly, switchgear and motor control centers, motor control logic and protection, power factor correction capacitors, and power quality issues.

Professional Component: Engineering Science - 25% Engineering Design - 75%
(Eng Science = math/science required for creative applications; Eng Design = decision making process of devising a system, component or process to meet a desired need)
**Additional Course Features:** This course will include a design project, requiring a written report. An optional field trip will also be offered. Although participation in the field trip is not required, it is strongly encouraged, as it will provide many unique learning experiences that cannot be duplicated in the classroom.

Although attendance will not be taken (other than the first day of class, per university policy), attendance and participation is strongly suggested to enhance the learning experience for all students.

Academic dishonesty of any kind will not be tolerated. If caught cheating, the guilty parties will be subject to AT LEAST failure of the course, up to and possibly including expulsion from the university. **DO NOT CHEAT!!**

**Relation of Course to EE Dept. Program Outcomes:**

- **Program Outcome “a”**: An ability to apply knowledge of basic math, science and engineering.
- **Program Outcome “c”**: An ability to design systems, components, or processes to meet desired needs.
- **Program Outcome “e”**: An ability to identify, formulate and solve engineering problems.
- **Program Outcome “f”**: An understanding of professional and ethical responsibility.
- **Program Outcome “g”**: An ability to communicate effectively.
- **Program Outcome “i”**: A recognition of the need for, and an ability to engage in lifelong learning.
- **Program Outcome “k”**: An ability to use techniques, skills and modern engineering tools necessary for engineering practice.
- **Program Outcome “m”**: Knowledge of basic and engineering science necessary to analyze and design complex electrical/electronic hardware/software devices and systems.

**Final Exam Info:**  
T 04/29/08, 10:30am-12:30pm

**Additional Course Info:** When E-mailing Dr. Fehr about this course, please either (1) include “IPD2:” as the first characters in the subject line, or (2) send the E-mail from Blackboard™ and keep its default subject line “[EELxxxx.xxxS08]” at the beginning of your subject line. Thank you!

Taping lectures requires the permission of the instructor. APEX students are responsible for designating a proctor for tests, and must inform the APEX office of their designation. Notifying the instructor of an inability to attend a class or class-related activity is appreciated.

**Syllabus Prepared by:** Ralph Fehr, Ph.D., P.E.

**Date of Approval of Syllabus by Area Subcommittee:** Spring 2007