ECE 4300: Electrical Power Systems
Senior Elective Course

2006-2007 Catalog Data: Three-phase circuits and per-unit notation. Distributed RLC for conductors and cables. Transmission lines, network analysis, symmetrical system faults, and introduction to symmetrical components.
Credit: 3 hours (3 hours lecture).
Corequisite: ECE 3300.

Textbook(s) and/or Required Materials:
1. H. Sadaat, *Power Systems Analysis*, 2nd edition, McGraw-Hill Higher Education, 2002.
2. Scientific calculator.

Recommended Materials:
1. Mathcad or MATLAB

Reference Materials:
1. W. D. Stevenson, *Elements of Power System Analysis*, 4th ed., McGraw-Hill, New York, 1982.
2. J. D. Glover and M. Sarma, *Power System Analysis and Design*, PWS-Kent Publishing Co., Boston, MA., 1989.

Course Coordinator: Joseph A. Kelemen, Associate Professor, ECE

Instructor (S-2007): Joseph A. Kelemen, Associate Professor, ECE

Prerequisites by Topic:
1. Linear algebra.
2. Network analysis.
3. Differential equations.
4. Electric and magnetic fields.

Course Objectives: (ABET Learning Outcomes[1])
ABET learning outcome assigned to this course by ECE assessment plan: e and j.
1. to analyze steady-state AC, balanced, three-phase circuits (a, e, i);
2. to develop distributed resistance, inductance and capacitance models for conductors, cables and bundled cables for single-phase and three-phase transmission lines (a, c, e, i);
3. to compute transmission line voltage regulation and transmission efficiency vs. loading (a, e);
4. to design reactive compensation circuitry for voltage control (a, c, e);
5. to develop one-line diagrams, circuit models for major power system components, i.e., three-phase generators, transformers, lines and equivalent loads (a, c, e, k);
6. to use per-unit notation for system analysis and design (a, c, e);
7. to reformulate and use for analysis the network equations in terms of the system bus admittance and impedance matrix (a, c, e, k);
8. to develop the non-linear "load flow" equations and solve using numerical analysis (a, c, e, k)
9. to use "load flow" analysis for system voltage control and power flow (a, c, e, h, i, j, k);
10. to develop and use for circuit breaker and fuse selection, the sub-transient, transient and steady-state model for symmetrical three-phase short circuits (a, c, e, k);
11. to develop and analyze system models in terms of symmetrical components for unbalanced faults and selection of protective devices (a, c, e, i, k);

[1.] The relevant ECE Department learning outcomes a-k, are included in parenthesis.
[2.] Refer to the ECE 4300 "Course Report", S2006 and S-2007.

ECE 4300 (Cont.)

Topics:

1. Review, single and three-phase AC circuits, steady-state (2 classes)
2. Transmission lines, distributed resistance, inductance and capacitance (6 classes)
3. Line models, performance and compensation (4 classes)
4. Generator and transformer models and per-unit notation (6 classes)
5. System modeling and network calculations (5 classes)
6. System power flow analysis (5 classes)
7. Transients and symmetrical three-phase faults (5 classes)
8. Symmetrical components and unsymmetrical faults. (4 classes)
9. Power system stability (3).

Evaluation:

1. One hour exams (2)-40%
2. Two hour final exam-40%
3. Reactive compensation design-8%
4. Homework -12%

Computer Usage:

Students are encouraged to use Mathcad or MATLAB software packages and the CD accompanying the course textbook for homework assignments.

Contribution to Professional Component:

ABET professional component content as estimated by faculty member who prepared this course description:

Engineering Design: 1 credit or 33%
Engineering Science: 2 credits or 67%

Relation of Course to Program Outcomes:

This course provides significant support for:

(1) EE AND CE program objectives for depth and professionalism.
(2) ECE expected learning outcomes: e and j.

Person who prepared this description and date of preparation:

Prepared by: Joseph A. Kelemen Date: 11 January 2007