ECE453

Course Syllabus

1. *Department*: Electrical Engineering *Number*: ECE453 *Credit Hours*: 3
Title: Distribution System Analysis, Design, and Operation *Elective*

2. *Course Description*:
Electric power distribution systems. Load characteristics and representation. Distribution transformers and connections. Capacitive compensation of feeders. Voltage regulation and control. Design of primary distribution systems. Distribution system operation and automation.

3. *Prerequisite(s)*: ECE 305 or equivalent

4. *Textbook(s) and/or other required material*:
Distribution System Modeling and Analysis, by William H. Kersting, 2001, CRC Press

Reference Text:

Electric Power Distribution Systems Engineering, by Turan Gonen, 1986, McGraw-Hill Book Company

5. *Course objectives. By the end of this course, the student should be able to: (use demonstrative verbs)*
1. Explain the principles of design and operation of electric distribution feeders.
2. Apply analytic techniques pertaining to primary distribution systems.
3. Use basic design principles for distribution substations and facilities.
4. Examine primary distribution systems using computer-based modeling.
5. Discuss computational algorithms of distribution system analysis and operation.

6. *Topics covered (number of lectures per topic, based on 45 50-minute lectures per semester)*:
1. Unbalanced three-phase circuits, power and per-unit calculations. (3)
2. Load definitions, characteristics, and uniform/nonuniform distribution models.(5)
3. Series impedance and shunt admittance of overhead and underground feeders, ground effects. (9)
4. Models of distribution feeders, voltage drop and power-loss calculations. (4)
5. Voltage regulators and feeder voltage regulation. (8)
6. Three-phase distribution transformer models. (6)
7. Power-flow calculations for unbalanced three-phase feeders, itrative solutions. (6)
8. Shunt capacitor, voltage regulator models for loss reduction and power flow calculations. (4)

7. *Class/laboratory schedule (sessions per week and duration of each session)*:
Two 75-minute lectures per week

8. *Contribution of this course to the professional component (ABET Criterion 4)*
General comments: None

Professional component	**Course content related to professional component**
Basic math and science, some experimental (1 yr. required).	
Engineering science and design (1.5 yrs. required)	3 hours
General education requirement	

9. *Relationship of this course to program learning outcomes*:
Text description (optional): None

Learning Outcome	**Level of Instruction**	**Course content related to outcome implementation/assessment**
Outcome A	Major	Learn how to model main components of a power distribution system: feeder, loads, transformers.
Outcome B	Basic	Students analyze distribution system data.
Outcome C	Intermediate	Analyze a representative distribution system and make design changes to satisfy a given set of system operating constraints.
Outcome E	Major	Students practice solving problems related to distribution system operation and control.
Outcome F	Intermediate	Responsibility for professional and ethical behavior related to homework assignments and other activities are required.
Outcome G	Basic	Students are required to submit homeworks through which they communicate their knowledge on the subject.
Outcome H	Basic	Discuss system design for its economical and social impacts and the factors involved in decision making.
Outcome I	Major	Importance of professional societies, (such as IEEE) in establishing national standards and engineering standards (ANSI) are discussed.
Outcome J	Basic	Emerging technologies such as distrubuted generation and novel communication systems are discussed.
Outcome K	Major	Students analyze and simulate distribution suystems using MATLAB.

10. *Date of preparation and person(s) who prepared this description*:
John J. Grainger, May 2004