ABET 2000 Course Objectives

Course: EEL 3216 Fundamentals of Power Systems
Credit (Semester Hours): 3
Pre-requisites: EEL 3112 Advanced Circuits with Computers
Subject Area Committee: Power
Course Coordinator(s): Baldwin, Thomas L. and McLaren, Peter

Catalog Description:
Introduction to the fundamentals of energy conversion; structure of power systems; and power system components: transformers, rotating machines, and transmission lines. The operation and analysis of power systems are presented.

Approved Textbooks:
(Required)
ELECTRIC MACHINERY AND POWER SYSTEM FUNDAMENTALS, by Stephen J. Chapman, McGraw-Hill, 2002.

Course Goals Related to Program Education Objectives:
This course is designed to provide students with an understanding of:

- A broad overview of electric power systems including generation, transmission, and distribution
- Basic operation, behavior, and modeling of power transformers, synchronous machines, and transmission lines
- The per-unit system for both single-phase and three-phase systems
- Voltage regulation and efficiency of transformers and transmission lines

Prerequisites by Topic:

- Electric circuits, including three-phase circuits, complex frequency and network functions, and magnetically-coupled circuits
- Electric and magnetic fields
- Electric currents and circuits, and motions of charged particles in fields

Desired Outcomes:
After completing the course, the student will be able to:

1. Analyze the performance of a simple power system with a single source and single load. For this,
   a) Read a single line diagram and construct a single-phase electrical circuit representation of a three-phase system
   b) convert delta connections to wye/star connections
   c) model a load given as a complex power as an impedance
   d) calculate the phase and line voltages in the circuit
   e) calculate the current flows and voltage drops in the circuit
2. Use the per unit system in circuit analysis. For this,
   a) Select an appropriate power and voltage bases
   b) Calculate the impedance and current bases
   c) Adjust the bases across transformers, taking into account the turns ratio
   d) Convert electrical quantities from engineering values to per unit values, and vice versa.
   e) Convert per unit impedances from one base to another
3. Analyze the performance of a piece of power apparatus (transformer, transmission line, synchronous machine)
   a) Form the electrical circuit model of the device
   b) Calculate the efficiency for various loading levels and power factors
   c) Calculate the maximum efficiency and the required loading
   d) Calculate the full-load voltage regulation for various power factors

4. Apply design concepts by specifying the parameters of a piece of power apparatus to meet system design criteria (i.e. specify the transformer ratings to meet voltage regulation requirements)

Instructional Model:
Lectures augmented with computer projection of power point style presentation
Web-based course support – Blackboard, for course information

Laboratory Content:
None.

Specific Design-Related Activities:
None.

Required Computer Utilization:
None.

Effective Technical Communications (ETC) Requirements:
Writing of a short technical paper (3-5 pages) of field tour of local utility power generation and substation facilities.

Assessment Plan:
- Weekly homework
- Two (2) in-class test
- Final examination

Recommended Grading Basis:
- In-class Tests $2 \times 25\%$
- Homework 25%
- Final Exam 25%

Recommended Attendance Policy:
Attendance is mandatory.

Contribution to the Professional Component:
This course provides three credit hours of engineering science.

Objective/Outcome Matrix - EEL 3216

Objective	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1a					3									
1b	2				3									
1c	3				3									
1d	3													
1e	3													
2a	3		3								3			
2b	3										3			
2c	3										3			
2d	3										3			
2e	3										3			
3a	3				3						3			
3b	3				3						3			
3c	3				2						2			
3d	3				3						3			
4	3		3		3									

Key:

A. an ability to apply knowledge of mathematics, science, and engineering
B. an ability to design and conduct experiments, as well as to analyze and interpret data
C. an ability to design a system, component, or process to meet desired needs
D. an ability to function on multi-disciplinary teams
E. ability to identify, formulate, and solve engineering problems
F. an understanding of professional and ethical responsibility
G. an ability to communicate effectively
H. the broad education necessary to understand the impact of engineering solutions in a global and social context
I. a recognition of the need for, and an ability to engage in life-long learning
J. a knowledge of contemporary issues
K. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice
L. a knowledge of probability and statistics as applied to electrical engineering
M. a knowledge of mathematics through differential and integral calculus, basic science, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components
N. a knowledge of advanced mathematics including differential equations, linear algebra, and complex variables and discrete mathematics

Outcomes:

1. if an objective is satisfied weakly – discussed but not in detail
2. if an objective is satisfied at a medium level – covered in lectures but may not be tested in exams
3. if an objective is satisfied strongly – covered in lectures and tested in exams