Philadelphia University

Faculty of Engineering - Department of Electrical Engineering

Course Details:

Title:	Power System Protection (610513)
Prerequisite:	Power System (2) (610412)
Credit Hours:	3 credit hours (16 weeks per semester, approximately 45 contact hours)
Textbook:	"Protective Relaying" J.L. Blackburn, Marcel Dekker, Inc.,3rd edition.2004.
References:	1. A.R.VanC Warington "Protective Relays:Theory and Practice". Chapman and Hall,1982. 2. A.G. Phadke and J.S. Thorp, "Computer Relaying for Power Systems", John Wiley a nd Sons, 1994
Course Description:	The course is a requirement for the electrical engineering students. It introduces the basic philosophy and the principles, operation, and design of power system protection schemes . Students will learn the various types of the old and modern types of protective relays used in protection of power system components. Studying the principles for protecting different elements and studying different technologies used in designing protective relays. And relay coordination with the application of computer programs for protective schemes.

Course Outlines:

Week	Topic
1	Introduction: Introduction and philosophy of power system protection
2,3	Aspects of power system protection: Primary and secondary power system components; Types of faults and abnormalities;
4,5	Protective relays: Types and classifications of relays; Directional and non directional relays.
6	Methods of protection; Protection zones; Primary and backup protections.
7	Instrument transformers; Current and voltage transformers.
8	Protective devices: Fuses and circuit breakers.
9	Overcurrent protection : Type of overcurrent relays ; Instantaneous ; time delay relays; Relay coordination; Applications.
10, 11	Unit protection schemes: Differential protection; Current balanced differential protection; Voltage balanced differential protection ; Percentage biased differential relays.
12, 13	Transmission lines and feeders protection: Overcurrent ; Pilot relaying; Power line carriers(PLC); Distance protection.
14,15	Unit protection schemes: Transformer protection; Generator protection; Motor protection ; Bus bar protection.
16	Computer Applications, and Revision

Course Learning Outcomes with reference to ABET Student Outcomes:

Upon successful completion of this course, student should:

1.	Able to demonstrate knowledge and understanding of the various types of protection systems and appreciate the importance of protective relays in power systems.	[a, c, e]
2.	Compare and contrast the operation of different types of protective schemes.	[a, c, e]
3.	Derive equations related to the different protection methods.	[a ,c, e]
4.	Formulate relevant equivalent circuits of the protection schemes to calculate their actual behavior.	[a, c]
5.	Identify different types of protective relays and their applications and choose among the different types of protection schemes to suit a given application task.	[a, c]
6.	Analyze simple problems related to protection schemes.	[a, c]
7.	Apply engineering studies for different types of power system protection . Interpret results and correlate them with theoretical predictions	[a , c ,e]

Assessment Guidance:

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

Sub-Exams: The students will be subjected to two scheduled written exams, first exam and second exam during the semester. Each exam will cover materials given in lectures in the previous 3-4 weeks.

Quizzes: (3-5) quizzes of (10-15) minutes will be conducted during the semester. The materials of the quizzes are set by the lecturer.

Tutorials, Homework and projects: Lectures will be supplemented with tutorial classes. Four to five tutorial sheets are expected, each including about ten problems. Tutorial classes will be largely problem solving sessions based on converter circuits recently covered. Students will be expected to participate in problem solving efforts vigorously. Questions and clarifications, both by students and the tutor should be treated as desirable aspects of these sessions. Homework should be solved individually and submitted before or on a set agreed date. Student may be assigned to present project(s).

Collective Participation: Brain storming and collective discussions will be carried out during any lecture. Individual student will be assessed accordingly.

Grading policy:

First Exam	20%
Second Exam	20%
Homework and projects	5 %
Quizzes and participation	15%
Final Exam	40%
Total:	100%

Attendance Regulation:

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course. If the excuse is approved by the deanship the student will be considered withdrawn from the course.