Academic Course Description

King Saud University
Electrical Engineering Department

EE342: Electrical Power Laboratory

Second Semester 1425/1426 (2004/2005)

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Text Books: - Electrical Power Laboratory Manual prepared by course instructors

- J. J. Grainger and W.D Stevenson, "Power System Analysis" McGraw Hill.

Support References : Supplementary reading material is included in the Lab Manual.

Pre-requisites: EE 340

Co-requisites : EE 341

Course Objectives: To enhance the student's understanding of the basic concepts of power generation, system operation, protection and control and high voltage testing and evaluation of system components and other associated topics by laboratory experiments and computer simulations. The course also aims to improve the communication, computer and laboratory skills of students and their ability to work in a group environment since the students perform laboratory sessions in group format in the High Voltage Laboratory and Power System Simulation Laboratory of the department.

Topics Covered: Breakdown and dielectric strength of different insulating materials; Flashover tests on insulators; Over-voltage protection and insulation co-ordination; Corona and its effects; Grounding resistance measurements; Characteristics of isolated and interconnected systems; Transmission line characteristics; Characteristics and co-ordination of protective relays; Load flow analysis and simulation.

Class / Tutorial Schedule: A 4-hour lab session per week is assigned for this course. During this session approximately one hour is used for discussion of background, theory and applications of the particular experiment and for pre-lab and post-lab quizzes.

Professional Component Contribution: Students can learn the practical measurement methods and modern simulation tools for solution of problems associated with power generation, transmission, operation and control and protection. They acquire the basic experimental skills of how to plan, approach and deal with real life situations and perform measurements on real and simulated systems in order to understand the design and operating problems of power systems. Students must also utilize knowledge of mathematics, physics, system's control, circuits, computational tools and basic engineering sciences in order to perform measurements, simulations and analysis of a diverse set of power system and high voltage related problems.

Relationship to Program Objectives: This course contributes to the general objectives listed for an Electrical Engineering Department.

Objective A: By teaching the student how to formulate basic problems related to measurements and simulations related to a power system, this course support the objective of producing graduate with a strong foundation in basic sciences.

Objective B: By teaching students how to deal with measurements and simulations of electrical power systems and high voltage networks, the course helps in the department's production of students with a strong foundation in electrical engineering.

Objective C: By motivating and encouraging students in discussions during experiments to get basic information and skills in a group environment and provide individual opinion on alternative methods of measurements, results and simulations as well as sources of errors in measurements, this course supports the objective of producing graduate with good communication skills.

Objective D: By encouraging the students to learn pertinent ethical and professional standards in dealing with choice of various measurement methods and simulation tools, they acquire mutual respect for diverse opinions. Hence, this course supports the objective of providing graduates with a broad based education so that they can appreciate diversity of opinion, better understand ethical issues and develop a more global perspective of the profession.

Objective E: By teaching how to design and implement simple measurement systems and circuits, this course supports the objective of producing graduates with relevant engineering design experience.

Evaluation: In this course, there are 10 experiments, 10 lab reports to be submitted, two- quizzes per experiment, two mid-term exams and a final exam covering both experiments and theory. The grade distribution is as follows:

Pre-lab and Post-lab Quizzes	25%
Class Participation	5%
Mid-Term Exams.	20%
Lab Reports and Lab performance	20%
Final Exam	30%
Total	100%

Challenges and Actions taken to improve the Course: Some basic background and pre-requisite type material are often reviewed during each lab session of the course. Since experiments cover a diverse range of topics in power system and high voltage technology, background and significance of each experiment is discussed and related to practical applications in power system, design, construction and operation. Thus each lab session covers an independent topic in depth with experiments and simulations etc. Students are required to perform experimental work in a group format whereas each student is required to write an independent report.

Weekly Teaching Plan

Week #	Deliverables
1	Introduction to the course and basic overview of aim, objectives and policy
2	Visit to the Power System Simulator Lab and the High Voltage Lab and introduction to the facilities and safety issues regarding the lab use
3	Experiment#1: Characteristics of an isolated synchronous generator
4	Experiment#2: Breakdown characteristics, applications and dielectric strength of insulation materials
5	Experiment#3: Characteristics of inter-connected synchronous generators in a power system
6	Experiment#4: Insulators flashover tests
7	Experiment#5: Performance characteristics of transmission lines and line compensation
8	Experiment#6: Volt-time characteristics, over-voltage protection and insulation co-ordination in high voltage systems
9	Experiment#7: Load flow analysis and simulation in power systems
10	Experiment#8: Detection and characteristics of corona in high voltage systems
11	Experiment#9: Characteristics and co-ordination of protective relays used in power systems
12	Experiment#10: Grounding systems and grounding resistance measurements
13	Both labs are open for all students for review and discussion and questions, etc regarding all experiments
14	Lab exams in both labs

September 19, 2005