

USC EE 599 – Electric Power Distribution Systems Syllabus

Spring 2014

Catalogue Description

Electric power distribution system planning, design and operations; load characteristics and distribution transformers; design of subtransmission lines and distribution substations; primary and secondary feeder design considerations; distribution system voltage regulation, protection and reliability; distributed generation and smart grid application.

Course Objectives

EE 599 – Electric Power Distribution Systems presents a full range of technology and application topics with the goal of providing students a fundamental understanding of one of the major functions of the electric power system – distribution. Students will learn the planning, design, analysis and operational concepts of the distribution system, including considerations of voltage regulation, protection, and reliability as well as application of distributed generation and smart grid technology. Upon completion of the course, students will be able to plan, model, study, and design distribution systems and associated equipment and devices.

Course Scope

Over the last four decades, the electric power industry has been undergoing unprecedented changes resulting from environmental, regulatory, technological, financial, and market conditions and challenges as well as growing electric power usage and coverage. Fundamental in these changes is the heightened need to transform the electric power distribution system creating an efficient and agile electric power delivery system.

The distribution system, with its vast electrical network and hardware infrastructure is one of the most capital and maintenance cost intensive assets of the electric power utility. Distribution system is the link that connects an electric utility to its customers and is the space where power transactions and customer interactions exist. Furthermore, the development of renewable resources and deployment of distributed generation is challenging the integration and bidirectional flow capability of distribution systems. Proper planning, design and study of this asset is at the heart of a modern electric utility and its ongoing process improvement and technology advancement strategic goal. Extensive electrical equipment, control devices, and measurement instrumentation such as transformers, voltage regulators and SCADA are employed to provide the needed infrastructure and technology to accomplish this strategic goal. Smart-grid technology is the newest frontier that is expected to further advance this goal.

To meet the above outlined goals, it is critical that engineers and managers have a fundamental understanding and know the building blocks of electric power distribution system and related technologies. The scope of the course will include the following topics:

- Distribution System Planning and Automation
- Load Characteristics
- Application of Distribution Transformers
- Design of Subtransmission Lines and Distribution Substations
- Design Considerations of Primary Systems
- Design Considerations of Secondary Systems
- Voltage Drop and Power Loss Calculations
- Application of Capacitors to Distribution Systems
- Distribution System Voltage Regulation
- Distribution System Protection
- Distribution System Reliability
- Electric Power Quality
- Distributed Generation

In addition to lectures and discussions, student will be assigned to prepare a team project related to distribution systems.

Prerequisite: EE 443

Instructor: Dr. Mohammed Beshir,
EEB 102C, (213) 740-6433
beshir@usc.edu
Office hours to be determined

TAs: TBD

Text: Electric Power Distribution System Engineering, 2nd Edition
by Turan Gonen;
CRC Press, 2007;
ISBN-10: 142006200X
ISBN-13: 9781420062007

Journal papers will be provided in a course reader.

Grading:	Homework	20%
	Term Paper	20%
	Midterm Exam	30%
	Final exam	30%

Class:	Mondays and Wednesdays	5:00 – 6:20 pm
	Room	ZHS163

Homework

The homework may take one of the three forms: (1) analysis and design issues and problems with numerical answers, (2) compiling news articles or publications on power system planning, design and operations and related policy issues on electric power distribution, or (3) discussion questions concerning the electric power distribution technology and policy issues taken from the readings. These assignments will allow students to integrate the lecture and reading materials as well as current events in a format that demonstrates their knowledge of the material along with their ability to reason and draw appropriate conclusions.

Late homework will not be accepted.

Term Paper

In the first few weeks of the semester, students will be provided detailed information on the term project. Term paper is due on Week 13.

Field Trip

Visit a distribution system facility – ***Friday, April 4, 2014*** (date may change.)

Weekly Course Schedule and Readings

Week 1 (1/13&15/14):	Introduction - Distribution System Planning and Automation – <i>Text Ch 1</i>
Week 2 (1/20&22/14):	Distribution System Planning and Automation – <i>Text Ch 1</i>
Week 3 (1/27&29/14):	Load Characteristics– <i>Text Ch 2</i>
Week 4 (2/3&5/14):	Application of Distribution Transformers– <i>Text Ch 3</i>
Week 5 (2/10&12/14):	Design of Subtransmission Lines and Distribution Substations – <i>Text Ch 4</i>
Week 6 (2/17&19/14):	Design Considerations of Primary Systems– <i>Text Ch 5</i>
Week 7 (2/24&26/14):	Design Considerations of Secondary Systems – <i>Text Ch 6</i>
Week 8 (3/3&5/14):	Voltage Drop and Power Loss Calculations– <i>Text Ch 7</i>
Week 9 (3/10&12/14):	Midterm
Week 10 (3/17&19/14):	Spring Break
Week 11 (3/24&26/14):	Application of Capacitors to Distribution Systems – <i>Text Ch 8</i>
Week 12 (3/31&4/2/14):	Distribution System Voltage Regulation – <i>Text Ch 9</i>
Week 13 (4/7&9/14):	Distribution System Protection – <i>Text Ch 10</i>
Week 14 (4/14&16/14):	Distribution System Reliability – <i>Text Ch 11</i>
Week 15 (4/21&23/14):	Electric Power Quality – <i>Text Ch 12</i>
Week 16 (4/28&30/14):	Distributed Generation – <i>Special Topic</i>
Week 17 (5/5&7/14):	Study Week
Week 18 (5/13/14):	Final Exam

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.