University of Puerto Rico
Mayagüez Campus
College of Engineering

Syllabus & Instructor Information Sheet Form

A. COURSE SYLLABUS

1. General Information:

Course Number: INEL 6077
Course Title: Surge Phenomena in Power Systems
Credit-Hours: 3

2. Course Description:

Generation, propagation and interaction of electrical transients in electric power systems. Analysis of single and multiple transients including three phase and switching transients. Mathematical modeling of transmission lines and other power equipment in the presence of surge phenomena.

3. Pre-requisites: INEL 4103 or equivalent

4. Textbook, Supplies and Other Resources:

Textbook: *Electrical Transients in Power Systems*, 2nd. Ed., by Allan Greenwood; Jonh Willey and Sons, 1991.

References:

1. Technical papers from journals and conferences on power delivery, power systems and power devices and apparatus.
2. *Voltage Stability of Electric Power Systems*, by T. Van Cutsem and C. Vournas, Kluwer Academic Press, 1998

5. Purpose:

The purpose of the course is to prepare students in the analysis of electrical transients and surge phenomena. This course is open to all graduate students.

6. Course Goals:

After completing the course, the student should be able to understand transient phenomena in power systems caused by switching and lightning surges. Also, the student will be able to design protection schemes to mitigate the impact of transients on the power system and apparatus.

7. Requirements:

All students are expected to bring a solid background in Laplace analysis, power system analysis, and electromagnetic concepts applied to transmission lines. Students are expected to learn the basics of the electromagnetic transient program (EMTP) to solve assignments. Usage of software packages such as Matlab will be encouraged to complement the analysis performed using EMTP.

8. Laboratory/Field Work:

No laboratory or field work in this course.

9. Department/Campus Policies:

9a. **Class attendance:** Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies, pp 39 1995-96)

9b. **Absence from examinations:** Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero of "F" in the examination missed. (Bulletin of Information Undergraduate Studies, pp 39, 1995-96)

9c. **Final examinations:** Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies, pp 39, 1995-96).

9d. **Partial withdrawals:** A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies, pp 37, 1995-96).

9e. **Complete withdrawals:** A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies, pp 37, 1995-96).

9f. **Disabilities:** All the reasonable accommodations according to the Americans with Disability Act (ADA) Law will be coordinated with the Dean of Students and in accordance with the particular needs of the student.

9g. **Ethics:** Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

10. General Topics:

1. Review of circuit elements characteristics, basic laws
2. Review of Laplace transform and its application to circuit analysis
3. RC, RL, and LC circuit transients
4. RLC circuit measurements
5. Single and multiple switching transients
6. Three phase and abnormal switching transients
7. Travelling waves on transmission lines, lattice diagrams
8. Lighting surge phenomena
9. Modeling of power apparatus for transient analysis
10. Selection of protective devices for transient events
11. Tests