Course Unit Description - (QUASE)

(Service Quality in Electrical Power Systems)

(Mestrado em Engenharia Electrotécnica - Sistemas Eléctricos de Energia)

Academic year: 2009/2010

Subject group: Sistemas de Energia

	Semestral	Compulsory	
Mode of study	Diurno	**Hours/Week**	**T-**Teórica
Year	1º		**PL-**Prática-Laboratorial
Semester	2º		**OT-**Orientação Tutorial

ECTS 7.5

Objectives

At the end of this unit students should:
• Have developed an integrated perspective about the concepts of Power Systems Quality;
• Be able to solve reliability problems in Power Systems;
• Identify and analyze the degradations of voltage quality;
• Analyze the impact of distributed generation in the Power Quality;

Course Contents

1. Basic concepts, vocabulary and definitions
2. Reliability
2.1 Objectives, techniques.
2.2 Component reliability.
2.3 System reliability
2.4 FaultTree
2.5 Cut sets
2.6 Conditional probability
2.7 Two atmospherics states
2.8 Markov chains
2.9 Reliability analyses in Power Systems
3. Voltage Quality
3.1 Voltage fluctuations
3.2 Harmonics
3.3 Flicker
3.4 Voltage unbalance
3.5 Frequency alterations
3.6 Consequence about weak voltage quality
4. Influence of the distributed generation in Power Quality
4.1 Legal framework
4.2 Types of generators.
4.3 Voltage regulation.
4.4 Short-circuit analysis in the receiving system.
4.5 Transients.
5. Stability problems. Regulation in power quality

Recommended reading

J. Endrenyi, Reliability Modeling in Electrical Power Systems, John Wiley and Sons, New York, 1978
R. Billinton, R. Allan, Reliability Evaluation of Engineering Systems, Concepts and techniques, Second Edition, Plenum, ISBN 0-306-44063-6, New York, 19
R. Billinton, R. Allan, Reliability Evaluation of Power Systems, Pitman Advanced Publishing Program, London, 1984
G. Anders, Probability Concepts in Electric Power Systems, John Wiley and Sons, 1990.
Math H. J. Bollen, Understanding Power Quality Problems – Voltage Sags and Interruptions, IEEE Press, ISBN O-7803-4713-7
Roger C. Dugan, Mark F. McGranaghan, Electrical Power Systems Quality, McGraw-Hill, ISBN 0-07-138622-X
Richard E. Brown, Electric Power Distribution Reliability, Marcel Dekker, Inc., ISBN 0-8247-0798-2, New York
C. Sankaran, Power Quality, CRC Press, ISBN 0-8493-1040-7
J. Schlabbach, D. Blume, Voltage Quality in Electrical Power Systems, ISBN 0-85296-975-9

Teaching Methods

In this course the teaching method consists of three kinds of lecture sessions: theoretical, practice/laboratorial and tutorial collective sessions, organized a
Theoretical classes – These sessions involve conventional lecturing, supported by slide shows about concepts and techniques. Mainly expositive classes.
Practice/laboratorial – Practice classes, where students are invited to solve specific problems related to discipline contents.
Tutorial classes – Students are stimulated to develop the proposed research projects and other problems under teacher´s supervision. Students should w
self-learning environment facing the arising challenges.

Assessment methods

Evaluation during learning period:
Student evaluation in the proposed works.

Evaluation in final examination:
The final examination is composed by two components, one theoretical (60%) and one practical (40%).

A positive evaluation (at least 10 out of 20) must be obtained, with the following conditions:
a) minimum of 5 values in the theoretical component;
b) minimum of 3 values in the pratical component;
c) minimum of 8 values in the final examination;

Course evaluation
50% Evaluation during teaching period + 50% Evaluation in final examination

Mark improvement
This classification is obtained by another examination, similar in structure to the final examination. The evaluation during learning period is considered.

	Name
Teacher responsible:	Fernando Mauricio Teixeira de Sousa Dias (FMD)
Lecturer:	Fernando Mauricio Teixeira de Sousa Dias (FMD) Fernando Manuel Domingues Fernandes (FDF) Teresa Alexandra Ferreira Mourão Pinto Nogueira (TAN)