Bachelor in Energy Engineering

Course information

Year 2020-21

GENERAL SPECIFICATIONS				
English name				
Electric Power Systems				
Spanish name				
Sistemas Eléctricos de Potencia				
Code		**Type**		
606711215		Compulsory		
Time distribution				
	Total	**In class**	**Out class**	
Working hours	150	60	90	
ECTS: 6				
Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4.5		0	0	1.5
Departments		**Knowledge areas**		
Electrical & Thermal Engineering, Design and Projects		Electrical Engineering		
Year		**Semester**		
3º		1º		

TEACHING STAFF			
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SPECIFIC INFORMATION OF THE COURSE
1. Contents description
1.1. In English:
• Analysis and modelling of the electric power system components • Elements of the power system in unbalanced conditions • Fault analysis
1.2. In Spanish
• Análisis y modelado de los componentes de un sistema eléctrico de potencia • Elementos de un sistema de potencia en condiciones no balanceadas • Análisis de faltas
2. Background
2.1. Situation within the Degree:
The Electric Power System course aims to provide its students with a good understanding of the fundamental concepts of power system analysis and their applications to real-world problems, with particular focus on the modelling of the electric power system components.

To help provide this insight, the course uses PowerWorld Simulator to integrate computer-based examples, problems and design projects.

2.2. Recommendations:

Students should have a theoretical knowledge of both DC & AC circuit analysis, as well as knowledge of three-phase electric power.

3. Objectives (as result of teaching):

The objective of this course is to present methods of power system analysis and design with the aid of a personal computer, in sufficient depth to give the student the basic theory at the undergraduate level. The approach is designed to develop students' thinking processes, enabling them to reach a sound understanding of a broad range of topics related to power system engineering, while stimulating their interest in the electrical power industry. Both theory and modelling are developed from simple beginnings so that their knowledge can be extended, allowing them to cope with new and complex situations.

4. Skills to be acquired

4.1. Specific Skills:

- Knowledge of electric power systems

4.2. General Skills:

- Problem solving ability
- Ability to apply knowledge to solve real-world problems
- Attitude of motivation and continuous improvements
- Ability to analyze and summarize
- Ability to think critically
- Develop a critical attitude, being able to analyze and synthesize.
- Develop an attitude of inquiry that permanently enables to review and deepen in the knowledge.
- Acquire Computer and Information Skills (CI2) and apply them working.

5. Training Activities and Teaching Methods

5.1. Training Activities:

- Theory sessions
- Problem solving sessions
- Computer lab sessions
- Other activities like: seminars, conferences, project supervision, tutorials and assessments.

5.2. Teaching Methods:

- Participative master class
- Problem solving class with numerical exercises
- Participative computer simulation class
- Individual and small group tutorials
- Written exams

5.3. Development and Justification:

- Lectures by teacher where the teacher's primary role is to coach and facilitate student learning and overall comprehension of the material.
- Class discussion conducted by teacher where students play an active role in the learning process.
- Practicals using computer-based simulator to help student see the details of how a problem is solved.
- Project-based learning in engineering where students are given a task to solve, involving mostly a background search of an interesting problem or a topic related to the subject.
- Tutorials where small groups of students discuss issues, essays or a topical problem. Also, individual or personal tutorials.

6. Detailed Contents:

1. TRANSFORMER MODEL & THE PER-UNIT SYSTEM
    1.1. Introduction
    1.2. Power transformer
    1.3. The Per-Unit system
    1.4. Regulating transformer
    1.5. Three-Winding transformer
2. TRANSMISSION LINE MODEL
    2.1. Introduction
    2.2. Line parameters
    2.3. Line model
    2.4. Lossless line
    2.5. Line compensation
    2.6. Line transient analysis
3. BALANCED FAUL
    3.1. Introduction
    3.2. Fault far from a generator
    3.3. Fault at the terminal of a generator
    3.4. Balanced three-phase fault
    3.5. Bus impedance matrix
    3.6. Protections
4. UNBALANCED FAULT
    4.1. Introduction
    4.2. Symmetrical components
    4.3. Systematic fault analysis
    4.4. Fault models
    4.5. Systematic faults analysis using bus impedance matrix
5. LABORATORY (Computer simulations)
    5.1. Line model and power flow
    5.2. Power flow control
    5.3. Voltage control of transformer
    5.4. Electromagnetic transients
    5.5. Line flows and losses
    5.6. Balanced three-phase faults
    5.7. Unbalanced faults

7. Bibliography

7.1. Basic Bibliography

- Power System Analysis, S.H. Saadat, McGraw-Hill (2nd-3rd Editions).
- Power System: Analysis & Design, J.D. Glover, T.J. Overbye, M.S. Sarma, Cengage Learning (4th-6th Editions).

7.2. Additional Bibliography:

- Fundamentals of Electric Power Engineering, I.D. Mayergoyz & P. McAvoy, World Scientific.
- Power System Analysis, J.J. Grainger & W.D. Stevenson Jr, McGraw-Hill.

8. Systems and Assessment Criteria

8.1. System for Assessment:

- Written exam. The written examination contains two parts, the first consisting of 40 questions (short answers just a few words, no multiple choice), and the second of 4 problems. This will be the 70% of the final mark i.e. 20% for questions and 50% for problems.
- Laboratory sessions. Computer simulation of electrical power systems employing PowerWorld software. Students will be given a schematic of a power system to be modelled and analysed. This will be the 20% of the final mark.
- Voluntary assignment. Students may or may not undertake a small project where he or she will propose a course-related theme. Any media tool can be employed. No public presentation is required. This will be the 10% of the final mark.

8.2. Assessment Criteria and Marks:

Final results will be given in terms of a numerical scale between 0 and 10 (including tenths), with the corresponding qualitative ratings below:

- ≤4.9: Fail (D)
- 5.0 - 6.9: Pass (C)
- 7.0 - 8.9: Pass with Merit (B)
- 9.0 - 10: Distinction (A)

Students must get a minimum mark of “1” on the questions part, a mark of “2.5” on the problems part and a mark of “1” on the labs, so that, the voluntary assignment can be added to the final mark.

Students may choose to go for just one final assessment. In that case, the question part of the written exam will weight 30% and it will have also an essay-type question (long answer). Students will not have the option to a voluntary assignment (continuous assessment).

The total number of distinctions cannot exceed 5% of the students enrolled in the subject in the academic year (unless the number of students enrolled is lower to 20, in which case one distinction can be awarded).
The grading system is subject to the Bachelor’s Degree Exam Regulations of the University of Huelva (Normativa de Evaluación para las Titulaciones de Grado de la Universidad de Huelva). Please refer to:
http://www.uhu.es/sec.general/Normativa/Texto_Normativa/Normativa_de_Evaluacion_grados.pdf
In particular, please note that make-up exams and other special circumstances will be subject to article 19 of these regulations.