

# **UNIVERSIDAD DE CASTILLA - LA MANCHA**

# **GUÍA DOCENTE**

#### 1. General information

Course: ELECTRICAL ENERGY SYSTEMS			<b>Code:</b> 19561			
Type: ELECTIVE			ECTS credits: 6			
Degree: 384 - MINING AND ENERGY ENGINEERING DEGREE			Academic year: 2020-21			
Center: 106 - SCHOOL OF MINING AND INDUSTRIAL ENGINEERING			Group(s): 51			
Year: 4			Duration: First semester			
Main language: Spanish			Second language: English English Friendly: Y			
Use of additional						
Web site:			Bilingual: N			
Lecturer: RAFAEL ZAR	ATE MIÑANO - Group(s): 51					
Building/Office	Department	Phone number	Email	Office hours		
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### 2. Pre-Requisites

To fulfill the learning objectives of this course, students should have the following knowledge and skills:

- Knowledge of the basic concepts of numerical calculus and its application to engineering topics.

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- Knowledge of computer programming techniques and usage of software with application to engineering topics.

- Knowledge of fundamental concepts on electric energy systems: electric power generation, transmission, sub-transmission, and distribution networks, as well as types of electrical lines and conductors.

- Knowledge of control systems.

#### 3. Justification in the curriculum, relation to other subjects and to the profession

Facilities related to the production, transmission, distribution, and consumption of electric energy conform what are call Electric Energy Systems also known as Power Systems. Electric energy is currently the main energy vector connecting primary energies to end-use energies. Therefore, the knowledge of the configuration, operation, and management of power systems must be a part of the academic training of every graduate in Mining and Energy Engineering specializing in Energy and Fuels.

Along with the courses on Energy Engineering and Renewable Energies Engineering, this course completes the academic training on Energy Technology offered in this degree.

4. Degree competence	s achieved in this course
Course competences	
Code	Description
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
CT00	To promote respect and promotion of Human Rights as well as global access principles and design for everybody according to the 10th final order of the Law 51/2003 of December 2nd; about equal opportunities, non-discrimination and universal accessibility for people with disabilities.
CT02	To be acquainted with Information and Communication Technology ICT
F01	Capacity to know, understand and apply the principles of using, transforming and managing energy resources
F03	Capacity to know, understand and apply the principles of generation industries, transport, transformation and management of thermal and electrical energy
F07	Capacity to know, understand and apply the principles of logistics and energy distribution.

## 5. Objectives or Learning Outcomes

## Course learning outcomes

## Description

Capacity to know, understand and use principles of exploitation, transformation and management of energy resources

Capacity to know, understand and use the principles of generation, transport, transformation and delivery of thermal and elctrical energy industries.

Capacity to know, understand and use the principles of logistics and energy distribution.

### Unit 2: Power systems operation

Unit 3: Economic management of power systems

Unit 4: Technical management of power systems

7. Activities, Units/Modules and Methodology							
Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON- SITE]	Lectures	CB03 CB04 CT00 CT02 F01 F03 F07	0.9	22.5	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CB03 CB04 CT00 CT02 F01 F03 F07	0.3	7.5	Y	N	
Computer room practice [ON-SITE]	Practical or hands-on activities	CB03 CB04 CT00 CT02 F01 F03 F07	0.3	7.5	Y	N	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	CB03 CB04 CT00 CT02 F01 F03 F07	0.6	15	N	-	
Writing of reports or projects [OFF- SITE]	Self-study	CB03 CB04 CT00 CT02 F01 F03 F07	0.8	20	Y	Ν	
Practicum and practical activities report writing or preparation [OFF- SITE]	Self-study	CB03 CB04 CT00 CT02 F01 F03 F07	0.8	20	Y	N	
Study and Exam Preparation [OFF- SITE]	Self-study	CB03 CB04 CT00 CT02 F01 F03 F07	2	50	N	-	
Progress test [ON-SITE]	Assessment tests	CB03 CB04 CT00 CT02 F01 F03 F07	0.3	7.5	Y	Y	
Total:			6	150			
Total credits of in-class work: 2.4							Total class time hours: 60
Total credits of out of class work: 3.6							Total hours of out of class work: 90

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System						
Evaluation System	Continuous assessment	Non- continuous evaluation*	Description			
Progress Tests	50.00%	50.00%	Understanding of concepts and procedures will be assessed by means of writing tests.			
Assessment of activities done in the computer labs	25.00%	25.00%	Both, attendance and performance in lab sessions, as well as the development of the corresponding report will be assessed.			
Assessment of problem solving and/or case studies	25.00%	25.00%	Submitted materials and, in this case, their defense/presentation will be assessed			
Total:	100.00%	100.00%				

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

### Evaluation criteria for the final exam:

### Continuous assessment:

The grading of all graded tasks will consist in a numerical value between 0 and 10. The student must have a final grade greater or equal to 5.0 to pass the course. The final grade will be obtained according to the following assessment system:

- Arithmetic mean of the grades obtained in the progress tests. The grade obtained in each progress test must be greater or equal to 5.0. The resulting mean will represent 50% of the final grade of the course. There will be an opportunity to retake the progress tests with grades lower than 5.0 by means of a writing test that will take place the day assigned to the regular term exam of the course.

- Grade obtained in lab activities. This grade will represent 25% of the final grade of the course. Students who want to improve their grades in these activities will have the opportunity by means of a writing test that will take place the day assigned to the regular term exam of the course.

- Grade obtained in the assignment. This grade will represent 25% of the final grade of the course. Students who want to improve their grades in this activity will have the opportunity by means of a writing test that will take place the day assigned to the regular term exam of the course.

## Non-continuous evaluation:

Evaluation criteria not defined

### Specifications for the resit/retake exam:

The resit exam will consist in a single writing test by means of which the student will have the opportunity to retake all graded activities of the course. The grading of this exam will consists in a numerical value between 0 and 10. A grade greater or equal to 5.0 must be obtained to pass the course.

### Specifications for the second resit / retake exam:

The second resit exam will consist in a single writing test by means of which the student will have the opportunity to retake all graded activities of the course. The grading of this exam will consists in a numerical value between 0 and 10. A grade greater or equal to 5.0 must be obtained to pass the course.

9. Assignments, course calendar and important dates					
Not related to the syllabus/contents					
Hours	hours				
Unit 1 (do 4), Dowor ovotomo configuration					
Unit 1 (de 4): Power systems configuration					
Unit 1 (de 4): Power systems configuration		Hours			
Unit 1 (de 4): Power systems configuration Activities		Hours			
Unit 1 (de 4): Power systems configuration Activities Class Attendance (theory) [PRESENCIAL ][Lectures]		Hours 6.25			

Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	3
Writing of reports or projects [AUTÓNOMA][Self-study]	10
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
Progress test [PRESENCIAL][Assessment tests]	2.5
Unit 2 (de 4): Power systems operation	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	6.25
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	3
Writing of reports or projects [AUTÓNOMA][Self-study]	10
Study and Exam Preparation [AUTÓNOMA][Self-study]	15
Progress test [PRESENCIAL][Assessment tests]	2.5
Unit 3 (de 4): Economic management of power systems	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3.75
Computer room practice [PRESENCIAL][Practical or hands-on activities]	3.75
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	4.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]	10
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Progress test [PRESENCIAL][Assessment tests]	1.25
Unit 4 (de 4): Technical management of power systems	
Unit 4 (de 4): Technical management of power systems Activities	Hours
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures]	Hours 5
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	<b>Hours</b> 5 3.75
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities]	Hours 5 3.75 3.75
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	Hours 5 3.75 3.75 4.5
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]	Hours 5 3.75 3.75 4.5 10
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study]	Hours 5 3.75 3.75 4.5 10 10
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests]	Hours 5 3.75 3.75 4.5 10 10 10 1.25
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity	Hours 5 3.75 3.75 4.5 10 10 10 1.25
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity Activities	Hours 5 3.75 3.75 4.5 10 10 10 1.25 hours
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity Activities Class Attendance (theory) [PRESENCIAL][Lectures]	Hours 5 3.75 3.75 4.5 10 10 10 1.25 <b>hours</b> 22.5
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	Hours 5 3.75 3.75 4.5 10 10 10 1.25 <b>hours</b> 22.5 7.5
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities]	Hours 5 3.75 3.75 4.5 10 10 10 1.25 hours 22.5 7.5 7.5 7.5
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Coroup tutoring sessions]	Hours 5 3.75 3.75 4.5 10 10 10 1.25 hours 22.5 7.5 7.5 7.5 7.5 15
Unit 4 (de 4): Technical management of power systems Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Practical or hands-on activities] Group tutoring sessions [PRESENCIAL][Group tutoring sessions] Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study] Study and Exam Preparation [AUTÓNOMA][Self-study] Progress test [PRESENCIAL][Assessment tests] Global activity Activities Class Attendance (theory) [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Lectures] Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises] Computer room practice [PRESENCIAL][Coroup tutoring sessions] Writing of reports or projects [AUTÓNOMA][Self-study]	Hours 5 3.75 3.75 4.5 10 10 10 10 1.25 hours 22.5 7.5 7.5 7.5 15 20
Unit 4 (de 4): Technical management of power systems         Activities         Class Attendance (theory) [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Practical or hands-on activities]         Group tutoring sessions [PRESENCIAL][Group tutoring sessions]         Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]         Study and Exam Preparation [AUTÓNOMA][Self-study]         Progress test [PRESENCIAL][Assessment tests]         Global activity         Activities         Class Attendance (theory) [PRESENCIAL][Practical or hands-on activities]         Group tutoring and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Practical or hands-on activities]         Group tutoring sessions [PRESENCIAL][Group tutoring sessions]         Writing of reports or projects [AUTÓNOMA][Self-study]         Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]	Hours           5           3.75           3.75           4.5           10           10           125           hours           22.5           7.5           15           20           20
Unit 4 (de 4): Technical management of power systems         Activities         Class Attendance (theory) [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Practical or hands-on activities]         Group tutoring sessions [PRESENCIAL][Group tutoring sessions]         Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]         Study and Exam Preparation [AUTÓNOMA][Self-study]         Progress test [PRESENCIAL][Assessment tests]         Global activity         Activities         Class Attendance (theory) [PRESENCIAL][Practical or hands-on activities]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Practical or hands-on activities]         Group tutoring sessions [PRESENCIAL][Group tutoring sessions]         Writing of reports or projects [AUTÓNOMA][Self-study]         Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]         Study and Exam Preparation [AUTÓNOMA][Self-study]	Hours           5           3.75           3.75           4.5           10           10           125           hours           22.5           7.5           15           20           20           50
Unit 4 (de 4): Technical management of power systems         Activities         Class Attendance (theory) [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Practical or hands-on activities]         Group tutoring sessions [PRESENCIAL][Group tutoring sessions]         Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]         Study and Exam Preparation [AUTÓNOMA][Self-study]         Progress test [PRESENCIAL][Assessment tests]         Global activity         Activities         Class Attendance (theory) [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Lectures]         Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]         Computer room practice [PRESENCIAL][Practical or hands-on activities]         Group tutoring sessions [PRESENCIAL][Procup tutoring sessions]         Writing of reports or projects [AUTÓNOMA][Self-study]         Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]         Study and Exam Preparation [AUTÓNOMA][Self-study]         Progress test [PRESENCIAL][Assessment tests]	Hours 5 3.75 3.75 4.5 10 10 10 1.25 <b>hours</b> 22.5 7.5 7.5 7.5 7.5 15 20 20 20 50 7.5

10. Bibliography and Sources							
Author(s)	Title/Link	Publishing house Citv	ISBN	Year	Description		
B04. Antonio J. Conejo y Luis Baringo	Power System Operations	Springer	978-3-319-69406-1	2018	Bibliografía complementaria		
B01. Antonio Gómez-Expósito, Antonio J. Conejo, y Claudio Cañizares (Coord.)	Electric Energy Systems	CRC Press	978-0849373657	2008	Bibliografía complementaria		
B02. Antonio Gómez Expósito (Coord.)	Análisis y Operación de los Sistemas de Energía Eléctrica	Hill/Interamericana de España, S.A.U.	978-8448135928	2002	Bibliografía complementaria		
B03. Fermín Barrero	Sistemas de Energía Eléctrica	Paraninfo	978-8497322836	2010	Bibliografía complementaria		
B00. Rafael Zárate Miñano	Apuntes de la asignatura https://campusvirtual.uclm.es				Bibliografía básica		