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Faculty: ETSI

GENERAL SPECIFICATIONS

COURSE 24/25

Subject Data

Name:
ELECTROTECNIA E INSTALACIONES ELÉCTRICAS
English name:
Electrical Technology and Installations

Code:	**Type:**
606110208	Obligatoria

Hours:

	Total	**In class**	**Out class**
Time distribution	150	60	90

ECTS:

Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4.5		1.5		

Departments:	**Knowledge areas:**
Ingeniería Eléctrica, Térmica, de Diseño y Proyectos	Ingeniería Eléctrica
Year:	**Semester**
2	2

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TEACHING STAFF

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Others Data (Tutoring, schedule...)

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SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

- Circuit devices.
- Circuit analisys methods.
- Steady state alternating current.
- Components of an electric network.
- Indoor electrical installations.
- Safety and protection at electrical installations.

1.2 In Spanish:

- Elementos de circuitos.
- Técnicas de análisis de circuitos.
- Corriente alterna en estado estacionario.
- Constitución de la red eléctrica.
- Instalaciones eléctricas de interior.
- Protección y seguridad en las instalaciones eléctricas.

2. Background:

2.1 Situation within the Degree:

This subject offers the student of Agricultural Engineering the possibility of knowing electrical technology and electrical installations, so important in any field of engineering, including Agricultural Engineering, since in any agricultural or livestock farm the use of electricity in all kinds of tasks.
It is in the 2nd semester of the 2nd year, so that the students have already acquired a minimum knowledge of mathematics and physics necessary to work on this subject.
On the other hand, after completing the subject, students will have the necessary knowledge for subsequent subjects.

2.2 Recommendations

It is recommended that the student has passed, or studied sufficiently, the first-year Mathematics and Physics subjects, and especially the topics corresponding to solving systems of equations, derivatives, integrals, and electric fields.

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3. Objectives (as result of teaching, or skills or abilities and knowledge):

• Know how to analyze electrical circuits of direct, alternating and three-phase current.
• Know the main components of alternating current and three-phase electrical installations.
• Know the main electrical machines, such as transformers and asynchronous motors.
• Know how to measure electrical magnitudes in electrical installations.

4. Skills to be acquired

4.1 Specific Skills:

C07: Ability to know, understand and use the principles of rural engineering: calculation of structures and construction, hydraulics, motors and machines, electrical engineering, technical projects.

4.2 General, Basic or Transversal Skills:

G01: Ability to solve problems.
G04: Ability to apply knowledge in practice.
G05: Ability to work in a team.
G07: Analysis and synthesis capacity.
G17: Capacity for critical reasoning.
CT2: Development of a critical attitude in relation to the capacity for analysis and synthesis.
CT3: Development of an attitude of inquiry that allows the review and permanent advancement of knowledge.

5. Training Activities and Teaching Methods

5.1 Training Activities:

- Theory sessions on the contents of the program
- Problem solving sessions
- Practice sessions in specialized laboratories or in computer rooms
- Academically Directed Activities by the Faculty: seminars, conferences, work development, debates, collective tutorials, evaluation and self-assessment activities...
- Individual/autonomous student work

5.2 Teaching Methods::

- Participatory master class
- Development of practices in specialized laboratories or computer rooms in small groups
- Troubleshooting and practical exercises
- Individual or collective tutoring. Direct teacher-student interaction
- Assessments and Exams

5.3 Development and Justification:

THEORY SESSIONS: A general and systematic vision of the topics will be offered, highlighting their most important aspects, offering the student motivation, dialogue and exchange of ideas. The theoretical classes will take place in the classroom. Numerical problem solving will be included at appropriate times to reinforce theoretical concepts. The video projector will be used as a means of projection and the blackboard as a means of support. The student will be provided with abundant study material for the subject, both complete notes on the topics and other documentation of interest, including links to web pages related to the subject.

LABORATORY PRACTICE SESSIONS: In this matter, an extensive application of the theory studied in the laboratory is essential, since some of the objectives of the subject, such as knowing how to measure electrical magnitudes and learning the necessary discipline and prudence in handling circuits electrical, can only be obtained in the laboratory. In these practices, students must carry out certain assemblies and measurements, normally in small groups of between 2 and 4 people. From the beginning of the semester, a list of scripts of the practices to be carried out will be made available to the students so that they can prepare previously. The practical sessions will be 1.5 hours. Attendance at all laboratory practices is not mandatory to pass the subject, but it will be necessary to have attended a minimum of 70% to be able to take the practical exam.

6. Detailed Contents

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1. CIRCUITS ELEMENTS
   - 1.1. Introduction.
   - 1.2. Current intensity, voltage and power.
   - 1.3. Passive elements: resistors, capacitors and coils.
   - 1.4. Active elements: independent voltage sources.
   - 1.5. Circuit topology: knots, branches, loops and meshes.

2. CIRCUIT ANALYSIS
   - 2.1. Kirchhoff's laws
   - 2.2. Association of elements.
   - 23. mesh analysis
   - 2.4. Principle of linearity
   - 2.5. Thévenin's theorem
   - 2.6. Maximum power transfer theorem.

3. ALTERNATING CURRENT CIRCUITS
   - 3.1. periodic waveforms.
   - 3.2. Effective value.
   - 3.3. Phasor representation.
   - 3.4. Impedance and admittance.
   - 3.5. Analysis of alternating current circuits.

4. POWER IN ALTERNATING CURRENT CIRCUITS
   - 4.1. Instant power.
   - 4.2. Active, reactive, apparent and complex powers.
   - 4.3. power factor. Reactive power compensation.
   - 4.4. Measurement of electrical power. Wattmeters.
   - 4.5. Measurement of electrical energy. Accountants.

5. THREE-PHASE CIRCUITS
   - 5.1. Three-phase systems. Phase and line voltages and currents.
   - 5.2. Analysis of balanced triphasic circuits.
   - 5.3. Power in three-phase circuits.
   - 5.4. Power factor correction.
   - 5.5. Power measurement in three-phase circuits.

6. ELECTRICAL MACHINES: TRANSFORMER
   - 6.1. Introduction. Electric machines. magnetic circuits.
   - 6.2. ideal transformer.
   - 6.3. actual transformer. equivalent circuits. Constructive features.
   - 6.4. Tests to determine parameters.
   - 6.5. Voltage drop in a transformer.
   - 6.6. Losses and performance.

7. ELECTRICAL MACHINES: INDUCTION MOTOR
   - 7.1. Introduction. Engine types.
   - 7.2. Construction characteristics and operating principle of the asynchronous machine.
   - 7.3. equivalent circuit. Essays.
   - 7.4. power and torque
   - 7.5. Starting and speed regulation.
   - 7.6. Technical features and nameplate.

8. LOW VOLTAGE ELECTRICAL INSTALLATIONS
   - 8.1. Transportation and distribution network.
   - 8.2. General characteristics of Low Voltage lines.
   - 8.3. Calculation of conductor sections.
   - 8.4. Low Voltage electrical switchgear.
   - 8.5. Protection of facilities.

LABORATORY PRACTICES.
   1. Association of resistances. Ohm's and Kirchhoff's laws.
   2. Capacitor and coil: Behavior in d.c. and c.a. Principle of linearity.
   3. Thevenin equivalent of a circuit. Maximum power transfer.

4. Alternating current. Oscilloscope. RC, RL and RLC loads.
5. Power measurement and power factor correction.
6. Three-phase circuits. Star and delta connection.
7. Three-phase circuits. Power measurement and reactive compensation.
8. Transformers. Three-phase motor.
9. Protections in electrical installations.

7. Bibliography

7.1 Basic Bibliography:

- "Circuitos Electricos". James W Nilsson. Pearson Educación, 2006.
- "Introducción al análisis de circuitos". Robert Boylestand. Pearson Prentice Hall, 2011.
- "Electromagnetismo y circuitos eléctricos". Jesús Fraile Mora. McGraw-Hill, 2005.
- "Circuitos eléctricos". J. A. Edminister, Mahmood Nahvi. Serie Schaum, McGraw-Hill. 2005.
- "Análisis básico de circuitos eléctricos". D. E. Johnson, J. L. Hilburn, J. R. Johnson. Prentice-Hall Hispanoamericana S. A. 1997.
- "Análisis de circuitos en ingeniería". W. H. Hayt, J. E. Kemmerly. McGraw-Hill. 2012.
- "Análisis básico de circuitos eléctricos y electrónicos". T. Ruiz Vázquez, et. al. Pearson–Prentice Hall. 2004.
- "Máquinas eléctricas". Jesús Fraile Mora. Editorial McGraw-Hill, 2008.
- "Máquinas eléctricas". S. J. Chapman, Editorial McGraw-Hill, 2005.

7.2 Additional Bibliography:

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- "Pinciples of electric circuits". Thomas L. Floyd. Prentice-Hall. 2007.
- "Electric circuits". Norman Balabanian. McGraw Hill. 1994.
- "Electric circuits". David A. Bell. Prentice Hall. 1998.
- "Introduction to electric circuits". R.C. Dorf, J.A. Svoboda. Wiley. 2010.
- "Electrical circuits and systems". A. M. Howatson. Oxford University Press. 1996.
- "Higher electrical principles". D.C. Green. Adison Wesley Longman. 1997.
- "Electrotecnia práctica". Alcántara Benjumea, Flores Garrido, Pérez Litrán, Pérez Vallés, Prieto Thomas, Rodríguez Vázquez, Salmerón Revuelta, Sánchez Herrera. Servicio de Publicaciones de la Universidad de Huelva. 2004.

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8. Systems and Assessment Criteria

8.1 System for Assessment:

- Theory exam/problems
- Practice Exam
- Individual student monitoring

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Convocatory I

The continuous evaluation will be carried out based on the results of the practical exam and partial written exams on theory and problems. The weight of the evaluation activities is as follows:

• Partial written exam on theory and problems (40%) on topics 1 to 4.

• Partial written exam on theory and problems (40%) on topics 5 to 8.

• Practical exam (20%).

WRITTEN EXAMS OF THEORY AND PROBLEMS (40%+40%): Each exam will consist of solving 3-4 blocks of theoretical-practical questions on the subject's agenda. The acquisition of skills CT2, CT3, C07, G01, G04, G07 and G17 will be evaluated with this exam.

PRACTICE EXAM (20%): If you do not attend a minimum of 70% of the laboratory practices, you will not be able to take the practical exam. This exam will be done only once, at the end of the semester. In the event of having attended the practices and not having taken the practical exam, if the final written exam is passed and the total mark does not reach 5 points, you will have the right to take the practical exam later. The practical note is maintained in future calls. The skills CT2, CT3, C07, G04 and G05 will be evaluated with this exam.

To pass the subject, the sum of both theory and problem exams must reach a pass (obtain a percentage of 40% by adding both). Once the theory item is approved, the mark obtained in practices is added. A total grade of 5 out of 10 must be obtained to pass the subject.

Students who opt for continuous assessment and attend the first partial are excluded from being able to switch to the single assessment modality.

8.2.2 Examinations Convocatory II

In Convocatory II the evaluation will be carried out in a single academic act consisting of a Theory Exam and a Practice Exam. The weight of the evaluation activities is as follows:

• Partial written exam on theory and problems (80%) about topics 1 to 8.

• Practical exam (20%).

To pass the subject they must obtain a total score of five (5 points, 50%) with the condition of passing both the theory and practical exams. The tests are described below: 1.- The written test will consist of solving 3-4 blocks of theoretical-practical questions on the subject's agenda (8 points, 80%). It will take place in a classroom and the duration will be three hours. 2.- The practical test will be carried out in the practical laboratory (2 points, 20%). The duration of this test will be half an hour.

Students who have passed the practice exam of Call I can choose to keep said grade and not take the practice exam in this call.

8.2.3 Examinations Convocatory III

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In Convocatory III the evaluation will be carried out in a single academic act consisting of a Theory Exam and a Practice Exam. The weight of the evaluation activities is as follows:

- Partial written exam on theory and problems (80%) about topics 1 to 8.
- Practical exam (20%).

To pass the subject they must obtain a total score of five (5 points, 50%) with the condition of passing both the theory and practical exams. The tests are described below: 1.- The written test will consist of solving 3-4 blocks of theoretical-practical questions on the subject's agenda (8 points, 80%). It will take place in a classroom and the duration will be three hours. 2.- The practical test will be carried out in the practical laboratory (2 points, 20%). The duration of this test will be half an hour.

Students who have passed the practice exam of Call I can choose to keep said grade and not take the practice exam in this call.

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8.2.4 Extraordinary Convocatory

In the extraordinary Convocatory, the evaluation will be carried out in a single academic act consisting of a Theory Exam and a Practice Exam. The weight of the evaluation activities is as follows:

- Partial written exam on theory and problems (80%) about topics 1 to 8.
- Practical exam (20%).

To pass the subject they must obtain a total score of five (5 points, 50%) with the condition of passing both the theory and practical exams. The tests are described below: 1.- The written test will consist of solving 3-4 blocks of theoretical-practical questions on the subject's agenda (8 points, 80%). It will take place in a classroom and the duration will be three hours. 2.- The practical test will be carried out in the practical laboratory (2 points, 20%). The duration of this test will be half an hour.

Students who have passed the practice exam of Call I can choose to keep said grade and not take the practice exam in this call.

8.3 Single Final Evaluation:

The students who take advantage of a single evaluation will have to carry out a single academic act. The weight of the evaluation activities is as follows:

- Partial written exam on theory and problems (80%) about topics 1 to 8.
- Practical exam (20%).

To pass the subject they must obtain a total score of five (5 points, 50%) with the condition of passing both the theory and practical exams. The tests are described below: 1.- The written test will consist of solving 3-4 blocks of theoretical-practical questions on the subject's agenda (8 points, 80%). It will take place in a classroom and the duration will be three hours. 2.- The practical test will be carried out in the practical laboratory (2 points, 20%). The duration of this test will be half an hour.

Students who, having attended the practices, have passed the practice exam for Call I can choose to keep said grade and not take the practice exam in this call.