DEGREE CURRICULUM

ELECTRICAL ENGINEERING BASICS

Coordination: SAIZ VELA, ALBERT

Academic year 2021-22

ELECTRICAL ENGINEERING BASICS 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>ELECTRICAL ENGINEERING BASICS</td></tr>
<tr><td>Code</td><td>102336</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's degree in Industrial Organization and Logistics Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Not informed</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Number of groups</td><td>3</td><td>2</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>SAIZ VELA, ALBERT</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>30 hours on-line learning (Theory) + 45 hours of self-guided work
20 hours classroom attendance (Praula) + 30 hours of self-guided work
10 hours classroom attendance (Pralab) + 15 hours of self-guided work

TOTAL -> 6 ECTS credits (60h classroom attendance/on-line learning + 90h self-guided work)</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan
Some educational lectures can be written in Spanish or English</td></tr>
<tr><td>Distribution of credits</td><td>3 credits (Theory) + 2 credits (Praula) + 1 credit (Pralab)

Theory -> Theory Class
Praula -> Class of Problems / Classroom practices
Pralab -> Practices in the laboratory</td></tr>
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ELECTRICAL ENGINEERING BASICS 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
SAIZ VELA, ALBERT	albert.saiz@udl.cat	10	

Subject's extra information

You can find educational lectures on the Virtual Campus: http://cv.udl.cat

The use of the Virtual Campus is fundamental to access the resources of the subject, to notifications about the dates of delivery of exercises, delivery of practices and evaluation tests.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

There will be a specific service for the *Campus Universitari d'Igualada*.

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

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Learning objectives

Once the course has been finished and passed, students should be able to:

- To know the operation of passive electrical components in DC (direct current) and AC (alternating current).
- Understand the basics, laws and basic methods in order to analyze and solve electrical circuits in direct current (DC) and alternating current (AC).
- Understand the physical laws and operational principles of electric machines (electric motors and transformers, single-phase and three-phase circuits with relays, etc.).
- Solve simple problems where transformers and single-phase and three-phase electric machines appear, taking into account the equivalent circuit model.
- Understand and know how to use the different measuring devices that are found in an electricity laboratory.
- Use of the scientific terminology associated with the subject in English.
- Work in a team by doing a division and distribution of appropriate tasks and solve any conflict that may arise when performing the different tasks assigned.

Competences

General competences

B01 That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of his/her field of study.

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

B03 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

B04 That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

B05 That students havedeveloped those learning skills necessary to undertake further studies with a high degree of autonomy.

Transversal competences

CT2. To develop meaningful command of a foreign language, especially English.

CT4. To apply basic knowledge of entrepreneurship and professional environments.

CT5. To apply essential notions of scientific thinking.

General competences

CG1. To conceptualize the drafting, signing and development of projects in the field of engineering in industrial organization, which have as their object, according to the specific technology training, the construction, reform, repair, conservation, demolition, manufacture, installation, assembly or exploitation of:structures, mechanical equipment, energy facilities, electrical and electronic installations, industrial facilities and processes and manufacturing and automation processes.

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To solve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical Engineering.

CG5. To carry out measurements, calculations, valuations, appraisals, surveys, studies, reports, work plans and

other analogous work.

CG6. To implement specifications, regulations and mandatory rules.

CG10. To work in a multilingual and multidisciplinary environment.

CG11. To understand and apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer.

Specific competenes

CE10. To implement the principles of circuit theory and electrical machines.

Subject contents

T1 Ideal components in Theory of Circuits: Kirchoff's Laws

- Electrical circuit: definition
- Design of electrical circuits
- Methods and techniques to solve electrical circuit design
- Electrical current
- Coulomb's Law
- Voltage
- Power and Energy
- Conservation of energy
- Fundamental magnitudes
- Units: Multiples and sub-multiples
- Active and passive components
- Analysis of circuits
- Kirchoff's Laws
- Mathematical model of an electrical circuit

T2 Steady-state direct current (DC)

- Electrical magnitudes of steady-state direct current
- DC response of ideal elements (R,L,C)
- Serial and parallel associations
- Voltage and current dividers

T3 Theory of electrical networks and Analysis of circuits

- Analysis of circuits
- Method of node voltages
- Method of mesh currents
- Millman's theorem
- Superposition principal
- Transformation of sources
- Equivalents of Thevenin and Norton
- Transfer of the maximum power

T4 Single-phase alternating current (AC)

- Sinusoidal signals
- Phasors. Phasographic diagrams.
- Passive elements of the circuit in the frequency domain.
- Kirchoff's laws in a permanent sinusoidal regime.
- Simplifications series, parallel and delta-star.
- Transformation of sources and equivalent circuits.
- Application of the method of node voltages and mesh currents.

T5 Power in single-phase alternating current (AC) systems

- Instantaneous, medium and effective power.
- The effective value in power calculations.
- Complex power
- Transfer of the maximum power.
- Theorem of Boucherot

T6 Three-phase alternating current (AC) systems

- Balanced three-phase voltages.
- Three phase voltage sources.
- Analysis of combinations of delta-star circuits.
- Power calculations in three-phase circuits.

T7 Introduction to electrical machines

- Transformers: basic operation
- Single-phase and three-phase alternating current motors
- DC motors
- Other types of motors

Methodology

The teaching methodology is divided into four different strategies depending on the teaching-learning activities to be carried out:

Master class / **Participative exhibition sessions**: Sessions where the learning process is centered on the oral presentation by the teacher about the contents of the subject. The exhibition is done using the blackboard and / or computer resources. When transparencies are used, they will be previously available in the virtual campus of the UdL. Short-term activities will be introduced to encourage debate and student participation.

Problem solving: Sessions related to solving exercises and / or carrying out work where the learning process is centered on the students. A problem or exercise is posed and the students are responsible for solving it by applying routines, formulas, the application of procedures and / or carrying out simulations. The students will carry out these tasks both individually and as a team. For group activities, strategies to encourage cooperative work will be used.

Practical sessions: These sessions will be held in the computer room and in the laboratory of the subject in relation to the activities of simulation and / or implementation of the practical activities of the subject in the laboratory.

In order to carry out the implementation of the described methodology a blended-learning system will be used. THEORY activities will be taught through an on-line platform whereas PRAULA and PRALAB activities will be taught in the Campus facilities.

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Note: Because to the current pandemic situation, the 21/22 academic year has been planned in a 50% in-person classes, 50% on-line classes and in-person exams. Due to the virus nature, it might be significant outbreaks that limit the people's mobility (throughout the whole territory or in specific areas). For this reason, the 21/22 academic year planning and teaching methodology is susceptible to modifications conditioned by the pandemic evolution.

Development plan

Week	Content	Methodology	Blended learning (50%-50%)	Self-guided work
1-2-3	T1,T2	Master class / Problem solving	12h	18h
4	T1,T2	Master class / Problem solving+ **Lab 1**	4h	6h
5	T3	Master class / Problem solving	4h	6h
6	T3	Master class / Problem solving + **Lab 2**	4h	6h
7	T3	Master class / Problem solving	4h	6h
8	T4	Master class / Problem solving+ **Lab 3**	4h	6h
9	Examen 1r parcial		2h	3h
10-11	T5,T6	Master class / Problem solving	8h	12h
12	T6	Master class / Problem solving + **Lab 4**	4h	6h
13-14	T6,T7	Master class / Problem solving	8h	12h
15	T7	Master class / Problem solving + **Lab 5**	4h	6h
16	Examen 2n parcial		2h	3h

TOTAL hours Campus/ on-line --> 60h (30h Campus facilites - 30h on-line) / **TOTAL hours self-guided work** --> 90h

Evaluation

The process of evaluation of the subject follows the system of continuous evaluation and will consist of the following activities:

- **EX1** Exam (theory and problems) 1st part (Weight in the final evaluation -> 30%) (2 hours)
- **EX2** Exam (theory and problems) 2nd part (Weight in the final evaluation -> 50%) (2h duration)
- **LAB** Assessable practices / Laboratory reports (Weight in the final evaluation -> 10%)
- **PRO** Resolution of questionnaires in class, problems / simulation of exercises via virtual campus, tests, work to be delivered on a specific date, etc ... (Weight in the final evaluation -> 10%)

The FINAL Grade of the subject is determined by the following formula:

FINAL Grade= 0.30 **x EX1 +** 0.50 **x EX2 +** 0.10 **x PRO +** 0.10 **x LAB**

- In order for the **EX1** and **EX2** exams to be included in the FINAL Grade formula, the minimum mark obtained in each exam should be **> = 3.5 (greater or equal to 3.5)**.
- Students have the right to recover any evaluation activity that is equal to or greater than 30% of the final mark in a subject or subject, except for the practices of the subject, if applicable (according to the assessment regulations and qualification of the UdL).
- In no case any **PRO** and /or **LAB** activity can be deliverded in the Recovery evaluation period in order to be evaluated during this period.
- The subject is passed when FINAL Grade > = 5 greater or equal to 5).

Bibliography

Basic

• Circuitos Eléctricos. James W. Nilsson, Susan A. Riedel. Pearson, Prentice Hall

Additional

• Problemas resueltos de Fundamentos de ingeniería eléctrica. Guillermo Robles Muñoz. Paraninfo.

• Circuitos Eléctricos. Problemas y ejercicios resueltos. Julio Usaola. Prentice Hall.

• Análisis de Circuitos en Ingeniería. William H.Hayt, Jack E. Kemmerly y Steven M.-Durbin. Prentice Hall

• Electrotecnia. Pablo Alcalde. Thomson Paraninfo.

• Máquinas Eléctricas- Jesús Fraile Mora. Mc Graw Hill.

• Máquinas Eléctricas. Stephen J. Chapman. Mc Graw Hill