ELECTRICITY AND MAGNETISM A

LEARNING OUTCOMES

A. GENERAL LEARNING OBJECTIVE

At the end of the course, the student will be able to apply the basic laws of electricity and associated phenomena to describe the behavior of resistive and capacitive elements in electrical circuits using a project-based approach.

B. EDUCATIONAL CONTENTS

STUDENT OUTCOMES TO WHICH THE TRAINING SPACE CONTRIBUTES.

Specific student outcomes	1.- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. 2.- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. 6.- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
Student outcomes of emphasis	Does not apply

PERFORMANCE INDICATORS, SKILLS AND SCIENTIFIC-PROFESSIONAL KNOWLEDGE
The professional performance indicators, knowledge and skills promoted by this formation space are:

Learning results that the student will achieve in this training space	
Performance indicators	The student… 1.1 Relates the physical phenomena to the theories and mathematical models that describe them. 1.6 Identifies and calculates the different forms of energy involved in mechanical, electrical, thermal, pneumatic, hydraulic, etc. systems. 1.7 Interprets and produces mechanical, electrical, pneumatic, hydraulic and control diagrams using symbology according to standards. 2.1 Applies a methodology for the design of a component, system or process. 2.3 Identifies and evaluates design constraints. 2.7 Identifies and selects the manufacturing processes necessary to build an electromechanical component or system. 2.8 Establishes the quality criteria of a product or process. 6.1 Identifies the need for experiments. 6.2 Selects the materials, devices and methods necessary to design experiments. 6.3 Uses a logical organization of procedures and applies mathematical and graphic analysis to interpret the results of an experiment. 6.4 Identifies in advance the problems that may arise in an experiment. 6.5 Describes the experimental results and their relationship with fundamental concepts and principles. 6.7 Uses modern and appropriate computing resources for engineering practice.

Knowledge	History of electricity. Standard NOM-008-SCFI-2002 General System of Measurement Units (or the current version). Team building. Properties of insulating and conducting materials. Report writing. Readings and presentations of topics in English. Symbology of electrical elements. Prototype presentation. Solution of cd resistive circuits Cd resistive-capacitive circuit solution Fundamental laws of electricity.
Skills	Teamwork. Problem solving. Effective presentations. Synthesis capacity. Handling of tools to assemble electromechanical components. Use of electrical components. Management to obtain resources. Management of measuring instruments for testing electromechanical equipment. Calculation and design procedures. Problems identification in electromechanical equipment. English language reading.

C. UASLP GRADUATE: PERFORMANCE INDICATORS AND TRANSVERSAL SKILLS

Graduate profile UASLP	Performance indicators and transversal skills promoted by this training space
Professional autonomy for learning (an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**)**	The student… **IME:** The student… 7.3 Has the ability to learn through the selection of reliable information sources. 7.4 Has information of engineering state-of-the-art.. **IEA:** 1. Has the ability to learn through the reliable selection of information sources. 2. Has information on the latest technological advances in engineering
Collaborative work skills (an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**)**	The student… **IME:** 5.1 Contributes positively and widely to the work team. 5.2 Assumes responsibilities as a team member. 5.3 Expresses his/her ideas and concerns without fear. **IEA:** 1. Contributes positively and extensively to the work team. 2. Assumes responsibilities as a member of a team. 3. Assumes leadership responsibilities.
Communication skills in spanish and other languages (an ability to communicate effectively with a range of audiences**)**	The student… **IME:** 3.1 Has organized oral communication, being consistent with the central message and using appropriate body language to express one's ideas. 3.2 Has organized written communication, which is consistent with the central message identified in the introduction, where the main points are linked to transitions and a

	conclusion. 3.3 Uses modern presentation tools, such as audio, video, etc. effectively. 3.4 Uses extensive and appropriate vocabulary, as well as correct grammar. 3.5 Communicates orally and in writing in a language other than the first language. 3.6 Prepares technical reports where made judgments as products of the results of engineering solutions. **IEA:** 1. Has organized verbal communication, is consistent with the central message and uses appropriate body language to express their ideas. 2. Has organized written communication and is consistent with the central message identified in the introduction, where main points are linked with transitions and a conclusion. 3. Effectively uses modern presentation tools, such as audio, video, etc. 4. Uses extensive and appropriate vocabulary; as well as correct grammar 5. Communicates orally and in writing in a language other than the mother tongue. 6. Prepares technical reports where judgments are made, product of the results of the engineering solutions.
Scientific, professional, and/or social creative project development	This student outcomes in engineering is considered as specific professional, the performance indicators are already integrated within this training space.
Social responsibility and ethical reflection (an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts)	The student… **IME:** 4.1 Identifies the facts and work methods considering ethical principles. 4.10 Selects the techniques and tools to give modern engineering solutions and makes judgments comparing the results with the alternative tools or techniques. **IEA:** 1. Identifies the facts and work methods related to ethical principles. 2. Selects the techniques and tools to provide modern solutions in engineering and makes judgments comparing the results with the alternative tools or techniques.

GENERAL STRUCTURE AND SUMMATIVE EVALUATION

D. GENERAL DIDACTIC PLANNING

During the course the student will learn about the laws of electricity, properties of materials and electrical principles necessary to analyze resistive and resistive-capacitive circuits. In addition, the student will carry out a project to foster the ability to analyze the properties of materials and determine the minimum gauge of conductors. The project consists of the design and construction of an electrical resistor under the specifications given by the teacher (it is suggested that it be of the ceramic type with a power of 80 W and that it be connected to 15 V DC). The following points should be taken into account in the project:

1. Research and state of the art
2. Definition of the problem and objective
3. Specifications and design considerations
4. Design flow chart
5. Methodology to develop the product.
6. List of materials and their function. Identification of insulating and conducting materials.

7. Detailed design including calculations.
8. Cost analysis.
9. Construction.
10. Testing and refinement. Comparison of the electrical parameters provided by the teacher (specifications), compared against the values obtained and verified through electrical measurement equipment in the prototype.

The student will submit three partial reports on the development of the project. In the first report the student must include points 1 and 2. In the second report the student must address the observations made by the teacher to the first report and will include points 3, 4, and 5. In the third report the student must address the observations made by the teacher to the second report and will include points 6, 7, 8 and 9. In the final report the student must address the observations made by the teacher to the third report and will include point 10.

The teaching methodology is:
- By the teacher: Facilitate learning by exposing topics, perform calculation exercises during class, encourage group discussion of the topics covered and facilitate learning through practical examples.

- For the student: Carry out research, technical readings and articles in English, review standards, solve tasks, present in English, prepare the team project and write reports.

The course is divided into 6 topics with a total of 64 hours of theory and 16 hours of practice, consisting of four evaluation moments. In the first three moments of evaluation, the exam has a value of 80% of the grade and the remaining 20% corresponds to the learning activities. In the fourth moment of evaluation, the exam has a value of 70% and the remaining 30% corresponds to learning activities.

The training and learning structure proposed for the training space is shown below.

#	Name of the unit or training phase	Unit learning objective	Specific educative contents (performance indicators, skills, knowledge)
1.	Background (2 h)	At the end of the unit, the student will be able to know the contribution of different scientist to the development of electricity in order to identify the units of measurement of electrical magnitudes through the study of the history of electricity.	**Specific educational content:** 1.1.- Historical background. 1.1.1.- Contributions by the Greeks to electricity. 1.1.2.- Contributions from: Benjamin Franklin, Luigi Galvani, Charles Augustin Coumlomb, Alessandro Volta, André-Marie Ampére, Francisco Javier Estrada and Tomás Alva Édison. **Learning activities**: History of electricity Study of the standard NOM-008-SCFI-2002 General System of Measurement Units (or the current version in force). **Performance indicators:** The student… **IME:** 7.3 Has the ability to learn through the selection of reliable information sources. 7.4 Has information on the-state-of-the-art engineering. **IEA:** 1. Relates physical phenomena with the theories and mathematical models that describe them.

2	2.- Coulomb's law and electric field (6 h)	At the end of the unit, the student will be able to analyze the origin of the electric field in order to analyze its effect on charged particles through the review of the properties of electric charges	**Specific educational content:** 2.1.- Electric charge and conservation of electric charge. 2.2.- Properties of electric charges. 2.3.- Insulators and conductors. 2.4.- Force between charged objects. Coulomb law. 2.5.- Electric field. 2.5.1.- Electric field lines. 2.5.2.- Of a punctual load. 2.5.3.- Of a continuous electric charge distribution. 2.6.- Movement of charged particles in a uniform electric field. **Learning activities**: Homework exercises Team work Properties of insulating and conducting materials Laboratory practice realization. **Performance indicators:** The student… **IME:** 1.1 Relates physical phenomena with the theories and mathematical models that describe them. 6.6 Develops a mathematical model from experimental data. **IEA:** 1. Relates physical phenomena with the theories and mathematical models that describe them.
3	3.- Electric charge, electric field and electric flow (10 h)	At the end of the unit, the student will be able to analyze electric charge distributions in order to calculate the electric field and flow produced using Gauss's Law.	**Specific educational content:** 3.1.- Electric flow. 3.2.- Gauss's Law. 3.3.- Applications of Gauss's Law to charged insulators. 3.4.- Electric field. 3.5.- Conductors in electrostatic equilibrium. 3.6.- Deduction of Gauss's Law. **Learning activities**: Homework exercises (1 point) Laboratory practices realization. Realization of the project report that includes the state of the art of the project and define the problem and objective (1 point) Study of the standard NOM-008-SCFI-2002 General System of Measurement Units (or the current version), for that the student relates the section of the standard with the topics covered in this training phase **Performance indicators:** **IME:** The student… 2.8 Establishes the quality criteria of a product or process.

			3.1 Has organized oral communication, being consistent with the central message and using appropriate body language to express one's ideas. 3.2 Has organized written communication, which must be consistent with the central message, identified in the introduction, where the main points are linked to transitions and a conclusion. 3.4 Uses extensive and appropriate vocabulary, as well as correct grammar. 4.1 Identifies the facts and work methods considering ethical principles. 5.1 Contributes positively and widely to the work team. 5.2 Assumes responsibilities as a team member. 5.4 Assumes leadership responsibilities. 6.1 Identifies the need for experiments. 6.2 Selects the materials, devices and methods necessary to design experiments. 6.3 Uses a logical organization of procedures and applies mathematical and graphic analysis to interpret the results of an experiment. 6.4 Identifies in advance the problems that may arise in an experiment. 6.5 Describes the experimental results and their relationship with fundamental concepts and principles. **IEA:** 1. Relates physical phenomena with the theories and mathematical models that describe them. 2. Selects and apply the mathematical tools that help you solve those models. 3. Identifies the scope of the experiment, the content of its design, and the fundamental principles for the analysis.
4	4.- Electric potential (12 h)	At the end of the unit, the student will be able to calculate the electric potential produced by a distribution of charges to determine the electric potential energy; through presentation of principles by the teacher and development of learning activities by the student.	**Specific educational content:** 4.1.- Electric potential & potential difference. 4.2.- Potential difference in a uniform electric field. 4.3.- Electric potential energy. 4.4.- Electric potential. 4.4.1.-Electric potential due to a continuous load. 4.5.- Getting the electric field from electric potential. 4.6.- Potential of a charged conductor. 4.7 Contact potential between two dissimilar materials. 4.8 Effect of the electric field on materials 4.8.1 In conductive materials 4.8.2 Dielectric materials **Learning activities**: Homework exercises. Completion of the project report that includes the specifications and design considerations, the design flow diagram, and the methodology to develop the project (1 point)

			Realization of laboratory practices. Presentation of a topic related to this unit, in English (1 point). Study of the standard NOM-008-SCFI-2002 General System of Measurement Units (or the current version), for that the student relates the section of the standard with the topics covered in this training phase. **Performance indicators:** The student… **IME:** 2.8 Establishes the quality criteria of a product or process. 3.1 Has organized oral communication, being consistent with the central message and using appropriate body language to express one's ideas. 3.2 Has organized written communication, which must be consistent with the central message, identified in the introduction, where the main points are linked to transitions and a conclusion. 3.4 Uses extensive and appropriate vocabulary, as well as correct grammar. 3.5 Communicates orally and in writing in a language other than the first language. 4.1 Identifies the facts and work methods considering ethical principles. 5.1 Contributes positively and widely to the work team. 5.2 Assumes responsibilities as a team member. 5.4 Assumes leadership responsibilities. 6.1 Identifies the need for experiments. 6.2 Selects the materials, devices and methods necessary to design experiments. 6.3 Uses a logical organization of procedures and applies mathematical and graphic analysis to interpret the results of an experiment. 6.4 Identifies in advance the problems that may arise in an experiment. 6.5 Describes the experimental results and their relationship with fundamental concepts and principles. **IEA** 1. Identifies the scope of the experiment, the content of its design, and the fundamental principles for the analysis. 2. Independently identifies problems in an experiment that is not working properly, and takes corrective action. 3. Uses an appropriate methodology to carry out the design of the component, system or process. 4. Presents a clear statement of the needs that must be satisfied by the design of the component, system or process.

5	5.-Electrical resistance and DC resistive circuits (20 h)	At the end of the unit, the student will be able to apply the relationship between voltage and current for a resistor connected in a direct current circuit to calculate the magnitudes of current, voltage, power and energy, through the presentation of principles by the teacher and the development of learning activities by the student.	**Specific educational content:** 5.1.- Batteries. 5.1.1 Electrical potential in batteries. 5.2.- Electrical conduction model 5.2.1 In conductors. 5.2.2 In semiconductor materials: type n and type p. 5.3.- Conductivity, resistivity and electrical resistance in conductors and insulators. 5.3.1 Specifications of a resistance. 5.3.2 Specifications of a conductor. 5.4.- Effect of temperature on conductivity. 5.5.- Conductors 5.5.1 Conductor gauge. 5.5.2 Conductors for electrical installations. 5.6.- Insulated wire. 5.6.1 Class and thermal stability. 5.6.2 Current capacity depending on the thermal class. 5.7.- Wire for the construction of electrical resistors. 5.8.- Variation of resistance with radiation (photoresistance). 5.9.- The electrical trace. 5.10.- Resistors for electronic circuits. 5.9.1 Specifications and color code. 5.9.2.- Deduction of Ohm's Law from the electrical conduction model. 5.11.-Relationship between voltage and current for a resistance. 5.12.- Simplification of resistances. 5.12.1.- Resistors in series and parallel. 5.12.2.- Arrangement of star and delta resistors 5.13.- Calculation of voltage and current in series and parallel circuits. 5.13.1.- The concept of short circuit. 5.13.2.- The concept of open circuit 5.14.- Power and energy 5.15.- Kirchhoff's laws. 5.15.1 The concept of meshes and nodes. 5.15.2. Circuit analysis with two and three meshes 5.15.3 Analysis of circuits with several nodes. **Learning activities**: Homework exercises (1 point) Symbology of electrical elements. Realization of laboratory practices. Realization of the project report with the list of materials and function they perform, detailed design that includes calculations, cost analysis and construction (1 point). **Performance indicators:** The student… **IME:**

			2.8 Establishes the quality criteria of a product or process. 3.1 Has organized oral communication, being consistent with the central message and using appropriate body language to express one's ideas. 3.2 Has organized written communication, which must be consistent with the central message, identified in the introduction, where the main points are linked to transitions and a conclusion. 3.4 Uses extensive and appropriate vocabulary, as well as correct grammar. 4.1 Identifies the facts and work methods considering ethical principles. 5.1 Contributes positively and widely to the work team. 5.2 Assumes responsibilities as a team member. 5.4 Assumes leadership responsibilities. 6.1 Identifies the need for experiments. 6.2 Selects the materials, devices and methods necessary to design experiments. 6.3 Uses a logical organization of procedures and applies mathematical and graphic analysis to interpret the results of an experiment. 6.4 Identifies in advance the problems that may arise in an experiment. 6.5 Describes the experimental results and their relationship with fundamental concepts and principles. **IEA:** 1. Identifies the scope of the experiment, the content of its design, and the fundamental principles for the analysis. 2. Independently identifies problems in an experiment that is not working properly, and takes corrective action. 3. Uses an appropriate methodology to carry out the design of the component, system or process. 4. Presents a clear statement of the needs that must be satisfied by the design of the component, system or process.
6	6.-Capacitance and DC resistive-capacitive circuits (14 h)	At the end of the unit, the student will be able to apply the relationship between voltage and current for a capacitor to calculate current, voltage, power, and energy in resistive-capacitive circuits through exposition of principles by the teacher and development of learning activities by the student.	**Specific educational content:** 6.1.- Definition of capacitor and capacitance. 6.1.1 Specifications of a capacitor. 6.2.- Dielectric properties of materials. 6.3.- Relationship between voltage and current for a capacitor. 6.4.- Equivalent capacitance calculation for a combination of series and parallel capacitances. 6.5.- Electric charge in capacitor arrangements. 6.6.- Steady state and transient response of RC circuits. 6.7.-Charging and discharging of a capacitor.

			6.8.- Energy stored in a capacitor. 6.9.- Constitution and selection of capacitors for direct current. 6.10.- Safety in handling capacitors. **Learning activities**: Homework exercises (1 point) Realization of laboratory practices. Symbology of electrical elements. Completion of the project report including testing and refinement (1 point). Prototype presentation (1 point). **Performance indicators:** The student… **IME:** 1.1 Relates the physical phenomena to the theories and mathematical models that describe them. 1.6 Identifies and calculates the different forms of energy involved in mechanical, electrical, thermal, pneumatic, hydraulic, etc. systems. 1.7 Interprets and produces mechanical, electrical, pneumatic, hydraulic and control diagrams using symbology according to standards. 2.1 Applies a methodology for the design of a component, system or process. 2.3 Identifies and evaluates design constraints. 2.7 Identifies and selects the manufacturing processes necessary to build an electromechanical component or system. 2.8 Establishes the quality criteria of a product or process. 3.1 Has organized oral communication, being consistent with the central message and using appropriate body language to express one's ideas. 3.2 Has organized written communication, which must be consistent with the central message, identified in the introduction, where the main points are linked to transitions and a conclusion. 3.3 Uses modern presentation tools, such as audio, video, etc. effectively. 3.4 Uses extensive and appropriate vocabulary, as well as correct grammar. 3.6 Prepares technical reports where made judgments as products of the results of engineering solutions. 4.1 Identifies the facts and work methods considering ethical principles. 4.10 Selects the techniques and tools to give modern engineering solutions and makes judgments comparing the results with the alternative tools or techniques. 5.1 Contributes positively and widely to the work team. 5.2 Assumes responsibilities as a team member.

			5.4 Assumes leadership responsibilities. 6.1 Identifies the need for experiments. 6.2 Selects the materials, devices and methods necessary to design experiments. 6.3 Uses a logical organization of procedures and applies mathematical and graphic analysis to interpret the results of an experiment. 6.4 Identifies in advance the problems that may arise in an experiment. 6.5 Describes the experimental results and their relationship with fundamental concepts and principles. 6.6 Develops a mathematical model from experimental data. 6.7 Uses modern and appropriate computing resources for engineering practice. 7.3 Has the ability to learn through the selection of reliable information sources. 7.4 Has information of engineering state-of-the-art. **IEA:** 1. Uses an appropriate methodology to carry out the design of the component, system or process. 2. Presents a clear statement of the needs that must be satisfied by the design of the component, system or process. 3. Deliver the complete and well-crafted design project.

Laboratory practices will be carried out with a duration of 16 hours in total. The topics are the following:
1. Safety in the Laboratory
2. Electrostatic
3. Coulomb's Law
4. Measurement equipment
5. Making a solar cell
6. Sources of electromotive force
7. Electrical Resistance
8. Ohm's Law
9. Series Circuits
10. Circuits in parallel
11. Design and construction of an analog voltmeter
12. Electric Power
13. Kirchhoff's Laws
14. Capacitance
15. RC Circuit Analysis
16. Evaluation

E. ASSESSMENT

The summative evaluation proposal for the training space is shown below. According to it, students will receive an ordinary grade. This training space reports four partial grades before the ordinary final grade, the percentages and weighting are as shown in Table 1. The learning activities that are indicated with a value of one point are mandatory for all groups. Additionally, the teacher will leave learning activities that he deems convenient and will be mandatory for the right to exam, the learning activities with the right to exam

can be chosen from those shown in the general didactic planning. The exam includes the topics developed by the teacher in class and the result of the learning activities developed by the student.

Table 1.

#	Time of evaluation	Proposal for the summative assessment of learning	Evaluation percentage
1.	Evaluation of the first partial exam according to the College calendar. It is evaluated from the beginning of the course to topic 3.4	First delivery of the project 1 point Topic 2 and 3 homework exercises 1 point Theoretical and practical written exam 8 points	25 %
2.	Evaluation of the second partial exam according to the College calendar. Subject 3.5 is assessed at the end of unit 4.	Second delivery of the project 1 point Presentation of a subject of the course in English language 1 point Theoretical and practical written exam 8 points	25 %
3.	Evaluation of the third partial exam according to the College calendar. It is evaluated from the beginning of unit 5 to topic 5.14.	Third delivery of the project 1 point Homework exercises on topic 5 1 point Theoretical and practical written exam 8 points	25 %
4.	Evaluation of the fourth partial exam according to the Faculty's calendar. It is evaluated from topic 5.15 at the end of unit 6	Final project report 1 point Prototype of an electrical resistance 1 point Homework exercises on topic 6 1 point Theoretical and practical written exam 7 points	25 %

Ordinary final assessment	The ordinary grade will be the sum of the grade obtained at each evaluation moment multiplied by the evaluation percentage. The grade will be reported based on 10 and will proceed according to the Examination Regulations to declare the subject accredited or, if appropriate, EE or ET. The evaluation value is 100%.
Extraordinary assessment	Theoretical and practical written exam. 100% of the topics and the result of the learning activities of this training space will be evaluated. The value of this evaluation is 100%. It will be carried out on the dates authorized for said evaluation.
Sufficiency assessment	Theoretical and practical written exam. 100% of the topics and the result of the learning activities of this training space will be evaluated. The value of this evaluation is 100%. It will be carried out on the dates authorized for said evaluation.
Regularization assessment	Theoretical and practical written exam. 100% of the topics and the result of the learning activities of this training space will be evaluated. The value of this evaluation is 100%. It will be carried out on the dates authorized for said evaluation.

F. BIBLIOGRAPHIC AND DIGITAL RESOURCES

BASIC TEXTS:

1. Raymond Serway, Jewett, Jonh W Física: electricidad y magnetismo 9a ed, Cengage, 2016.

2. Tipler Paul Allen, Mosca Gene; Física para la ciencia y la tecnología 6a ed, Reverté, 2010.
3. Boylestad Robert L. Introducción al análisis de circuitos, Pearson Educación, 2011
4. Sears y Zemansky, Hugh D. Young, Roger A. Freedman, A. Lewis Ford.. Física universitaria 14a ed, Pearson Educación, 2019.
5. Martínez, J. R. (2007). Francisco Javier Estrada, el físico mexicano más notable y olvidado del siglo XIX. Lat. Am. J. Phys. Educ. Vol, 1(1), 101.
6. Resnick Robert, Halliday David, Krane Kenneth S., Física 4a ed. CECSA, 2002.
7. Giancoli Douglas C, Física para universitarios 3a edición, Pearson Educación, 2002.

ELECTRONIC ADDRESSES OF INTEREST:

8. www.scopus.com
9. www.sciencedirect.com
10. https://ocw.mit.edu/courses/physics/8-02-physics-ii-electricity-and-magnetism-spring-2007/class-slides/
11. www. learnEngineering.org
12. https://ieeexplore.ieee.org/Xplore/home.jsp
13. https://phet.colorado.edu/es/simulation/charges-and-fields (PhET Interactive simulators)
14. http://legismex.mty.itesm.mx/normas/scfi/scfi008-02.pdf

CURRICULAR AND SCHOOL DATA

Area	Line	Type of credit	Type of formation space	Language of instruction	Method of delivery
Basic (Math & Basic Sciences)	N/A	Required	Course	Spanish	In person

CREDITS

According to the official curricular proposal, the school data of the formation space are:

Semester	Number of weeks	Classroom hours per week	Contact hours of practice per week	Hours of autonomous student work per week	Credits per agreement 17/11/17(before 279)
10	16	4	1	4	9

REQUIREMENTS TO ATTEND THE FORMATION SPACE

The school requirements for the formation space are noted below, if necessary

#	REQUIREMENTS
1.	None

EQUIVALENCIES OF THE FORMATION SPACE

Next, the equivalences of the training space with spaces of previous educational programs are indicated, if necessary.

EQUIVALENCES

None

INTEROPERABILITY

This formation space is shared with other educational programs and/or academic entities: No.

ACADEMIC INSTITUTION AND EDUCATIONAL PROGRAMS
College of Engineering: Electromechanical Engineering, Electrical and Automation Engineering

OTHER FORMS OF ACCREDITATION

- This formation space can be accredited through the presentation of a document certifying that the student has already acquired the necessary learning: **No**.

- This formation space can be accredited through an exam that certifies that the student has already acquired the necessary learning: **No**.

FORMATION OPTIONS

This formation space is part of the following options:

Training option	Yes/ No
Bachelor's Degree	Yes
Dual formation program	No
Higher University Technician	No
Executive career	No
Partial accreditation option	No
Residency or internship	No

TEACHER PROFILE

The teacher must know about the student outcomes that are promoted in the students of the Electromechanical and Electrical and Automation Engineering engineering programs.

Formation and academic experience

Electromechanical Engineering, Electrical and Automation Engineering or related career with Master's or Doctorate studies.

Formation and professional and work experience

The professor must have experience in the field of electrical installations or research products related to components of electrical systems.

The teacher's role

- The professor will have the task of facilitating the student's learning of the course topics, as well as providing the necessary theoretical tools for the student to develop the project. He will monitor the activities carried out by the student through reviews of the project reports. He will issue a grade in each part according to the percentages established in Table 1.

MAXIMUM AND MINIMUM NUMBER OF STUDENTS PER GROUP

- Maximum number of students to guarantee academic, pedagogical, and financial viability: 25

- Minimum number of students to guarantee academic, pedagogical, and financial viability: 10

TYPE OF PROPOSAL

- It is a version of programs that are presented as a curricular adjustment of content within the framework of an existing educational program.

DEVELOPERS AND REVIEWERS

Developers of this programs	Reviewers of this programs
M. Eng. Miguel Ángel Gallego Guerrero	Eng. Raúl Montante Salazar
PhD. Baudel Lara Lara	Eng. Salvador Balbontín Montaño
M Eng. Alfredo Jacobo Puerta	