APPENDICES

APPENDIX A – COURSE SYLLABI

INCLUDE ONLY COURSE SYLLABI FOR THE DISCIPLINE-SPECIFIC COURSES OF THE PROGRAM FOR READINESS REVIEW

Code	INE201	Prerequisites	None
Name	Electrical Engineering Seminar	Co-requisites	None

Credits	Contact Hours
02	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Santo Percel

Text book
NFPA. (1999). Código Eléctrico Nacional NEC 1999. Massachusetts: National Electric Code de la NFPA 70.
Other supplemental materials
Corporación Dominicana de Empresas Eléctricas Estatales. CDEEE. (2014). Retrieved from http://www.cdeee.gov.do/ CDEEE - DECON. (1989). Normas de Distribución de Republica Dominicana. Dominican Republic: CDEE. EGEHID. (2014). Recuperado de http://www.hidroelectrica.gob.do/ Edesur. (2014). Recuperado de https://www.edesur.com.do/ Edeeste. (2014) Recuperado de http://www.edeeste.com.do/ Edenorte. (2014). Recuperado de http://www.edenorte.com.do/ Empresa de Transmisión Eléctrica Dominicana. ETED. (2014).). Retrieved from http://www.eted.gov.do/ Ministerio de Industria y Comercio. MIC. (2014). Energía no Convencional. Retrieved from http://www.seic.gov.do/energ%C3%ADa-no-convencional.aspx NFPA. (1999). Código Eléctrico Nacional NEC 1999. Massachusetts: National Electric Code de la NFPA 70. Organismo Coordinador del Sistema Eléctrico Nacional Interconectado de la República Dominicana. Recuperado de http://www.oc.org.do/ SENI (2014). REPORTES. Recuperado marzo 17, 2014.). Retrieved from http://www.oc.org.do/Reportes.aspx Superintendencia de Electricidad. (2014). Retrieved from http://www.sie.gob.do/ Superintendencia de Electricidad. (2014). Ley General de Electricidad 125-01.). Retrieved from http://www.sie.gob.do/index.php?option=com_phocadownload&view=file&id=682:ley-general-de-electricidad-125-01&Itemid=158

Description	
This program reveals the profile and area of knowledge of an electrical engineer and understands space in multidisciplinary activities; Know the organization chart and the functions of each institution related to all aspects of electrical matters. At the same time, know the legal framework and regulations that govern the affairs of the electrical industry. The profile and area of knowledge of an electrical engineer is analyzed and understanding of space in multidisciplinary activities. Explain all the stages in which everything related to the affairs of the electrical industry is handled and governed.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Show openness and tolerance to new opinions, ideas and concepts in dialogue with peers and teachers. 2. Understand in depth the study plan of the electrical engineering career and the usefulness of the subjects that compose it, as well as useful tools for its performance. 3. Demonstrate a positive attitude and commitment to the continuous improvement of their learning, identifying strengths, resources and points for improvement in themselves. 4. Prepare didactic documentation and exposes their concepts through the visual information technology resources provided by the study center.
Student outcomes	SO3. Communicate effectively with a variety of audiences. SO4. Recognize ethical and professional responsibilities in engineering situations and makes informed judgments considering the impact of engineering solutions in global, economic, environmental, and social contexts. SO7. Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. What is engineering Unit II. What is Electrical Engineering Unit III. Study of the curriculum Unit IV. Organization chart of the National Electric Industry structure Unit V. Other entities

Code	INE202	Prerequisites	INS208, INS208L
Name	Computer Tools for Engineering	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Yeulis Rivas, Ms.

Text book
Castrillón, M. (2011). Fundamentos de informática y programación para ingeniería: ejercicios resueltos para C y Matlab. Madrid: Paraninfo.
Other supplemental materials
National Instruments (2012) LabVIEW Core 1: course manual. Austin, TX: Autor. Signatura topográfica: 005.369 | L127c1. National Instruments (2012) LabVIEW Core 2: course manual. Austin, TX: Autor. Signatura topográfica: 005.369 | L127c2. Pérez López, C. (2011) MATLAB a través de ejemplos. Madrid: Garceta. Pineda Olivares, A. (2015) Instrumentación virtual. Fundamento de programación gráfica con LabVIEW Digital Editorial of the Tecnológico de Monterrey.

Description	
In this course, the student will acquire knowledge and skills related to computer software such as LabVIEW and Matlab. In the LabVIEW each student will explore measurement and control tools in power and control system applications. Regarding Matlab and Simulink, the group will develop skills for the manipulation of mathematical functions, applications in power systems and control and automation systems.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Describe in detail the basic functions of computer programs used to solve different problems in the field of electrical engineering. 2. Apply the knowledge of computer science and engineering to design innovative solutions to various problems of various kinds in the electrical engineering career.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Introduction to Labview Unit II. Labview Applications Unit III. Project development using Labview Unit IV. Introduction to Matlab and Simulink Unit V. Matlab and Simulink Applications Unit VI. Project development

Code	INE377	Prerequisites	CBF212 CBF212L
Name	Circuits I	Co-requisites	INE377L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Omar García. Prof. Juan Pablo Cuevas.

Text book
Alexander, C. K., & Sadiku, M. N. O. (2018). Electrical Circuit Fundamentals. (6th Edition) Mexico: McGraw Hill Publishing House.
Other supplemental materials
Boylestad (2011). Introduction to Circuit Analysis. (12th Edition) Pearson Education Publishing, Inc. Boylestad (2015). Introductory Circuit Analysis (13th Edition). Pearson Education Publishing, Inc Dorf, R., Svaboda, J.A. (2014) Introduction to Electrical Circuits. (9th edition) United States: John Wiley & Sons, Inc. Friar Mora, J. (2012) Electric circuits. Madrid: Pearson Education S.A. Hayt, W. H., Surbin, S. M., Kemmerly, J. E. (2012) Circuit analysis in engineering. (8th Edition). Printed in Mexico: McGraw Hill. Nilsson, J.W., Riedel, S. (2015). Electrical Circuits. (7th edition) Madrid: Pearson education. Nilsson, J.W., Riedel, S. (2015). Electric Circuits. (10th edition) United States Edition: Pearson education.

Description	
Students will acquire the concepts of charge, current, voltage, resistance, energy and power. In addition, the basic laws governing the behavior of electrical circuits (Ohm's Law, Kirchhoff's Laws) will be stated. Skills will be developed to analyze electrical circuits through the different circuit analysis techniques (mesh analysis, node, superposition theorem, Thevenin and Norton theorem) in the different operating regimes of steady state and transient operation (alternating and direct current), methods of circuit solutions. The student will also become familiar with the main characteristics of the behavior of passive elements (Resistor, coil and capacitor) used in electrical circuits.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Recognize and interpret engineering principles appropriately to solve problems related to electrical circuits. 2. Apply knowledge of mathematics and engineering to find solutions to problems in the field of electrical circuits.

	3. Solve basic problems using the principles of mathematics and engineering in electrical circuits.
Student outcomes	SO1. Identify, formulate and solve complex Engineering problems by applying principles of Engineering, Sciences and Mathematics

Topics
Unit I. Basic concepts and experimental laws of electric circuits Unit II. Circuit analysis techniques Unit III. Steady-state analysis of sine circuits. Unit IV. Operational Amplifiers (OPAM) Unit V. First and second order electric circuits

Code	INE377L	Prerequisites	CBF212 CBF212L
Name	Circuits I Laboratory	Co-requisites	INE377

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Rene Lazala

Text book
Sbriz, G. (2015). Circuitos I: prácticas de laboratorio. Manual de Laboratorio. Instituto Tecnológico de Santo Domingo. Alexander, C. K., & Sadiku, M. N. O. (2018) Fundamentals of Electrical Circuits. (6th Edition) Mexico: Editorial McGraw Hill.
Other supplemental materials
Hayt, W. H., Kemmerly, J. E., Durbin, S. M. (2012) Circuit Analysis in Engineering. (8th Edition) Mexico: Editorial McGraw Hill. Dorf, R.C., & Svoboda, J.A. (2010) Introduction to Electric Circuits. (8th edition) United States: John Wiley & Sons, Inc. Nahvih, M. & Edminister, J.A., (2004). Electrical circuits. (4th edition) United States: McGraw-Hill.

Description	
In this subject, the student acquires practical knowledge of how theoretical behavior is related to practical behavior, from building resistive circuits and measuring current and voltage variables in resistive circuits according to how resistor connections are combined. The matter will observe the same topics as in theoretical version of the same. For this, students will be taught how to measure voltage, current and resistance with a multimeter.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify and know the operation of the materials and equipment necessary to carry out the practices. 2. Analyze the variables obtained in the experimentation to elaborate a conclusion of the operation of the electric circuit in DC. 3. Apply the basic laws and techniques of electrical engineering to perform the appropriate experimentation. 4. Analyze and argue the results obtained in the experimentation in order to verify the proper functioning of the electric circuit in DC.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyzes and interprets data, and use engineering criteria to draw conclusions.

Topics
Unit I. Introduction to the Circuits laboratory I

Unit II. Resistors. Serial, parallel and mixed connections Unit III. Electrical circuit. Switches. Use of voltage divider rheostats and potentiometers Unit IV. Ohm's law. Kirchhoff's laws. open and short circuit Unit V. Polarity in circuits. Resistive. series voltage sources. Unit VI. Network calculations. Thévenin and Norton overlapping theorems Unit VII. Simulation software for DC and AC circuits. Unit VIII. Alternating current. alternating current polarity

Code	INE336	Prerequisites	CBF213, CBF213L
Name	Electromagnetic Fields	Co-requisites	None

Credits	Contact Hours
04	4
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ramón Moya

Text book
Lehner, G. (2010), Electromagnetic Field Theory for Engineers and Physicists.
Other supplemental materials
Hayt, W., Buck, J. (2010). Engineering Electromagnetics Sadiku, Matthew (2003). Elementos de Electromagnetismo

Description	
This program contemplates developing the basic knowledge of electromagnetism that allows establishing the relationships between electromagnetic fields and their sources, from the descriptive and quantitative points of view, using Maxwell's equations as a fundamental pillar. The course covers the fundamentals of calculating electromagnetic fields in a vacuum and in the presence of matter, power and electromagnetic, electrostatic, magneto static energy and electromagnetic waves.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify engineering tools optimally to solve problems related to electromagnetic fields. 2. Apply the knowledge of mathematics and engineering to find solutions to problems in the field of electromagnetic fields. 3. Solve basic problems using engineering tools in electromagnetic fields.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Coulomb's Law Unit II. Electric Field Density Unit III: Definition of Potential Difference and Electric Potential Unit IV: Current and Current Density Unit V: Biot-Savart Law Unit VI: Force between Current Elements Unit VII: Faraday's Law Unit VIII: Applications of Maxwell's Equations

Code	INE361	Prerequisites	INE377 INE377L
Name	Efficiency and Electrical Audit	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Giuseppe Sbriz Zeitun

Text book
Community of Madrid (S.F de S.F of 2007). Guide to Savings and Energy Efficiency in Offices and Dispatches. Retrieved from fenercom: http://www.fenercom.com/pdf/publicaciones/guia-de-ahorro-y-egencia-energetica-in-offices-and-offices-fenercom.pdf
Other supplemental materials
Community of Madrid (sf of sf of 2016). Fenercom. Obtained from the Guide on Saving and Energy Efficiency in Escalators and Moving Platforms: http://www.fenercom.com/pdf/publicaciones/Guia_sobre_AEE_en_Escaleras_Mecanicas_y_Andenes_Moviles-fenercom_2016.pdf Guide on Saving and Energy Efficiency in Stairs and Moving Walks. (2017). www.fenercom.com. Retrieved from http://www.fenercom.com/pdf/publicaciones/Guia_sobre_AEE_en_Escaleras_Mecanicas_y_Andenes_Moviles-fenercom_2016.pdf GreenPeace. (sf of sf of 2011). Green Guide to Energy Efficiency. Retrieved from: http://www.greenpeace.org/argentina/Global/argentina/report/2011/guia_verde_eficiency_2011.pdf Superintendence of Electricity (October 30, 1998). Tariff Regime Applicable by the Distribution Companies. (Resolution no. 237) Obtained from Superintendencia de Electricidad: http://www.sie.gob.do/images/sie-documentos-pdf/marco-legal/resoluciones-seic/seic/1998/seic-237-98 -tariff-regime-applicable-by-the-distributing-companies.pdf

Description
In this subject, students will be introduced to the environment of energy efficiency, in particular to the electrical part. At the end of the program, the student is expected to develop the management of the improvement of the use of electrical energy, the proper use of energy consumption equipment and also the application of technologies to obtain an optimal result that leads us to reduce the negative impact by environment, product of pollution caused by the use of fossil fuels. All this without impacting the production capacity and the comforts that electricity offers us; the result being economically and environmentally beneficial. The contents to be addressed will be concepts applied to energy efficiency, residential and commercial energy efficiency, preparation of an energy audit, fundamentals of

lighting, motors, air conditioners, and familiarization with equipment to be used in an energy audit.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Write a technical report following a standard format to document an engineering design, experimental or test plan, computational, experimental or analytical results. 2. Independently use publicly available resources (ie Internet, journals, patents, standards, tutorials), to collect and synthesize information.
Student outcomes	SO3. Communicate effectively with a variety of audiences. SO7. Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. Concepts Unit II. Energy Efficiency (Residences) Unit III. Energy Efficiency (Commercial and Industrial Sector) Unit IV. Units of Measurement for Energy Efficiency Unit V. Measuring Instruments Unit VI. Energy Audit Unit VII. Lighting Basics-Air Conditioner-Electric Motors Unit VIII. Audit Project

Code	INE378	Prerequisites	INE377
Name	Circuits II	Co-requisites	INE378L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ing. Omar García, PhD

Text book
Alexander, C. K., & Sadiku, M. N. O., (2017) Fundamentals of Electrical Circuits. Publisher McGraw Hill. Nilsson, J.W. & Riedel, S. (2015). Electric Circuits. Pearson education. Hayt, W. H., Durbin, S. M., Kemmerly, J. E. & Phillips, J.D. (2019). Engineering Circuits Analysis McGrawHill.
Other supplemental materials
Boylestad (2011). Introduction to Circuit Analysis. (12th Edition) Publisher Pearson Education, Inc. Fernandez Moreno, J. (2011). Circuit Theory: Theory and Solved Problems. Publisher Paraninfo S.A. Fraile Mora, J. (2012) Electrical circuits. Madrid: Pearson Education S.A. Hayt, W. H. Jr., & Kemmerly, J. E. (2012) Circuit Analysis in Engineering. (8th Edition). Publisher McGraw Hill.

Description	
The objective of this subject is for student to acquire knowledge on the following topics: concepts of instantaneous, average, apparent, reactive, complex power and power factor. Understand in a general way the behavior of three-phase systems and calculate their electrical variables. Apply methods of analysis and theorems in magnetically coupled circuits to calculate stored energies in inductors affected by mutual inductance. Line and ideal transformers, autotransformers and three-phase transformers. Analysis of circuits with variable frequency responses (resonant circuits, transfer functions, bode diagrams, filters). Applied mathematics for analysis of circuits with variable frequencies (Laplace transforms and Fourier Series).	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Demonstrate ability to take initiatives in solving different problems that arise in the development of the subject. 2. Develop the ability to perform the tasks assigned by the teacher within the periods indicated during the development of the subject. 3. Search for technological solutions using computer programs to analyze and solve problems in electrical circuits. 4. Analyze and find solutions to complex electrical circuit problems using applied mathematics.

Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO7. Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. AC Power Analysis Unit II. Polyphase circuits Unit III. Magnetically Coupled Circuits Unit IV. Circuit analysis in the ω domain. Unit V. Analysis of circuits in the S Domain.

Code	INE378L	Prerequisites	INE377 INE377L
Name	Circuits II Laboratory	Co-requisites	INE378

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Omar Garcia, PhD.

Text book
Manual of Practices, Edibon. Ref. equipment M-2, February 2013
Other supplemental materials
User Manual, GW INSTEK PART NO. 82AF-21200EC1. Arbitrary Function Generator, AFG-2000 Series. User Manual, Digital Storage Oscilloscopes. TBS1000B and TBS1000B-EDU Series. Tektronix, Inc. Alexander, C. K., & Sadiku, M. N. O., (2006) Fundamentals of Electrical Circuits. (3rd Edition). Publisher McGraw Hill Boylestad (2011). Introduction to Circuit Analysis. (12th Edition) Publisher Pearson Education, Inc. Hayt, W. H., Surbin, S. M., Kemmerly, J. E. (2007) Circuit Analysis in Engineering. (7th Edition) Mexico: McGraw Hill

Description	
This laboratory focuses on providing students with spaces for practice and development of skills related to alternating current circuits. During the course, students will be working with Matlab's Simulink to simulate electrical circuits in the alternating current (AC) domain, to verify their behavior and find the main variables that define their operation. The student learns to properly use the instruments (signal generator, oscilloscope, and load plate) necessary for the correct performance of each of the practices. The student verifies in a practical way the basic laws that govern the behavior of an (a.c.) circuit, the magnitude and phase relationship between current and voltage in resistive, resistive-inductive, and resistive-capacitive circuits as a function of frequency variations. Acquire knowledge about the assembly and behavior of filters, resonant circuits, and ideal transformers.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify and knows the operation of the materials and equipment necessary to carry out the practices. 2. Apply the knowledge of mathematics and engineering to find solutions to problems in the field of electrical circuits in a.c. 3. Analyze the variables obtained in the experimentation to draw a conclusion of the operation of the electrical circuit in a.c.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyzes and interprets data, and uses engineering criteria to draw conclusions.

Topics
Unit I. Uses of instruments and equipment
Unit II. Characteristic of an alternating signal
Unit III. Behavior of coils and capacitors in ac
Unit IV. Behavior of coils and capacitors in ac
Unit V. Phase relations in RL and RC circuits in ac
Unit VI. Passive RLC filters
Unit VII. Resonant circuits
Unit VIII. The perfect transformer
Unit IX. Using matlab/simulink
Unit X. Practical evaluation
Unit XI. Project evaluation and simulations

Code	INE379	Prerequisites	CBM203 INE202
Name	Numerical Calculus Theory	Co-requisites	INE379L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ramón Moya

Text book
Ayyub, B., & McCuen, R. (2016). Numerical analysis for engineers. Boca Raton: CRC Press.
Other supplemental materials
Burden, R., Faires, D., Numerical Analysis, 7th ed., Thomson Learning, 2014. Chapra, S., Canalés, R., Numerical Methods for Engineers, 6th ed., McGraw Hill, 2010. Kincaid, D., & Hayes, L. (2014). Iterative methods for large linear systems. Burlington: Academic Press/ Elsevier Science. Scott, L. (2011). Numerical analysis. Princeton: Princeton University Press.

Description	
This program aims to provide students with knowledge about the mathematical foundations and computational methods that allow them to solve mathematical problems that appear in scientific and technological problems in activities of Engineering careers, with emphasis on electrical engineering. The main fields are studied, such as treatment of rounding errors, resolution of nonlinear equations and systems of equations (linear and nonlinear), interpolation and approximation (discrete), differentiation and numerical integration, and resolution of ordinary differential equations.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Show skills to identify engineering tools optimally to solve problems related to electromagnetic fields. 2. Develop skills to apply the knowledge of mathematics and engineering to find solutions to problems in the field of electromagnetic fields. 3. Solve basic problems using engineering tools in electromagnetic fields.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Basic concepts of the subject. Unit II. Roots of equations Unit III. Linear algebraic equations Unit IV. Numerical differentiation and integration Unit V. Numerical differentiation and integration

Code	INE379L	Prerequisites	CBM203
Name	Numerical Calculus Theory Laboratory	Co-requisites	

Credits	Contact Hours
01	
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ramón Moya

Text book
Chapra, S., & Canalés, R. (2010). Numerical Methods for Engineers (6th ed.). McGraw-Hill
Other supplemental materials
Burden, R., & Faires, D., (2014). Numerical Analysis (7th ed.). ThomsonLearning Esquerro Fernández, J. A. (2012). Iniciación a los métodos numéricos (1st ed.) Universidad de la Rioja Mora, W. (2012). Introducción a los métodos numéricos (1st ed.). Instituto Tecnológico de Costa Rica Sesé Sánchez, L. M. (2013). Análisis numéricos y estadística aplicada (1st ed.). www.uned.es/publicaciones

Description	
This program aims to provide the student with knowledge about the application of computational methods that allow him to solve problems of subject numerical calculation theory through the Matlab simulation software. Among the contents that are addressed are: types of numerical methods, real roots of nonlinear equations, methods to solve equations and numerical integration.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify numerical calculation tools to solve problems related to engineering through the use of Matlab. 2. Apply knowledge of mathematics and engineering to find solutions to engineering problems using Matlab.
Student outcomes	SO1. Identify, formulate and solve complex engineering problems by applying the principles of Engineering, Science and Mathematics

Topics
Unit I. Types of numerical methods Unit II. Real roots of non-linear equations Unit III: Direct methods for solving systems of linear equations Unit IV: Iterative methods for solving systems of linear equations Unit V: Numerical integration

Code	INE380	Prerequisites	INE336 INE378 INE378L
Name	Electrical Machines I	Co-requisites	INE380L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Miguel Euclides Aybar

Text book
Wildi, T. (2007). Máquinas eléctricas y sistemas de potencia (6 ed.). Naucalpán de Juárez: Pearson Educación.
Other supplemental materials
Gerling, D. (2015). Electrical Machines, Mathematical Fundamentals of Machine Topologies, Mathematical Engineering. ISBN 978-3-642-17584-8 (eBook). Springer-Verlag Berlin Heidelberg 20150 Jacek F. Gieras, (2017) Fundamentals of Electromechanical Energy Conversion Electrical Machines, 2017 by Taylor & Francis Group, LLC, International Standard Book Number-13: 978-1-4987-0883-8 (Hardback) Sahdev, S. K. (2018) Electrical Machines, ISBN 978-1-108-43106-4 Paperback, University Printing House, Cambridge CB2 8BS, United Kingdom, Information on this title: www.cambridge.org/9781108431064 Stone, G. C. & Culbert, Ian & Boulter, E. A. (2014). Electrical Insulation For Rotating Machines. Design, Evaluation, Aging, Testing, and Repair. Second Edition, Published by John Wiley & Sons, Inc., Hoboken, New Jersey. Mazón, J. (2008). Guía de autoaprendizaje de máquinas eléctricas (12th ed.). México: Pearson Educación.

Description	
The student will acquire the necessary concepts to understand and manage alternating current electrical machines. Introduced to the principles of synchronous machines, transformers, and generators. Skills developed for the analysis and development of the equivalent circuits of electrical machines. In addition, the student will learn about the characteristic curves and vector diagrams of the synchronous generator, their excitation and speed control.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Integrate the knowledge of mathematics and science to understand the principle of operation of electrical machines. 2. Effectively solve electrical variable calculus problems for electrical machines.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Basic concepts Unit II. Transformers Unit III. Fundamentals of Alternating Current Machines Unit IV. Synchronous Generators

Code	INE380L	Prerequisites	INE336 INE378 INE378L INE202
Name	Electrical Machines I Laboratory	Co-requisites	INE380

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Miguel Aybar

Text book
Markey, K. (2015). Online Searching: A Guide to Finding Quality Information Efficiently and Effectively: Rowman & Littlefield Publishers.
Other supplemental materials
Manual de prácticas de los módulos de laboratorio TERCO brand Plata, L. D. J. S. (2019). Cómo Hacer Un Perfil Proyecto De Investigación Científica: Palibrio. ISBN 1506527205, 9781506527208. 218 pages Paitán, H. Ñ. et al (2014) - Metodología de la investigación: cuantitativa - cualitativa y redacción de la tesis / 4. ed. - Bogotá: Ediciones de la U, 2014. - 536 p.: il; 24 cm. Hernández Sampieri, R. (2014). Metodología de la investigación (6. ed. ed.). México: McGraw Hill. ISBN: 978-1-4562-2396-0. Cunha, I. (2016). El trabajo de fin de grado y de máster: Redacción, defensa y publicación: Editorial UOC. ISBN 849116376X, 9788491163763. 208 pages.

Description	
In this subject, the student acquires practical knowledge of how theoretical behavior is related to practical behavior, based on the different tests carried out on transformers and synchronous generators. The subject will observe the same topics as in the theoretical version: How to measure parameters such as active power and power factor.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Integrate the knowledge of mathematics and science to understand the principle of operation of electrical machines. 2. Effectively solve electrical variable calculus problems for electrical machines.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Instrumentation, principle of electromagnetism and safety in the laboratory Unit II. Operating principle of single-phase transformers Unit III. Equivalent circuit single-phase transformers

Unit IV. Operating principle of three-phase transformers Unit V. Three-phase transformer equivalent circuit Unit VI. Three-phase connections in transformers Unit VII. Status instrumentation of power transformers Unit VIII. Synchronous generator operating principle Unit IX. Synchronous Generator Equivalent Circuit Unit X. Project design applying

Code	INE381	Prerequisites	INE378 INE378L ING225
Name	Electrical Installations Design I	Co-requisites	INE381L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Juan Pablo Cuevas Caro

Text book
Hartwell, F.P., Mcpartland, J. F., Mcpartland, B. J. (2017) National Electrical Code Handbook (29th), Estados Unidos: McGraw- Hill. NFPA70, National Electrical Code (2020). NFPA
Other supplemental materials
National Fire Protection Association (2017) NEC 2017: NFPA 70: National Electric Code; International Electrical Code Series (1st edition, new). Superintendencia de Electricidad (2016). Código Nacional de la Republica Dominicana, SIE-056-MEMI, agosto 2016. Richter, H. (2015) Manual práctico de Instalaciones Eléctrica. (2nd edition): CECSA. García Trasancos, J. (2016) Instalaciones Eléctricas en Media y Baja Tensión (7ª edición). Madrid España: Editorial Paraninfo. Zumtobel Lighting GmbH (2018) The Lighting Handbook (6th edition). Dornbirn, Austria. Santoso, S., Beaty, H.W. (2018) Standard Handbook for Electrical Engineers (17th edition) Estados Unidos: McGraw- Hill. Superintendencia de Electricidad (2016). Reglamento Diseño y Construcción para Redes Eléctricas de Distribución Aéreas, Resolución SIE-029-2015-MEMI, July 2016 edition, volume II.

Description	
This program contemplates the acquisition of reference knowledge for the understanding and elaboration of the designs of electrical installations in the residential, industrial, commercial and institutional fields. You will know the elements that make up these facilities, operating principles and applications of transformers, protection elements, conductors, ducts, grounding systems, lighting, etc. serving them as supports for their professional practice and the understanding of subsequent professionalizing subjects.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Properly perform the necessary calculations for the dimensioning of parts in engineering installations. 2. Apply the engineering design process to produce solutions relevant to specific needs in an engineering facility, taking into account safety, comfort, economic, and environmental factors.

	3. Recognize ethical and professional responsibilities clearly in engineering situations and can make informed judgments considering the impact of economic and environmental solutions.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO2. Apply the engineering design process to produce solutions that meet specific needs taking into account public health, safety and welfare, as well as global, cultural, social, environmental and economic factors. SO4. Recognize ethical and professional responsibilities in engineering situations and makes informed judgments considering the impact of engineering solutions in global, economic, environmental, and social contexts.

Topics
Unit I. Criteria and regulations for electrical installations
Unit II. Conductors and Ducts
Unit III: Residential Electrical Installations Project
Unit IV: Interior Lighting
Unit V: Non-residential interior electrical installations

Code	INE381L	Prerequisites	INE378 INE378L ING225
Name	Electrical Installations Design I Laboratory	Co-requisites	INE381

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Giuseppe Sbriz Zeitun

Text book
NFPA. (1999). National Electric Code NEC 1999. Massachusetts: National Electric Code of NFPA 70. Código Eléctrico Nacional de la Republica Dominicana, SIE-056-MEMI, agosto 2016. Manual práctico de Instalaciones Eléctrica. (2da edición)
Other supplemental materials
CDEEE - DECON. (1989). Normas de Distribución de Republica Dominicana. República Dominicana: CDEE. García T., J., (1999). Instalaciones Eléctricas en Media y Baja Tensión. Madrid, España: Editorial Paraninfo. Hickey, R.B., (2004). Electrical Engineer's Portable Handbook. US: McGraw-Hill Turan, G., (1986). Electric Power Distribution System Engineering. USA: McGraw-Hill Book Company.

Description	
In this subject the student acquires the practical knowledge of how to connect the different elements to carry out a residential electrical installation, what the conductors mean and how it is the most efficient way to manage and choose the conductors in residential installations. The teaching methodology is used from questions about the theoretical framework on which the practice of that week is based.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Apply engineering knowledge to find solutions to problems in the field of electrical circuits. 2. Effectively manage the necessary tools for the design and calculation of electrical systems. 3. Integrate the knowledge for an effective and efficient design of an electrical installation.
Student outcomes	SO2. Apply the engineering design process to produce solutions that meet specific needs taking into account public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.

Topics

Unit I. Electrical Materials Unit II. Tools use Unit III. Solder Tin Unit IV. Electrical installations Unit V. Troubleshooting Unit VI. Relays Unit VII. Ladder Type Diagram Unit VIII. Combinational Logic

Code	INE382	Prerequisites	INE378 INE378L
Name	Electronic Theory	Co-requisites	INE382L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ariel Lopez Marcelino

Text book
Robert L. Boylestad, Louis Nashelsky. Circuit Theory and Electronic Devices, 10. ed - Mexico: Pearson Education, c2009 - xviii, 894 p
Other supplemental materials
Luis Miguel Cuesta García, Antonio José Gil Padilla, Fernando Remiro Domínguez. Electrónica digital: algebra de Boole - Circuitos combinacionales y secuenciales - Automatismos – Memorias. México: McGraw-Hill, 1992 - x, 445 p : il. Ramos Álvarez, M. Principios de electrónica (2012). México: Red Tercer Milenio. Hermosa Donate, A. Principios de electricidad y electrónica III. (2013). 2nd ed. México: Alfaomega.

Description	
The student will know the history, composition, behavior, use and application of the main semiconductor devices of modern Basic Electronics. Beginning with knowing the behavior of semiconductor elements, the student will know the behavior of these elements and their applications at the beginning of the application of the electronic term; how and why these elements become the main column of the development and application of electronics and its main figures in history. Knowing this, the teacher will detail the most used components in basic electronics, explain and show their semiconductor composition with audiovisual support and how these elements behave in different scenarios of saturation, doping, type of connection and power supply (AC and DC). Each topic, based on three large blocks: intrinsic knowledge of the component, mathematical modeling of its behavior in AC or DC power scenarios, and concluding with examples and practical exercises in which its real applications are demonstrated.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Recognize and interpret engineering principles appropriately to solve problems related to basic electronic circuits. 2: Identify, understand and apply the knowledge related to basic electronic engineering components. 3: Solve and apply the knowledge of mathematics and engineering to know and design and evaluate basic electronic circuits.

Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Introduction. Unit II. Semiconductor diodes. Unit III. Transistors. Unit IV. Operational Amplifiers (OPAM). Unit V. Introductory theory of Digital electronics.

Code	INE382L	Prerequisites	INE378 INE378L
Name	Electronic Theory Laboratory	Co-requisites	INE382

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Jorge Luis Feliz Volquez

Text book
Robert L. Boylestad, Louis Nashelsky. Circuit Theory and Electronic Devices, 10. ed - Mexico: Pearson Education, c2009 - xviii, 894 p
Other supplemental materials
Díaz Marcilla, J., & Ruiz García, J. E. (2015). UF0149 – Electrotecnia. Edition Paraninfo, S.A. ISBN 8428381364, 9788428381369. 198 páginas. Palacios, G. (2019). Problemas resueltos de Electrónica Analógica. Paraninfo Universidad. Ingeniería. Ediciones Paraninfo, S.A. ISBN 8428341249, 9788428341240. 164 pages. Schuler, C. A. (2018). Electronics: Principles and Applications (9th ed.). SBN 13:978-0073373836. ISBN 10:0073373834. McGrawHill. Schultz, M. E. (2015). Grob's Basic Electronics (12th ed.). McGrawHill. ISBN 13:9780073373874 Westcott, S., & Westcott, J. R. (2017). Basic Electronics: Theory and Practice (2nd ed.). Mercury Learning and Information. ISBN : 978-1-683920-33-5

Description	
In this subject the student acquires practical knowledge of how theoretical behavior is related to practical behavior, from knowing how the different electronic components behave, how they are controlled to use them effectively and how they should be designed in a practical way. Such that they are able to solder and install them. The subject will observe the same topics as in the theoretical version of it.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify the functioning of the materials and equipment necessary to carry out the practices. 2. Apply the knowledge of mathematics and engineering to find solutions to problems in the field of electrical circuits in AC and DC. 3. Analyze the variables obtained in the experimentation to draw a conclusion on the operation of the different electronic components.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering criteria to draw conclusions.

Topics
Unit I. Introduction.

Unit II. Semiconductor diodes.
Unit III. BJT transistors.
Unit IV. FET transistors.
Unit V. Operational Amplifiers (OPAM).
Unit VI. Introductory theory of Digital electronics.

Code	INE383	Prerequisites	INE336 INE378, INE378L
Name	Transmission Lines	Co-requisites	INE383L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ramón Moya

Text book
Catchpole, P. & Fife, B. (2014). Structural Engineering of Transmission Lines.
Other supplemental materials
Farzaneh, M & Farokh, Shahab (2012) Electrical Design of Overhead Power Transmission Lines Pansini, A, J. (2005) Power Transmission & Distribution

Description	
In this subject, the student will develop throughout the course the theoretical foundations and basic calculation techniques that will allow them to analyze the behavior of a transmission line with load; as well as the analysis of the different parameters of the design of a power line. They will be able to see, analyze and understand the different study models of transmission lines. In addition, they will be able to understand and analyze the mechanical characteristics that the design of said line must have.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Optimally identify engineering tools to solve problems related to transmission lines 2. Apply knowledge of mathematics and engineering to find solutions to problems in the field of transmission lines 3. Solve basic problems using engineering tools on transmission lines.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. General Fundamentals Unit II. Transmission line parameters Unit III: Representation of power systems Unit IV: Calculation of transmission lines Unit V. Analysis of lines

Code	INE383L	Prerequisites	INE336 INE378, INE378L
Name	Transmission Lines Laboratory	Co-requisites	INE383

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ramón Moya

Text book
Glover, D., & Sarma, M. (2012). Power System Analysis and Design (5th Ed.).
Other supplemental materials
Catchpole, P., & Fife, B. (2014). Structural Engineering of Transmission Lines. Checa, L. (2000). Líneas de transporte de energía (3rd Ed.). Farzaneh, M., & Farokh, S. (2012). Electrical Design of Overhead Power Transmission Lines. Grainger, J., & Stevenson, W. (1996). Análisis de Sistema de Potencia (3rd Ed.). Pansini, A, J. (2005). Power Transmission & Distribution. Saadat, H. (1999). Power system analysis (1st Ed.).

Description	
In this subject, the student acquires practical knowledge of how theoretical behavior is related to practical behavior, based on knowing how transmission lines behave and the different effects they have on power systems depending on their length. The subject will observe the same topics that are taught in the theoretical version.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Demonstrate skills in identifying power system software tools to troubleshoot transmission line related issues 2. Develop skills to apply the knowledge and software tools of power systems in engineering to find solutions to problems in the field of transmission lines 3. Solve basic problems using engineering tools on transmission lines.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Software Description Unit II. Tests Unit III: Representation of power systems.

Code	INE384	Prerequisites	INE380, INE380L
Name	Renewable Energy Systems I	Co-requisites	INE384L

Credits	Contact Hours
04	04
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Yeulis Rivas, Ms.

Text book
Centrales de energías renovables. Edición 1ra, 2019.
Other supplemental materials
Carta Gonzalez, J., Calero, R. (s.f). Centrales de Energías Renovables. Generación eléctrica con energías renovables. Pearson Ley de Incentivos al desarrollo de las Energías Renovables, No. 57-07, República Dominicana Ley General de Electricidad, No. 125-01, República Dominicana Salgado, J. M. (2011). Guía Completa de la Energía Eólica, (1st Edition). AMVEdiciones Scarpellini, Sabina, (2009). Análisis de Viabilidad Económico-Financiero de un Proyecto de Energías Renovables. (1st Edition).

Description	
Throughout this subject, it is expected to develop general basic concepts of conventional and unconventional energy sources, as well as their technology in terms of generating electrical energy without negatively impacting the environment. The subject explores the management of costs, technologies, environmental impact, data collection and their development over time. The teaching-learning methodology is based on various activities carried out throughout the class period. The teacher explains the contents of the topics through lectures and reinforces them, assigning research topics to the students to encourage self-learning in the students. Of the topics explained and discussed in class, the teacher, through objective tests, evaluates the learning of the contents of each student.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify useful mathematical tools for finding solutions to energy production problems with renewable and/or non-renewable sources. 2. Use engineering tools to provide solutions to problems of various kinds, in relation to the production of electrical energy from renewable energy sources. 3. Recognize the need to take care of the environment from the use of renewable sources in the design of systems for the production of electrical energy.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

	SO2. Apply the engineering design process to produce solutions that meet specific needs, taking into consideration public health and safety, global, cultural, social, environmental, economic factors, and any other factors as appropriate to the discipline.

Topics
Unit I. General Concepts on Energy
Unit II. Types of Energies
Unit III. Technologies for the Exploitation of Energy
Unit IV. Environmental and Economic Aspects
Unit V. Solar Thermal and Photovoltaic Power Plants
Unit VI. Wind Power Plants
Unit VII. Mini Hydraulic Power Plants

Code	INE384L	Prerequisites	INE380, INE380L
Name	Renewable Energy Systems I Laboratory	Co-requisites	INE384

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Luis Alberto Guillermo, M.Sc.

Text book
Radian Belu, Energy Storage, Grid Integration, Energy Economics, and the Environment. Nano and Energy. CRC Press, 2019. ISBN1000449025, 9781000449020. Length: 376 pages.
Other supplemental materials
Economic Modeling, Analysis, and Policy for Sustainability. Advances in Finance, Accounting, and Economics (2327-5677). Editor Goswami, Anandajit. Publisher IGI Global, 2016. ISBN 1522500952, 9781522500957. Length 388 pages Ley de Incentivos al desarrollo de las Energías Renovables, No. 57-07, República Dominicana Ley General de Electricidad, No. 125-01, República Dominicana Mohamed EL-Shimy (editor). (2017). Economics of Variable Renewable Sources for Electric Power Production. ISBN 13:978-3-330-08361-5 Yoshihiro Yamamoto. (2018). Feed-in Tariffs and the Economics of Renewable Energy. ISBN 13: 978-3-319-76864-9

Description	
This laboratory is based on providing students with spaces for practice and development of skills related to renewable energies. The contents for the development of the practices are complemented by the theoretical part of the subject, among which the following stand out: introduction to renewable energy, wind energy, photovoltaic energy, thermal solar energy, hydraulic energy and biofuels. The teaching methodology is based on the teacher's exposition and the subsequent development of the practices by the students. The teacher will be a guide, for the good performance of the students during the practices, allowing the student to develop the necessary skills and abilities for the implementation of a renewable energy project in the initial stage. Evidence of competency progress will be documented through the checklist and rubric.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Manage the proper use of tools for data collection and evaluation. 2. Identify the use of materials and accessories in renewable energy installations. 3. Preliminary determination of the start-up of a renewable project.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyzes and interprets data, and uses engineering criteria to draw conclusions.

Topics
Unit I. Introduction to Renewable Energy
Unit II. Collection and processing of information
Unit III. Wind power
Unit IV. Photovoltaic Solar Energy
Unit V. Hydraulic energy
Unit VI. Biofuels
Unit VII. Wind - solar integration to the interconnected system

Code	INE385	Prerequisites	INE380, INE380L
Name	Electrical Machines II	Co-requisites	INE385L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Juan Pablo Cuevas Caro

Text book
Chapman, S. (2012). Máquinas Eléctricas (5ta edición). McGraw-Hill/Interamericana Editores.
Other supplemental materials
Fitzgerald, A. E, Fitzgerald, C. K., & Umans, S. D. (2004). Maquinas Eléctricas (6th ed.). México: McGraw-Hill. Fraile, J. (2008). Maquinas Eléctricas (6th ed.). Madrid: McGraw-Hill. Wildi, T. (2007). Máquinas eléctricas y sistemas de potencia (6th ed.). Naucalpán de Juárez: Pearson Educación. Chapman, S. J. (2005). Maquinas Eléctricas (4th ed.). Mexico: McGraw-Hill. Mazón, J. (2008). Guía de autoaprendizaje de máquinas eléctricas (12th ed.). México: Pearson Educación. The MathWorks, Inc. 2018. Retrieved July 10, 2018, from https://la.mathworks.com/academia/students.html

Description	
The student will acquire the necessary concepts to understand all types of electric motors. The principles of induction motors, DC motors and generators, single-phase motors and special motors will be introduced. Skills will be developed for the analysis of the behavior of the magnetic flux and with it the basis for the operation of these machines. In addition, the student will learn about the techniques of design, selection and mathematical modeling of asynchronous generators and motors, and direct current generators and motors. In this course, the teacher will present the relevant concepts and problem solving based on selected examples for the application of the theoretical concepts learned. The student will be given objective tests, assignment of practice exercises and simulations of electrical circuits for the evaluation of the student's performance and learning. The progress of the skills will be assessed with authentic assessment instruments such as checklists, portfolios, objective tests and rubrics.-	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Integrate the knowledge of mathematics and science to understand the principle of operation of electrical machines. 2. Effectively solve electrical variable calculus problems for electrical machines.

Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Introduction Unit II. Induction Motors Unit III. Fundamentals of Direct Current Machines Unit IV. DC Motors & Generators Unit V. Single-Phase Motors And Special Motors

Code	INE385L	Prerequisites	INE380, INE380L
Name	Electrical Machines II Laboratory	Co-requisites	INE385

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Miguel Aybar

Text book
Manual of practices of induction and direct current machines of TERCO equipment Manual of practices of induction and direct current machines of Labvolt equipment Manual of practices of the TERCO brand laboratory modules
Other supplemental materials
Gerling, D. (2015). Electrical Machines, Mathematical Fundamentals of Machine Topologies, Mathematical Engineering. ISBN 978-3-642-17584-8 (eBook). Springer-Verlag Berlin Heidelberg 20150 Jacek F. Gieras, (2017). Fundamentals of Electromechanical Energy Conversion Electrical Machines, 2017 by Taylor & Francis Group, LLC, International Standard Book Number-13: 978-1-4987-0883-8 (Hardback). Sahdev, S. K. (2018). Electrical Machines, ISBN 978-1-108-43106-4 Paperback, University Printing House, Cambridge CB2 8BS, United Kingdom, Information on this title: www.cambridge.org/9781108431064 Stone, G. C. & Culbert, Ian & Boulter, E. A. (2014). Electrical Insulation for Rotating Machines. Design, Evaluation, Aging, Testing, and Repair. Second Edition, Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Description	
In this subject, the student acquires practical knowledge of how theoretical behavior is related to practical behavior, based on the different tests that are carried out on asynchronous machines, DC machines and single-phase motors in their different configurations, each one of them. The subject will observe the same topics as in the theoretical version. How to measure the parameters such as mechanical torque, rotational speed and temperature. The evaluation methodology will be stipulated in the weekly evaluation of the electrical machines and comparison of how the electrical phenomena in the practice of these. In the same way, reports will be delivered on the data acquired in practice and what they mean in order to provide information on what happens in the evaluated machine.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Integrate the knowledge of mathematics and science to understand the principle of operation of electrical machines. 2. Effectively solve electrical variable calculus problems for electrical machines.

Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Synchronous motors
Unit II. Three-phase induction operating principle
Unit III. Equivalent circuit wrapped rotor induction motors
Unit IV. Equivalent circuit of squirrel cage induction motors
Unit V. Asynchronous generator and rota phase
Unit VI. Single-phase motors part 1
Unit VII. Single-phase motors part 2
Unit VIII. Direct current motors

Code	INI386	Prerequisites	CBM311 INE382 INE382L
Name	Control Systems I	Co-requisites	INE386L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Miguel Baldera

Text book
Ogata, K. (2009). Modern Control Engineering. (5th edition) Prentice Hall.
Other supplemental materials
Dorsey, J. (2005). Continuous and Discrete Control Systems. Mc. Graw Hill Hernández Gaviño, R. (2010). Introducción a los sistemas de control: Conceptos, aplicaciones y simulación con MATLAB. (1ª edición). México: Pearson Educación, Rodríguez Ávila, J. E. (1998). Introducción a la ingeniería del control automático. McGraw Hill. Kuo, B.C. (1996). Automatic control systems. (7th edition) PRENTICE HALL. Jacobs, O.L.R. (1993.) Introduction to control theory. (2nd Edition) Oxford: Oxford University Navarro, R. (2004.) Ingeniería de Control Analógica y Digital. McGraw-Hill. Dorf, R. Bishop, R. (2005). Modern control systems. (10th edition) Prentice Hall. The MathWorks, Inc. 2018. Retrieved July 10, 2018, from https://la.mathworks.com/academia/students.html

Description	
Control Systems I encompasses the basic concepts and procedures of automatic control theory of continuous linear systems. With this course, the students will develop skills in applying the principles of science, mathematics and engineering to solve problems of different levels of complexity. More specifically, skills will be developed to formulate the equations of the systems, elaborate the transfer functions, analyze the systems in the time and frequency domain. The student will also learn about the selection of the system controller to improve the temporary response of the systems and an introduction to modern methods of solving the problem of the synthesis of servo-systems. In addition, Nyquist Analysis, Bode Analysis and stability will be performed.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Integrate knowledge of mathematics and science to understand the operating principle of automatic control systems. 2. Effectively solve problems of calculation of control variables in open-loop and closed-loop systems
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Basic concepts and terminology
Unit II. transfer functions
Unit III. block diagrams
Unit IV. Time domain analysis
Unit V. Steady state errors
Unit VI. General approach to the problem of servo systems
Unit VII. Nyquist analysis
Unit VIII. Bode analysis
Unit IX. Stabilization by means of correctors in the direct chain
Unit X. Stabilization and performance improvement with the help of partial chain reactions
Unit XI. Stability analysis by Evans method
Unit XII. Closed loop behavior
XIII unit. The problem of the synthesis of servo systems. Classic method and modern method
Unit XIV. Modulated Servo systems

Code	INE386L	Prerequisites	CBM311 INE382 INE382L
Name	Control Systems Laboratory I	Co-requisites	INE386

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Miguel Aybar

Text book
Manual of practices of induction and direct current machines of TERCO equipment Manual of practices of induction and direct current machines of Labvolt equipment Manual of practices of the TERCO brand laboratory modules
Other supplemental materials
Pérez López, César. (2014). Matlab Control Systems Engineering, ISBN-13 (Pbk): 978-1-4842-0290-6 , ISBN-13 (Electronic): 978-1-4842-0289-0. Bolton, William. (2015). Instrumentation and Control Systems, Second Edition, ISBN: 978-0-08-100613-9. De Cañete, J. Fernández & Galindo, C. & Barbancho, J. & Luque, A. (2018). Automatic Control Systems In Biomedical Engineering, An Interactive Educational Approach. ISBN 978-3-319-75716-2 ISBN 978-3-319-75717-9 (Ebook), https://Doi.Org/10.1007/978-3-319-75717-9. Springer International Publishing AG Reinoso García, Óscar & , Vidal, Adrián Peidró & Gil Aparicio, Arturo. (2017). Prácticas de Sistemas de Control - Continuos y Discretos. ISBN 8416024480, 9788416024483 The MathWorks, Inc. 2018. Retrieved July 10, 2018, from https://la.mathworks.com/academia/students.html

Description	
In this subject, the student acquires practical knowledge of how theoretical behavior is related to practical behavior, from the different tests that are carried out on control systems, how the components are calculated to obtain the desired gains according to the configurations. The subject will observe the same topics as in the theoretical version. The evaluation methodology will be stipulated in the weekly evaluation of control signals and the variables of how they are done in practice. In the same way, reports will be delivered on the data acquired in practice and what they mean in order to provide information on what happens in the evaluated machine.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Recognize and interpret engineering principles appropriately to solve problems related to continuous linear systems

	2. Apply the knowledge of mathematics and engineering to find solutions to problems in the field of continuous linear systems. 3. Apply analysis methods such as Fourier, Laplace to solve complex systems of control equations in simpler ways.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Introduction to the Matlab Environment
Unit II. Transfer Function
Unit III. Time Domain Analysis
Unit IV. Introduction to the Control System Toolbox
Unit V. Modeling Control of a DC Motor
Unit VI. Second Order Systems
Unit VII. Geometric Place of the Roots
Unit VIII. Controller Design
Unit IX. Pid Controllers
Unit X. Project design

Code	INE366	Prerequisites	INE385 INE385L
Name	Electrical Substations	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Eduardo A. De León C.

Text book
Mejía V.S.A. (2003). Subestaciones de alta y extra alta tensión (2nd Edition). Padilla, E. (2015). Substation Automation Systems: Design and Implementation. Wiley.
Other supplemental materials
Martín, José Raull & Orozco Perez, Enrique. (1992). Diseño de Subestaciones. México: McGrawHill / Interamericana. Ramírez Vázquez, José. (1972). Enciclopedia CEAC de electricidad (1st ed.). Estaciones de transformación y distribución: protección de sistemas eléctricos. (1092 p.: il.). Barcelona, España: CEAC Editions. Subestaciones de Alta y Extra Alta Tensión. HMV Ingenieros. Mejia Villegas S.A. Ingenieros consultores. Second edition. John D. McDonald (2012). Electric Power Substations Engineering (Electrical Engineering Handbook) Evelio Padilla. (2015). Substation Automation Systems: Design and Implementation Terry Krieg y John Finn (2018). Substations (CIGRE Green Books) Alexandre. (2010). Substation Operation & Maintenance Leon Kempner Jr (2008). Substation Structure Design Guide: Asce Manuals and Reports on Engineering Practice No. 113 (ASCE MANUAL AND REPORTS ON ENGINEERING PRACTICE)

Description	
It will provide the description and operation of the different types of Substations, as well as their constituent elements (power transformers, measurement transformers, switches, disconnectors, and measurement devices). Low Voltage auxiliary equipment is also studied in this part, as well as the various types of automatic assemblies necessary for their operation. At the same time, the student will obtain management knowledge in administrative and personnel aspects.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify and clearly define the concepts and components that make up an electrical energy production system, based on reliability, safety and flexibility. 2. Design electrical substations according to the needs of the electrical system, using different configurations, to meet specific needs in society; taking into consideration social, economic and environmental aspects.

	3. Prepare technical reports with quality criteria on the socioeconomic and environmental impact of projects on the design of electrical substations according to the different configurations. 4. Create the plans, procedures, specifications, as well as other means of communication of the design, following norms or standards of engineering in general.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO2. Apply and use the engineering design process to produce solutions that meet specific needs, taking into consideration public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. SO4. Recognize ethical and professional responsibilities in engineering situations and makes informed judgments considering the impact of engineering solutions in global, economic, environmental, and social contexts. SO7.Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. Generalities Unit II. Equipment in a Substation Unit III. Substation Bus System. Unit IV. Grounding System Unit V. Protections Unit VI. Testing and Commissioning

Code	INE387	Prerequisites	INE380, INE383, INE379, INE380L, INE383L
Name	Power System I	Co-requisites	INE387L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Elvin Jiménez

Text book
Stevenson, W. y Grainger, J. (2015). Power System Analysis. McGraw-Hill. Glover, J. D,; Overbye, T,; y Sarma, M.S (2017). Power System Analysis and Design (6ta Ed)
Other supplemental materials
Grainger, J. & Stevenson Jr., W. Fitzgerald (1996). Analisis de Sistemas de Potencia (1st ed.). México: McGraw-Hill. Glover, D. & Sarma, M. (2004). Analisis y Diseño de Sistemas de Potencia (3rd ed.). Mexico: Thomson Editores, S.A. Saadat, H. (2011). Power System Analysis (3rd ed.). Milwaukee: McGraw-Hill. Gomez-Exposito, A., Conejo, A. & Cañizares, C. (2009). Electric Energy Systems Analysis and Operation (1st ed.). New York: CRP Press –Taylor & Francis Group. Weedy, B. & Cory, B (2012). Electric Power Systems (5th edition). United Kingdom, John Wiley & Sons, Ltd. J. Duncan Glover | Thomas Overbye | Mulukutla S. Sarma (2017). Power System Analysis and Design with MindTap, 6th edition Hemchandra Madhusudan Shertukde. (2019). Power Systems Analysis Illustrated with MATLAB and ETAP

Description	
The student will acquire the concepts for understanding and analyzing the operation of electrical power systems, the models of their elements, such as transmission lines, generators, transformers, loads, compensation elements, etc. It is also contemplated that the student acquires the skills for the understanding and analysis of power flow, short-circuit studies in their different aspects, as well as the economic operation of power systems. In this way, the student acquires the necessary knowledge to understand the main topics in the main field of career.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Apply knowledge of mathematics, science and engineering elements in the analysis of models of the main elements of a system. 2. Correctly solve optimization problems in the management of a system considering restrictions. 3. Manage modern computer tools to solve electrical engineering problems.

Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Basic Concepts Unit II. Mathematical Models of Elements Unit III. The Admittance Model and the Calculation of Networks Unit IV. The Impedance Model and the Calculation of Networks Unit V. Power Flow Solutions Unit VI. Symmetric Faults

Code	INE387L	Prerequisites	INE380, INE383, INE379, INE380L, INE 383L
Name	Power System I Laboratory	Co-requisites	INE387

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ing. Eduardo A. de León C.

Text book
Manual DigSilent. Joe H. C., Juan J.S. G (2020). Power System.
Other supplemental materials
John Grainger, William Stevenson, Jr (2015). Power Systems Analysis Libros de consultas Glover, D. & Sarma, M. (2004). Analisis y Diseño de Sistemas de Potencia (3rd ed.). Mexico: Thomson Editorials, S.A. Saadat, H. (2011). Power System Analysis (3rd ed.). Milwaukee: McGraw-Hill. Gomez-Exposito, A., Conejo, A. & Cañizares, C. (2009). Electric Energy Systems Analysis and Operation (1st ed.). New York: CRP Press –Taylor & Francis Group. Grainger, J. & Stevenson Jr.,W. Fitzgerald (1996). Analisis de Sistemas de Potencia (1st ed.). México: McGraw-Hill. J. Duncan Glover, Thomas Overbye (2016). Power System Analysis and Design Weedy, B. & Cory, B (2012). Electric Power Systems (5th edition). United Kingdom, John Wiley & Sons, Ltd. J. Duncan Glover | Thomas Overbye | Mulukutla S. Sarma (2017). Power System Analysis and Design with MindTap, 6th edition Hemchandra Madhusudan Shertukde. (2019). Power Systems Analysis Illustrated with MATLAB and ETAP

Description	
In this subject, the student acquires the knowledge of how theoretical behavior is related to practical behavior, from knowing how power systems behave and the different effects that their typology has, how to use the different software products that are used in the market. The subject will observe the same topics as in the theoretical version of the same.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify the functioning of the materials and equipment necessary to carry out the practices. 2. Apply knowledge of mathematics and engineering to find solutions to problems in the field of power systems.

	3. Analyze the variables obtained in the experimentation to draw a conclusion of the operation of the power system.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering criteria to draw conclusions.

Topics
Unit I. Use of DigSilent software. Unit II. Features and functions of the DigSilent. Unit III. Declaration of bars, lines and towers. Unit IV. Creation of transformers. Unit V. Creation of loads. Unit VI. Generators. Unit VII. System operation Unit VIII. Simulation of power flow (Load Flow). Unit IX. Case studies.

Code	INE388	Prerequisites	INE386 INE386L
Name	Automation, Control and Instrumentation	Co-requisites	INE388L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Fausto Taveras Lay

Text book
Basic Fundamentals of Instrumentation and Control, first edition, 2017.
Other supplemental materials
Gonzalez, D. (2004). Automatización y Control: prácticas de laboratorios. Mc Graw Hill. Trevathan, V. (s.f). A Guide to the Automation Body of Knowledge (2d Ed). ISA.

Description	
In this subject, each student will acquire the concepts and general skills of automation, control and instrumentation designs of electrical power systems, in the different areas where this knowledge is developed. The skills to be developed are about electrical circuits to operate and design automation systems. At the same time, design and interpret automatic control systems for electrical systems and have the ability to select and apply the measurement instruments used in the measurement of the variables of different processes. For the development of the subject, the teacher will give explanations of the relevant concepts. Exercises will be carried out in class that lead to the development of a conceptualization. Furthermore, students will perform exercises explaining the reasoning process used. The practices and schemes carried out by the students will be evaluated through rubrics.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Apply knowledge of mathematics, science, and engineering elements to solve problems in industrial settings that can be solved using an automation process. 2. Know the elements and programming logic necessary to design and implement a control system in an industrial environment and according to the necessary parameters. 3. Develop programming and connection of elements that involve automation. 4. Interpret measurements which allow you to identify possible failures or breakdowns.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO2. Apply the engineering design process to produce solutions that meet specific needs taking into consideration public health and safety, global,

	cultural, social, environmental, economic factors, as well as any other factors as appropriate to the discipline.

Topics
Unit I. Electric automation
Unit II. Industrial Automatic Control
Unit III. Electric motors. Basic concepts.
Unit IV. Programmable Controllers Generalities
Unit V. Failure Analysis
Unit VI. Instrumentation

Code	INE388L	Prerequisites	INE386 INE386L
Name	Automation, Control and Instrumentation Laboratory	Co-requisites	INE388

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Jesús Mercedes

Text book
Lab-Volt. (2008). Basic controls. [Quebec]. Lab-Volt. (2008). Fault location and repair. [Quebec].
Other supplemental materials
Gutierrez Hinestroza, M., & Iturralde Kure, S. (2017). Fundamentos Básicos de Instrumentación y Control (1st Edition).

Description	
In this subject, the student acquires the knowledge of how theoretical behavior is related to practical behavior, the logic with which the control diagrams and forces used to fulfill a need must be executed. The subject will observe the same topics as in the theoretical version of the same. The evaluation methodology will be stipulated in the weekly evaluation of the topics covered in theory based on questions in it and comparison of how power systems behave in practice. In the same way, software such as Rslink is used, to see theoretically how these can be simulated and design a control diagram according to what is required.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify and know the operation of the materials and equipment necessary to carry out the practices. 2. Apply knowledge of mathematics and engineering to find solutions to problems in the field of automation 3. Analyze the variables obtained in the experimentation to elaborate a conclusion of the operation of the different devices for the automation of processes.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering criteria to draw conclusions.

Topics
Unit I. Basic principles of motor control. Unit II. Circuit diagram and specifications. Unit III. Basic control circuits.

Unit IV. Idle control circuits.
Unit V. Circuits with timed relays.
Unit VI. Circuits with programmed logic controllers.
Unit VII. Circuits with AC and DC speed variators.
Unit VIII. Introduction to fault location and repair.
Unit IX. Location and repair of faults in basic circuits for motor control.
Unit X. Location and repair of faults in circuits with PLC.
Unit XI. Locating and repairing faults in variator circuits

Code	INE389	Prerequisites	INE382, INE382L, INE386, INE386L
Name	Applied Power Electronics Theory	Co-requisites	INE389L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Miguel Baldera Arvelo

Text book
Rashid, M. (2015). Power Electronics (4th edition). Pearson Education.
Other supplemental materials
Malvino, A.P. (2000). Principles of Electronics (Sixth Edition). McGraw-Hill. Neamen, D.A. (1998). Analysis and Design of Electronic Circuits Vol.I". McGraw-Hill. Neamen, D.A. (1999). Analysis and Design of Electronic Circuits (Vol. II). McGraw-Hill. Savant, C.J., Roden, M.S., & Carpenter, G.L. (2000). Electronic Design: Circuits and Systems (Third Edition). PearsonEducation.

Description	
This subject of Applied Power Electronics Theory includes knowledge of solid-state electronic devices and their applications to control and convert electrical energy, and their use in industry from the manufacture of sources to motor speed controllers. Students are expected to be able to correctly describe and analyze the operation of various power electronic devices and formulate analysis of complex electronic systems with the aid of computer simulation tools. The contents to be developed in the matter will be presented in a logical way, starting with power calculations, power devices according to their types, converters, rectifiers and controllers, thus concluding with inverters according to their type.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Recognize and interpret the principles of engineering in an appropriate way to solve problems related to power electronics. 2. Apply knowledge of mathematics and engineering to find solutions to problems with power electronic devices. 3. Apply analysis methods to design practical electronic applications and identify their role in automated industry.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Introduction to Applied Power Electronics Unit II. DC-DC Converters

Unit III. Controlled Rectifiers Unit IV. AC Voltage Controllers Unit V. Digital Modulated Systems

Code	INE389L	Prerequisites	INE382, INE382L, INE386, INE386L
Name	Applied Power Electronics Theory Laboratory	Co-requisites	INE389

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Miguel Baldera Arvelo

Text book
Rashid, M. (2015). Power Electronics (4th edition). Pearson Education.
Other supplemental materials
Savant, CJ, Roden, MS, & Carpenter, G.L. (2000). Electronic Design: Circuits and Systems (Third Edition). Pearson Education. Malvino, A.P. (2000). Principles of Electronics (Sixth Edition). McGraw-Hill. Neamen, DA (1998). Analysis and Design of Electronic Circuits (Vol.I). McGraw-Hill Mexico. Neamen, DA (1999). Analysis and Design of Electronic Circuits (Vol.II). McGraw-Hill Mexico.

Description	
In this subject, the student acquires practical knowledge of how theoretical behavior is related to practical behavior, from knowing how the different electronic components behave for applications that require power, how they are controlled to use them effectively and how they should be designed. in a practical way so that they are able to solder and install them. The matter will observe the same topics as in the theoretical version of the same.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Plan the experiment appropriately in your assignment. 2. Conduct the experiment appropriately based on the knowledge learned. 3. Analyze and interpret the results you get in your assignments. 4. Discuss the results obtained from the experiment.
Student outcomes	SO6. Develop and conduct appropriate experimentation, analyzes and interprets data, and uses engineering criteria to draw conclusions.

Topics
Unit I. Introduction to Applied Power Electronics Unit II. DC-DC converters Unit III. Controlled Rectifiers Unit IV. Alternating Voltage Controllers Unit V. Digital Modulated Systems

Code	INE365	Prerequisites	INE385 INE385L INM300
Name	Power Plants	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ing. José Mateo

Text book
Breeze, P. (2019). Power Generation Technologies (3rd Ed.). Elsevier. Potter, P. J. (1959) Power Plant Theory and Design (2nd edition).
Other supplemental materials
Fernández Diego, I., Robles Díaz, A. (2010). Centrales de Generación de Energía Eléctrica Haywood. (2000) Ciclos termodinamicos de potencia y refrigeracion/Analysis of Engineering Cycles Ramírez Vázquez, J. (2004). Estaciones de transformación y distribución: protección de sistemas eléctrico. CEAC. Rolf Kehlhofer (2009). Combined-Cycle Gas & Steam Turbine Power Plants. (3er Ed.). PennWell Books. Sarkar, D. (2015). Thermal Power Plant: Design and Operation. Elsevier Swift, C.D. (1965). Steam plants: start-up, testing and operation. Continental.

Description	
Know the different types of electricity generation and the descriptions of the plants (hydroelectric, thermal, conventional, nuclear, among others), as well as the study of the excitation, regulation, operation and protection of the main electrical equipment of the Plant (generators and transformers) and the interaction with complementary equipment and the power shuffling of said set. At the same time, the student will obtain management knowledge in administrative and personnel aspects. In this way, it is sought that the student knows each of the parts of said technologies observed in class and their operation.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Apply knowledge of mathematics, science and engineering elements to analyze the stability and control of the main variables and concepts of a generation plant. 2. Handle modern engineering tools to describe and explain the planning processes for the operation of a power plant.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics

Unit I. Fundamentals of Power Plants. Unit II. Steam Power Plant Cycles. Unit III. Gas Turbine Cycles. Unit IV. Combined Cycles. Unit V. Hydroelectric Power Plants. Unit VI. Plant Electrical System. Unit VII. Generator Unit VIII. Plant Control and Protection Systems

Code	INE390	Prerequisites	ECO203 INE384
Name	Electric Markets	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	René Báez

Text book
Harris, C. (2006). Electricity markets. John Wiley & Sons, Ltd. Ley General de Electricidad y su Reglamento de la República Dominicana, Ley No. 125-01. 2001. Congreso de la República Dominicana. Magraner, T. (2021). Mercado eléctrico y tarificación. Centro de Estudios Financieros (CEF).
Other supplemental materials
Biggar, D. R., & Hesamzadeh, M. R. (2014). The economics of electricity markets (1st ed.). John Wiley & Sons Ltd. Pérez-Arriaga, I. J. (Ed.). (2013). Regulation of the power sector. Springer. Rothwel, Geoffrey S. l., Gomez San Roman, T., & Schetzen, M. (2003). Electricity Economics: Regulation and Deregulation (IEEE Press Series on Power Engineering). IEEE; ISBN: 0471234370. Rothwel, Geoffrey S. l., Gomez San Roman, T., &, Schetzen, M. (2003). Electricity Economics: Regulation and Deregulation (IEEE Press Series on Power Engineering). IEEE; ISBN: 0471234370. Shively, B., & Ferrare, J. (2004). Understanding Today's Electricity Business. Enerdynamics. Wood, A. J. (2014). Power generation, operation, and control (3rd ed.). John Wiley & Sons, Inc,.

Description	
The different structures of the electricity markets and their fundamentals will be known, reviewing the regulatory framework of the Dominican Electricity Market and its main characteristics. The student's training will be expanded, through the deepening of knowledge of an economic, regulatory and technological nature required in the Electricity Sector, specifically in the new market environment. So that the student is equipped with the tools to be able to manage and function in the market, in an adequate and efficient way.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Clearly define the concepts and components that make up the fundamentals of microeconomics, identifying all the parties that interact in the electronic market. 2. Design systems or processes for the commercialization of electrical energy, using the different organisms and agents, to meet specific needs in

	society; taking into consideration social, economic and environmental aspects. 3. Apply acquired knowledge to discern between the different types of electricity markets. 4. Identify own learning strengths and needs, using research to design appropriate study strategies.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO3. Communicate effectively with a variety of audiences. SO4. Recognize ethical and professional responsibilities in engineering situations and makes informed judgments considering the impact of engineering solutions in global, economic, environmental, and social contexts. SO7. Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. Fundamentals of Microeconomics. Unit II. Principles of Regulation Unit III. Electricity Sector Regulation Models Unit IV. Generation and Wholesale Market Unit V. Dominican Electricity Sector: Technical Aspects Unit VI. Dominican Electricity Sector: Economic Aspects

Code	INE391	Prerequisites	INE387 INE387L
Name	Power Systems II	Co-requisites	INE391L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Eduardo A. De León C.

Text book
Stevenson, W. y Grainger, J. (2015). Power System Analysis. McGraw-Hill. Glover, J. D, Overbye, T, y Sarma, M.S (2017). Power System Analysis and Design (6ta Ed)
Other supplemental materials
Brokering, W., Palma, R. & Vargas, L. (2008). Los Sistemas Eléctricos de Potencia (1st ed.). México: Prentice Hall-Pearson Education. Glover, D. & Sarma, M. (2004). Analisis y Diseño de Sistemas de Potencia (3rd ed.). Mexico: Thomson Editors, S.A. Gomez-Exposito, A., Conejo, A. & Cañizares, C. (2009). Electric Energy Systems Analysis and Operation (1st ed.). New York: CRP Press –Taylor & Francis Group. Grainger, J. & Stevenson Jr., W. Fitzgerald (1996). Power Systems Analysis (1st ed.). Mexico: McGraw-Hill. Jan Machowski, Janusz W. Bialek, et á (2008). Power System Dynamics: Stability and Control Peter W. Sauer, M.A. Pai, (2017). Power System Dynamics and Stability: With Synchrophasor Measurement and Power System Toolbox (Wiley - IEEE) Saadat, H. (1999). Power System Analysis (1st ed.). Milwaukee: McGraw-Hill. Saadat, H. (2011). Power System Analysis (3rd ed.). Milwaukee: McGraw-Hill. Stanley H. Horowitz, Arun G. Phadke. (2014). Power System Relaying Weedy, B. & Cory, B (2012). Electric Power Systems (5th edition).United Kingdom, John Wiley & Sons, Ltd.

Description	
In the Power Systems II course, students will acquire and delve into the necessary skills for the analysis of the operation of electrical power systems, the study of their faults and stability, and the control of their main variables and parameters. It is also contemplated that each student acquires the skills to understand the planning processes of the operation in the short and half term of an electrical power system and identify the updated technology used for such purposes.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Apply knowledge of mathematics, science and engineering elements in the analysis of the stability and control of the main variables and concepts of an electrical power system.

	2. Use modern engineering tools to understand and explain the planning processes for the operation of an electrical power system.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Asymmetric Faults Unit II. Economic Operation Unit III. Automatic Frequency and Generation Control Unit IV. State estimation and Transient Stability

Code	INE391L	Prerequisites	INE387 INE387L
Name	Power Systems Laboratory II	Co-requisites	INE391

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ing. Eduardo A. De León C.

Text book
Manual DigSilent Joe H. C., Juan J.S. G (2020). Power System Modeling, Computation and Control (Wiley-IEEE).
Other supplemental materials
Grainger, J., & Stevenson, W., Jr. (2015). Power Systems Analysis. Saadat, H. (2011). Power System Analysis (3rd ed.). McGraw-Hill. Brokering, W., Palma, R., & Vargas, L. (2008). Los Sistemas Eléctricos de Potencia (1st ed.). Prentice Hall-Pearson Education. Glover, J. D., & Sarma, M. (2004). Análisis y Diseño de Sistemas de Potencia (3ra ed.). Thomson Editors, S.A. Gomez-Exposito, A., Conejo, A., & Cañizares, C. (2009). Electric Energy Systems Analysis and Operation (1st ed.). CRP Press –Taylor & Francis Group. Horowitz, S.H., & Phadke. A.G. (2014). Power System Relaying. Machowski, J., Bialek, J., et al. (2008). Power System Dynamics: Stability and Control. Saadat, H. (1999). Power System Analysis (1st ed.). Milwaukee: McGraw-Hill. Sauer, P.W. M. A. Pai (2017). Power System Dynamics and Stability: With Synchrophasor Measurement and Power System Toolbox. Wiley – IEEE. Weedy, B., & Cory, B. (2012). Electric Power Systems (5th ed.). John Wiley & Sons, Ltd.

Description	
In this subject, the student identifies how theory is related to practice, based on knowing how the power system is structured and the behavior it has during the events that occur in it and the different effects that each of its topologies have; as well as how to use the different software available in the market. In the laboratory of Power Systems II, the same topics that are raised in the theoretical subject of Power System II are observed in a practical way.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Manage modern computer tools to successfully carry out flow runs in an electrical power system and analyze the results obtained. 2. Apply knowledge of mathematics and engineering to find solutions to problems in the field of power systems. 3. Analyze the variables obtained in the experimentation to draw a conclusion of the abnormal behavior of the power system.

Student outcomes	SO6. Develop and conduct appropriate experimentation, analyzes and interprets data, and uses engineering criteria to draw conclusions.

Topics
Unit I. Tension control.
Unit II. Declaration of events and comparison of cases.
Unit III. Short circuit creation and analysis.
Unit IV. Use of Standards in Short Circuit Analysis
Unit V. Introduction to transient analysis
Unit VI. Stability analysis in power systems
Unit VII. Determine critical fault clearance time
Unit VIII. Protections in the power system
Unit IX. DigSilent Programming Language (DPL)

Code	INE374	Prerequisites	ING211 ING210 Have approved 200 credits
Name	Electrical Engineering Project I	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Miguel Aybar, Ms.

Text book
Plata, L. D. J. S. (2019). Cómo Hacer Un Perfil Proyecto De Investigación Científica: Palibrio. ISBN 1506527205, 9781506527208. 218 pages Hernández Sampieri, R. (2014). Metodología de la investigación (6th ed.). México: McGraw Hill. ISBN: 978-1-4562-2396-0.
Other supplemental materials
Bernal Torres, C. A. (2006) Metodología de la investigación: para administración, economía, humanidades y ciencias sociales. Pearson Educación. ISBN 9702606454, 9789702606451. p286. Gido, J., Clements, J. (s.f.) Administración exitosa de proyectos. (Fifth Edition) Cengage Learning. ISBN: 978-607-481-854-3 Lerma, H.D. (2009). Metodología de la investigación: propuesta, anteproyecto y proyecto. Educación y pedagogía. Ecoe Editions. ISBN 958648372X, 9789586483728. p165. Padilla Sierra, G. (2010). Manual de publicaciones de la American Psychological Association: Guía de entrenamiento para el estudiante. ISBN 6074480567, 9786074480566. 2nd Edition. Zahera Pérez, M. (2017). Gestión integrada de proyectos innovadores. Ediciones Pirámide. ISBN 8436836804, 9788436836806, p232.

Description	
The subject Electrical Engineering Project I includes the review of the criteria and fundamentals of scientific research applied to the execution of the degree project and progress in the development of the degree project.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify and formulate the methodology used to make a technical report on the realization of a project in the area of electrical engineering. 2. Use the tools of mathematics and engineering to design a process or project in energy management and/or saving, to provide solutions to problems in society. 3. Analyze the scope of the project using critical thinking – reflective of certain situations in its development; in addition to understanding the implications and consequences of it.

	4. Identifies how to foster trust in each member of the work team, the ability to make decisions, responsibility and teamwork.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO2. Apply the engineering design process to produce solutions that meet specific needs taking into consideration public health and safety, global, cultural, social, environmental, economic factors, as well as any other factors as appropriate to the discipline. SO4. Recognize ethical and professional responsibilities in engineering situations and makes informed judgments considering the impact of engineering solutions in global, economic, environmental, and social contexts. SO5. Function effectively as a member or leader of a team setting goals, planning tasks, meeting deadlines, and creating a collaborative and inclusive environment.

Topics
Unit I. Basic Content of the Subject Unit II. Quantitative Method Unit III. Qualitative Method Unit IV. Delivery methods of draft reports.

Code	INE392	Prerequisites	INE366 INE202
Name	Communications	Co-requisites	INE392L

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Nicolás Castillo, Ms. Prof. Miguel Aybar, Ms.

Text book
Bruce Carlson, A. P. (2007). Sistemas de Comunicación (Fourth ed.). México: McGraw Hill. ISBN:970-10-6105-5.
Other supplemental materials
Bateman, A. (2003). Comunicaciones digitales: diseño para el mundo real. Marcombo. ISBN:8426713378, 9788426713377 Gallardo Vazquez, S. (2015). Elementos de sistemas de telecomunicaciones. Ediciones Paraninfo. ISBN:8428336636, 9788428336635 Sanchis, E. (2004). Fundamentos y electrónica de las comunicaciones. Universitat de València. ISBN 843705916X, 9788437059167 Tomasi, W. (2003). Sistemas de comunicaciones electrónicas. Pearson Educación. ISBN:9702603161, 9789702603160

Description	
This communications subject includes knowledge of analog modulations, modulated signals, carriers, baseband, basic communications theory. Students are expected to be able to correctly describe and analyze the operation of analog and digital modulations commonly used in analog and digital communication systems.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Recognize and interpret engineering principles appropriately to solve problems related to communication systems. 2. Apply the knowledge of mathematics and engineering to find solutions to problems in the field of communications systems. 3. Apply analysis methods, such as Fourier, to solve complex circuits in simpler ways.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Introduction to Communications Unit II. Fourier Transform Unit III. System Analysis

Unit IV. Analogue Modulated Systems Unit V. Base-Band Signaling Unit VI. Digital Modulated Systems Unit VII. Communications System

Code	INE392L	Prerequisites	INE366 INE202
Name	Communications Laboratory	Co-requisites	INE392

Credits	Contact Hours
01	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Miguel Aybar, Ms.

Text book
Frenzel Jr., Louis E. (2016). Principles of electronic communication systems. Fourth Edition. McGraw-Hill. ISBN 978-0-07-337385-0 W. Leis, John. (2018). Communication Systems Principles Using MATLAB. ISBN 13:9781119470687. Wiley.
Other supplemental materials
Kanatas, Athanasios G. & Nikita, K.S. & Mathiopoulos, Panagiotis. (2018). New Directions in Wireless Communications Systems: From Mobile to 5G. CRC Press. Taylor & Francis Group. ISBN-13: 978-1-4987-8545-7. Jyrki T. J. Penttinen. (2015). The Telecommunications Handbook: Engineering Guidelines for Fixed, Mobile and Satellite Systems. ISBN 10:1119944880. ISBN 13:9781119944881. John Wiley & Sons, Ltd. Rodger E. Ziemer, William H. Tranter. (2015). Principles of communication: systems, modulation, and noise. ISBN 13:978-1-118-07891-4. ISBN 10:1118078918. Seventh Edition. Wiley. Matin, Mohammad A. (2018) Communication Systems for Electrical Engineers. ISBN 13:978-3-319-70129-5. Series: SpringerBriefs in Electrical and Computer Engineering Frenzel Jr., Louis E . (2016). Principles of electronic communication systems. Fourth Edition. McGraw-Hill. ISBN 978-0-07-337385-0

Description	
This laboratory focuses on providing students with spaces for practice and development of skills related to analog and digital modulations commonly used in modern communication systems.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Recognize and interpret engineering principles appropriately to solve problems related to communication systems. 2. Apply the knowledge of mathematics and engineering to find solutions to problems in the field of communications systems. 3. Apply analysis methods, such as Fourier, to solve complex circuits in the simplest way.

Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics.

Topics
Unit I. Principle of DTMF
Unit II. Fourier Transform
Unit III. Analog Filters
Unit IV. Base-Band Signaling / Analogue Modulation
Unit V. Digital Modulations ASK-FSK
Unit VI. PSK-QPSK-QAM Digital Modulations
Unit VII. Communications System
Unit VIII. Guided Media Communications
Unit IX. Guided Media Communications
Unit X. Project design applying

Code	INE393	Prerequisites	None
Name	Quality Assurance and Management	Co-requisites	None

Credits	Contact Hours
02	22
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Ismael Bautista

Text book
Evan, J., & Lindsay, W. (2014). Administración y Control de la Calidad (9th ed.). Cengage Learning.
Other supplemental materials
López Lemos, P. (2016). Herramientas para la Mejora de la Calidad. Roque, P. (2018). Manual Básico para el control, aseguramiento, mejora y gestión de la calidad: Gestión de Calidad, Aseguramiento de Calidad, Control de Calidad. IEEE (2014). IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems, in IEEE Std 519-2014 (Revision of IEEE Std 519-1992), pp.1-29, doi: 10.1109/IEEESTD.2014.6826459. Kiran, D.R. (2016). Total Quality Management: Key Concepts and Case Studies. Landeta, J. M., & Izar & Ortiz, J. H. (2004). Las 7 herramientas básicas de calidad: descripción de las 7 herramientas estadísticas para mejorar la calidad y aumentar la productividad. Universidad Potosina. Letuchev, G. M., Aleksandrova, S. V., & Vasiliev, V. A. (2017). Improvement of processes of quality management. 2017 International Conference "Quality Management, Transport and Information Security, Information Technologies" (IT&QM&IS), St. Petersburg, 2017, pp. 432-435, doi: 10.1109/ITMQIS.2017.8085854. Mohamad, F., Abdullah, N. H., Kamaruddin, N. K., & Mohammad, M. (2014). Implementation of ISO50001 energy management system. 2014 International Symposium on Technology Management and Emerging Technologies, Bandung, Indonesia, pp. 275-280, doi: 10.1109/ISTMET.2014.6936518. Ntanzi, K., Lumbwe, A. K., Mukwakungu, S. C., & Sukdeo, N. (2020). The Relationship Between the Implementation of Quality Management Practices and Service Quality in the South African Financial Service Industry. 2020 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Singapore, Singapore, 2020, pp. 1235-1240, doi: 10.1109/IEEM45057.2020.9309805. (J) Viriansky, Z. Y., & Shaposhnikov, S. O. (2019) Quality Assurance of Quality Management Systems. 2019 International Conference "Quality Management, Transport and Information Security, Information Technologies" (IT&QM&IS), Sochi, Russia, 2019, pp. 323-325, doi: 10.1109/ITQMIS.2019.8928299.

Description
The quality and management of limited resources is presented as a priority in the field of engineering and in both public and private companies to achieve proposed goals. This subject will allow the student to know and apply the relevant quality tools. Among

the topics contained in the program are the basic concepts, planning, management and quality tools necessary to control, monitor quality during any process, knowledge of industrial manufacturing processes and the position of the Engineer against processes related to all aspects of quality issues and their impact on processes.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Accurately expose their ideas and projects, using examples and graphic support, as well as the necessary tools associated with the principles of quality management. 2.1 Designs a Quality Management System based on the effective management of processes, continuous improvement and quality assurance. 2.2 Produces written reports for their projects using the appropriate technical language.
Student outcomes	SO3. Communicate effectively with a variety of audiences. SO7. Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. Basic Concepts of Quality Management Unit II. Quality Planning (Design) Unit III. Process management Unit IV. Quality Tools Unit V. Quality Assurance in Electrical Engineering

Code	INE395	Prerequisites	CBQ208 CBQ208L
Name	Electrical Materials for Engineering	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Vesselina Radeva

Text book
Askeland, D. y Wenselix J., W. (2017). Ciencia e Ingeniería de los Materiales. 7ma.
Other supplemental materials
Comunidad de Madrid (S.F from S.F from 2007). Guía de Ahorro y Eficiencia Energética en Oficinas y Despachos. Obtenido de fenercom: http://www.fenercom.com/pdf/publicaciones/guia-de-ahorro-y-eficiencia-energetica-en-oficinas-y-despachos-fenercom.pdf Comunidad de Madrid (s.f from s.f from 2016). Fenercom. Obtenido de Guia sobre Ahorro y Eficiencia Energetica en Escaleras Mecanicas y Andenes Moviles: http://www.fenercom.com/pdf/publicaciones/Guia_sobre_AEE_en_Escaleras_Mecanicas_y_Andenes_Moviles-fenercom_2016.pdf Guia sobre Ahorro y Eficiencia Energética en Escaleras y Andenes Moviles. (2017). www.fenercom.com. Retrieved from http://www.fenercom.com/pdf/publicaciones/Guia_sobre_AEE_en_Escaleras_Mecanicas_y_Andenes_Moviles-fenercom_2016.pdf GreenPeace. (s.f from s.f from 2011). Guía Verde de Eficiencia Energetica. Retrieved from: http://www.greenpeace.org/argentina/Global/argentina/report/2011/guia_verde_eficiencia_2011.pdf Superintendencia de Electricidad (30 de Octubre de 1998). Régimen Tarifario Aplicable por las Empresas Distribuidoras. (Resolución no. 237) Obtenido de Super Intendencia de Electricidad: http://www.sie.gob.do/images/sie-documentos-pdf/marco-legal/resoluciones-seic/seic/1998/seic-237-98-regimen-tarifario-aplicable-por-las-empresas-distribuidoras.pdf

Description	
In this course, students will explore the characteristics of the different materials typically used in Electrical Engineering, all their mechanical and magnetic properties, etc. At the end of the program, each student is expected to develop criteria for the selection of materials commonly used in the design of electrical and electronic devices. Similarly, they will demonstrate skills to analyze the structures of materials and their relationship with the properties necessary for engineering design, understand the changes that material treatments produce in their properties, through the study of structural changes. The content to be addressed covers basic concepts to fully understand and exploit the relationship between the structure, properties and processing of materials in engineering.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1.Research examples of energy savings to discuss in class and use as references of good practices in their projects. 2. Investigate forms of evaluation and current procedures in order to apply them in energy efficiency projects and practices. 3. Use the most appropriate techniques and tools for the study of efficiency and for the preparation of an electrical audit.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO7. Acquire and apply new knowledge using appropriate learning strategies.

Topics
Unit I. Energy scenarios Unit II. Definitions, objectives and scope Unit III. Energy Efficiency (Residences) Unit IV. Energy Efficiency (Commercial Sector) Unit V. Units of Measurement for Energy Efficiency Unit VI. Energy audit Unit VII. Lighting Basics-Air Conditioner-Electric Motors Unit VIII. Measurement tools

Code	INE396	Prerequisites	INE374
Name	Electrical Engineering Project II	Co-requisites	None

Credits	Contact Hours
04	44
Categorization of credits	
Math and basic science	
Engineering topic	X
Other	

Instructor's course name:	Prof. Miguel Aybar, Ms.

Text book
Cunha, I. (2016). El trabajo de fin de grado y de máster: Redacción, defensa y publicación: Editorial UOC. ISBN 849116376X, 9788491163763. 208 pages
Other supplemental materials
Plata, L. D. J. S. (2019). Cómo Hacer Un Perfil Proyecto De Investigación Científica: Palibrio. ISBN 1506527205, 9781506527208. 218 pages Paitán, H. Ñ. et al (2014) - Metodología de la investigación: cuantitativa - cualitativa y redacción de la tesis / 4. ed. - Bogotá: Ediciones de la U, 2014. - 536 p.: il.; 24 cm. Hernández Sampieri, R. (2014). Metodología de la investigación (6th ed.). México: McGraw Hill. ISBN: 978-1-4562-2396-0. Markey, K. (2015). Online Searching: A Guide to Finding Quality Information Efficiently and Effectively: Rowman & Littlefield Publishers. Bairagi, V., & Munot, M. V. (2019). Research Methodology: A Practical and Scientific Approach: CRC Press. ISBN 1351013262, 9781351013260. 304 pages Plata, L. D. J. S. (2019). Cómo Hacer Un Perfil Proyecto De Investigación Científica: Palibrio. ISBN 1506527205, 9781506527208. 218 pages Paitán, H. Ñ. et al (2014) - Metodología de la investigación: cuantitativa - cualitativa y redacción de la tesis / 4. ed. - Bogotá: Ediciones de la U, 2014. - 536 p. : ill. ; 24 cm.

Description	
The Electrical Engineering Project II subject includes the development, assembly and start-up of the preliminary project selected in the Electrical Engineering Project I subject. The content to be developed in it includes: presentation of the evaluation matrix, completion of the final project degree, the planning and management of a project, budgeting as well as innovation in it.	
Type of course	☒ Required ☐ Elective

Specific goals for the course	
Outcomes of instruction	1. Identify and formulate the methodology used to make a technical report on the realization of a project in the area of Electrical Engineering. 2. Design processes or projects aimed at managing and/or saving energy to provide solutions to problems in society, using mathematical and engineering tools.

	3. Analyze using critical thinking – reflective of certain situations in project development; in addition to understanding the implications and consequences of it 4. Identify how to foster trust in each member of the work team, the ability to make decisions, responsibility and collaboration.
Student outcomes	SO1. Identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics. SO2. Apply the engineering design process to produce solutions that meet specific needs taking into consideration public health and safety, global, cultural, social, environmental, economic factors, as well as any other factors as appropriate to the discipline. SO4. Recognize ethical and professional responsibilities in engineering situations and makes informed judgments considering the impact of engineering solutions in global, economic, environmental, and social contexts. SO5. Function effectively as a member or leader of a team setting goals, planning tasks, meeting deadlines, and creating a collaborative and inclusive environment.

Topics
Unit I. Presentation of the Evaluation Matrix Unit II. How to do a final degree project Unit III. Planning and managing a project Unit IV. Budgeting of a project Unit V. Contributions of innovation in the project result Unit VI. Project progress presentation