## A) COURSE

| Course Id: | Course |
|---|---|
| 5692 | Electrotechnology for engineering I |

| Class Hours per Week | Lab hours per week | Complementary practices | Credits | Total hour course |
|---|---|---|---|---|
| 4 | 1 | 4 | 9 | 64 theory<br>16 practice |

## A) GENERAL COURSE INFORMATION

| | EE (IEA) | ME (IM) | MME (IMA) | EME (IME) | MTE (IMT) |
|---|---|---|---|---|---|
| **Level:** | | V | V | | II |
| **Course Type (Required/Elective)** | | Required | Required | | Required |
| **Prerequisite Course:** | | 135 credits | 135 credits | | 45 credits |
| **CACEI Classification:** | | CB | CB | | CB |

## C) COURSE OBJECTIVE

| **At the end of the course, the student will be capable of:** |
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| That the student analyzes the laws, concepts and fundamental principles of the electricity and magnetism, to understand the electromagnetic phenomena associated with applications of electrical engineering. To check the fundamental laws of electromagnetism, by performing the proposals labs. |

## D) TOPICS (CONTENTS AND METHODOLOGY)

| 1.- Electric field and Coulomb's law. | | **5hours** |
|---|---|---|
| Specific Objective: | That the student understand the concepts: electric charge, conductors, insulators, electric charge density, power lines, and the properties determined by Coulomb's law. | |
| 1.1 Electric charge.<br>1.2 Coulomb's law.<br>1.3 Electric charge density.<br>1.4 Electric field.<br>1.5 Power lines. | | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. | |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. | |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. | |

| 2.- Gauss' law. | **4 hours** |
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|---|---|
| Specific Objective: | That the student acquires others knowledge basic of electrostatic: electric field flow, charges and electric field in a conductor; the relations between charge and field through the Gauss' law application. |
| 2.1 Electric field flow<br>2.2 Gauss' law.<br>2.3 Charges and electric field in an isolated conductor.<br>2.4 Gauss' law application. | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. |

| 3.- Electric potential. | **8hours** |
|---|---|
| Specific Objective: | That the student understands the potential concepts, potential difference, relation between potential and electric field, between energy and electric potential. |
| 3.1 Potential difference.<br>3.2 Electric potential calculation.<br>3.3 Potential gradient.<br>3.4 Energy and electric potential. | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. |

| 4.- Electrical resistive circuits. | **11 hours** |
|---|---|
| Specific Objective: | That the student understand the concepts: electrical current, electromotive force, resistance and resistivity, to the solution of electric circuits through application of Ohm's law and Kirchhoff's laws, in addition to reducing series-parallel. |
| 4.1 Electrical current.<br>4.2 Resistance and resistivity.<br>4.3 Ohm's law.<br>4.4 Series circuit, parallel circuit and series-parallel circuits.<br>4.5 Energy and power.<br>4.6 Electromotive force.<br>4.7 Measuring equipment: voltmeter, ammeter, ohmmeter and wattmeter.<br>4.8 Kirchhoff's laws. | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. |

| 5.- Batteries. | **4 hours** |
|---|---|
| Specific Objective: | That the student understand like the electric energy develops, starting of chemical reactions. Identify like can storing energy; as well as the study different types of piles and batteries. |
| 5.1 Chemical energy and Electromotive force.<br>5.2 Primaries and secondaries batteries.<br>5.3 Different types of batteries. | |

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| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. |

| 6.- Capacitance and Capacitors | | **4 hours** |
|---|---|---|
| Specific Objective: | That the student understands the characteristics of the capacitors, the concept of capacitance, influence of dielectric in capacitors; as well as ways to connect different and its application to simple R-C circuits in direct current. | |
| 6.1 Capacitance.<br>6.2 Geometry and parameters of a capacitor.<br>6.3 Capacitors with dielectrics.<br>6.4 Series and parallel capacitors<br>6.5 RC circuits direct current.<br>6.6 Safe handling of capacitors. | | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. | |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. | |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. | |

| 7.- Magnetic field | | **6hours** |
|---|---|---|
| Specific Objective: | That the student understand the basic concepts of magnetism: magnetic field induction lines, magnetic flux. | |
| 7.1 Magnetic field.<br>7.2 Magnetic properties of matter.<br>7.3 Induction lines and magnetic flow.<br>7.4 Force on a movil charge.<br>7.5 Force on a conductor.<br>7.6 Momentum on a turn with current | | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. | |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net. | |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. | |

| 8.- Ampere's law | | **6 Hours** |
|---|---|---|
| Specific Objective: | That the student analyze the interactions between electrical currents and magnetic fields, using the concepts of Ampere's law and the solenoid study. | |
| 8.1 Ampere's law.<br>8.2 Field of straight conductor.<br>8.3 Electrodynamic force between parallel conductors.<br>8.4 Magnetic field of solenoid. | | |

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|---|---|
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. |

| 9. Induced electromotive force. Faraday's Law. | | **11hours** |
|---|---|---|
| Specific Objective: | That the student understand the behavior of electrical current conductors and the presence of variables magnetic fields; identify the concepts of current and electromotive force induced using the analysis of Faraday's law and Lenz's law. | |
| 9.1 Faraday's law and Lenz's law.<br>9.2 Principle of generator.<br>9.3 Basic principle of generating voltages and AC.<br>9.4 Ideal transformer principles. | | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. | |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net | |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. | |

| 10.- Inductance. | | **5hours** |
|---|---|---|
| Specific Objective: | That the student apply the inductance concept, like circuits element to solve simple circuits LR, LC, RLC. | |
| 10.1 Definition and calculating.<br>10.2 RL and LC series circuits.<br>10.3 Definition of RLC circuits. | | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. | |
| **Teaching methods** | Exercise class and homework, as well as them respective interpretation of results; digital simulation exercises, different activities in digital platforms on the net | |
| **Learning activities** | Develop of lab practices applying the theory concepts. Practices report, group and individual problem resolution. | |

**E) TEACHING AND LEARNING METHODOLOGIES**

Each topic will expose using the traditional method, audiovisual and demonstrative. A series of exercises will be solved. Also the students will solve problems and elaboration of a project. The students will perform 10 lab practices, 1 hour each week.
The teacher, with support of lab assistant will perform the presentation of the practice and taking care that the students develop the practice in correct form.

**F) EVALUATION CRITERIA**

| Evaluation: | Schedule | Suggested Form of Evaluation and weighing | Topics |
|---|---|---|---|
| First partial evaluation | Session 16 | Exam 80% , Homeworks 5%, Practices 15% | 1,2,3 |

| | | | |
|---|---|---|---|
| Second partial evaluation | Session 32 | Exam 80% , Homeworks 5%, Practices 15% | 3, 4, 5 |
| Third partial evaluation | Session 48 | Exam 80% , Homeworks 5%, Practices 15% | 5, 6 , 7 |
| Fourth partial evaluation | Session 64 | Exam 80% , Homeworks 5%, Practices 15% | 8, 9, 10 |
| Ordinary final evaluation | | 80% (Average partial evaluations) 20% Final project | |
| Another activity: | Final project: percentage and criteria defined by the teacher at the beginning of the semester . | At each partial will perform lab practices that will be cosidered in the evaluation | |
| Extraordinary exam | Week 17 of the semester | 100% Written exam | 100% agenda |
| Title exam | According to scheduling school secretary | 100% Written exam | 100% agenda |
| Regularization exam | According to scheduling school secretary | 100% Written exam | 100% agenda |

**G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES**

**Main Books**


- SERWAY, JEWETT, Física: electricidad y magnetismo, CengageLearning, Séptima Edición, 2009.
- BOYLESTAD, ROBERT L, Introducción al Análisis de Circuitos, decimo segunda edición, 2011
- TIPLER PAUL A., Física para la ciencia y la tecnología, Volumen II, Reverté, sexta edición, 2009.


**Complementary Books**


- SEARS-ZEMANSKY-YOUNG, Física universitaria, Volumen II, Pearson, decimo segunda edición, 2009.


**Internet Links**

- http://www.learnengineering.org
- http://www.ni.com/multisim/whatis/esa/
-

**Software:**
Multisim