NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF MECHANICAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM

ML121 – LABORATORY OF ELECTRIC CIRCUITS

I. GENERAL INFORMATION

CODE	: ML121
SEMESTER	: 5
CREDITS	: 1
HOURS PER WEEK	: 2 (Laboratory)
PREREQUISITES	: Electric Circuits, ML-140
CONDITION	: Compulsory

II. COURSE DESCRIPTION

The course prepares the students so that at the end of it, using measuring instruments and appropriate equipment, they can structure direct and alternating current electrical circuits; selecting the appropriate components. They will also prepare a technical report; explaining the structured electrical circuits, as well as their operation; supporting the results obtained.

III. COURSE OUTCOMES

The student will:

1. Structure direct and alternating current electrical circuits starting with the interconnection of electrical elements.
2. Check experimentally the main laws and properties of electrical circuits.
3. Determine the main electrical magnitudes of a direct and alternating current electric circuit using electrical measuring instruments.
4. Recognize and explain the characteristics of the elements of a direct and alternating current electric circuit.

IV. LEARNING UNITS

1. **THE KIRCHHOFF LAWS; EQUIPMENT RECOGNITION, INSTRUMENTS AND COMPONENTS IN LINEAR ELECTRIC CIRCUITS / 2 HOURS**
   Theoretical Explanation / Electric Circuits Implementation / Experience Procedures / Presentation of Results Report.

2. **THEVENIN, NORTON AND MAXIMUM TRANSFER POWER THEOREMS / 2 HOURS**
   Theoretical Explanation / Electric Circuits Implementation / Experience Procedures / Presentation of Results Report.

3. **USE OF THE WAVE GENERATOR AND THE OSCILLOSCOPE: CHARACTERISTIC VALUES OF PERIODICAL WAVES / 2 HOURS**
   Theoretical Explanation / Implementation of Electrical Rectifiers / Experience Procedures / Presentation of Results Report.

4. **FIRST AND SECOND ORDER TRANSIENT CIRCUITS / 2 HOURS**

   Theoretical Explanation / Implementation of RC and RLC Electrical Circuits / Experience Procedures / Presentation of Results Report.

5. **SCALAR AND COMPLEX RELATIONS IN LINEAR AC CIRCUITS / 2 HOURS**
   Theoretical Explanation / Implementation of Alternating Current Electrical Circuits / Experience Procedures / Presentation of Results Report.

6. **ENERGY AND POWER MEASUREMENT AND CORRECTION OF THE POWER FACTOR IN SINGLE-PHASE CIRCUITS / 2 HOURS**
   Theoretical Explanation / Implementation of RC, RL and RLC Alternating Current Electrical Circuits / Experience Procedures / Presentation of Results Report.

7. **THREE-PHASE ELECTRIC CIRCUITS / 2 HOURS**
   Theoretical Explanation / Implementation of THREE-PHASE electrical circuits with WYE and DELTA connection / Experience Procedures / Presentation of Results Report.

8. **MEASUREMENT OF THE MUTUAL INDUCTANCE IN A COUPLED CIRCUIT / 2 HOURS**
   Theoretical Explanation / Implementation of a single-phase COUPLING circuit using single-phase TRANSFORMERS / Experience Procedures / Presentation of Results Report.

V. LABORATORIES AND PRACTICAL EXPERIENCES

- Laboratory 1: The Kirchhoff laws; equipment recognition, instruments and components in linear electric circuits.
- Laboratory 2: Thevenin, Norton and maximum transfer power theorems.
- Laboratory 3: Use of the wave generator and the oscilloscope: characteristic values of periodical waves.
- Laboratory 4: First and second order transient circuits.
- Laboratory 5: Scalar and complex relations in linear AC circuits.
- Laboratory 6: Energy and power measurement and correction of the power factor in single-phase circuits.
- Laboratory 7: Three-phase electric circuits.
- Laboratory 8: Measurement of the mutual inductance in a coupled circuit.

VI. METHODOLOGY

The course is developed in 8 laboratory sessions. In each session, a brief summary of the theoretical basis of the experience to realize, how to set up the circuit and how to perform the experimental tests is presented. The report of the results obtained in the experience is presented in the following session and are subsequently exhibited by the students. In all the sessions the active participation of the student is promoted.

VII. GRADING FORMULA

System of evaluation “D”. Calculation of Final Average: FA = (LP1+LP2+ LP3+ LP4 LP5 + LP6 + LP7 + LP8)/8 LP1: Laboratory Practice 1 LP2: Laboratory Practice 2 LP3: Laboratory Practice 3 LP4: Laboratory Practice 4 LP5: Laboratory Practice 5 LP6: Laboratory Practice 6 LP7: Laboratory Practice 7 LP8: Laboratory Practice 8.

VIII. BIBLIOGRAPHY

1. BOYLESTAD ROBERT. Introduction to the Circuits Analysis. Pearson Education Editorial, 2004.
2. JOHNSON DAVID. Basic Analysis of Electric Circuits. PRENTICE-HALL HISPANOAMERICANA Editorial, 2005.
3. DORF RICHARD. Electric Circuits, Introduction to Analysis and Design. ALFA Y OMEGA Editorial, 2000.