NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL ENGINEERING PROGRAM

EE392 – LABORATORY OF ELECTRICAL MEASUREMENTS II

I. GENERAL INFORMATION

CODE	**:**	EE392 – Laboratory of Electrical Measurements II
SEMESTER	**:**	8
CREDITS	**:**	01
HOURS PER WEEK	**:**	02 (Laboratory)
PREREQUISITES	**:**	EE364 – Electrical Measurements II EE391 – Laboratory of Electrical Measurements I
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

It is a subject of a practical nature and belongs to the area of professional training. Its purpose is to practically train the student to perform electrical measurements of industrial type and research laboratory.

III. COURSE OUTCOMES

At the end of the course the student will:

- Identify, design and understand the functions of all the components of an electric circuit.
- Select correctly the equipment and instruments to be used according to the experience to be developed.
- Properly handle measuring and control instruments, configuring and connecting them correctly.
- Build analog circuits to verify their proper functioning with the measuring and control instruments.
- Tabulate the results in an orderly manner and make graphs and correctly interpret the results obtained, generalize and formulate conclusions.
- Compare the experimental results with the theoretical ones verifying the validity of the analog circuits built in the experiences.
- Prepare clear technical reports detailing the process developed, interpreting results and formulating conclusions.

IV. LEARNING UNITS

1. INFLUENCE OF THE POWER FACTOR IN THE READING OF A VATIMETER.

A constant intensity is applied to the ammeter meter of a wattmeter and using a phase shifter a constant modulus voltage, but of varying angle, is applied to its voltmeter coil. Then the

values read in the wattmeter for angle values of tension between -90 and +90 are compared with the theoretical ones and studied the causes of the deviations.

2. **DIFFERENTIAL CURRENT.**
   A differential circuit is armed to apply it to the protection of a transformer, then simulating an internal fault, the circuit response and the transformation errors are studied.

3. **INSULATION RESISTANCE**
   The behavior of the insulation resistance of an electric machine, obtained by means of the rectified alternating voltage in a magnifier, is experimentally found. Results are compared and the effects of each of the methods are analyzed.

4. **MAGNETIC AMPLIFIER**
   A sinusoidal alternating voltage is applied to a transformer by the primary winding and continuous voltage in the secondary winding, its behavior is analyzed for amplification of an alternating, saturated, symmetrical magnetic and fast response. Applications.

5. **SATURATED INTENSITY TRANSFORMER**
   A current transformer is saturated, by using load impedances of various types. For each of them the waveform of the secondary current is taken and the behavior of the transformer is studied.

6. **HIGH VOLTAGE HIGH POWER CONTROL BOARD.**
   The complete scheme of a measuring board for high voltage is drawn, the values of the measuring instruments for variable load with power factor in arrears are taken. The errors of the energy consumed by the load are determined by comparing the direct and indirect method.

7. **VATIMETER WITH R-C SCROLL**
   In a single-phase circuit the reactive power is measured, with a single-phase wattmeter taking into account the loading effect of its voltmeter coil. Advantages and applications.

8. **ERRORS OF A VOLTAGE TRANSFORMER**
   Using a voltage transformer, its behavior is studied in vacuum and under load, then determining the relationship and phase errors for various electrical variables for industrial use.

9. **GROUND ELECTRICAL RESISTIVITY**
   Using a grounding meter, by means of three electrodes of which two are fixed or one moves between the fixed ones, resistance readings of the earth pit are obtained for each position of the mobile electrode. The resistance value is plotted as a function of the distance between the mobile electrode and the earth pit. Grounding resistance measurement methods.

10. **CAPACITIVE VOLTAGE DIVIDER**
    A capacitive voltage divider is constructed and by connecting it through a voltage transformer and an inductive reactance its operation is checked for voltage, load and frequency variations.

V. METHODOLOGY

The course is developed in laboratory sessions. In these sessions, the teacher presents the laboratory guides. At the end of the laboratory the student team must submit a technical report. In all sessions the active participation of the student is promoted.

VI. EVALUATION FORMULA

The learning will be evaluated through the "D" system.

- Average of Laboratory experiences (L) is equal to the Final Grade.

$$\boldsymbol{FA} = \frac{\boldsymbol{L1 + L2 + L3 + L4 + L5 + L6}}{\boldsymbol{6}}$$

VII. BIBLIOGRAPHY

- “Electrical Measurements and Measuring Instruments”, S. Kamakshaiah, J. Amarnath. I. K International Pvt, 2011.
- “Capacitors Magnetic Circuits and Transformers”, Sal G. CreateSpace Independent, 2002.
- “Control in Power Electronics”, Marian P. Kazmierkowski. Elsevier, 2002.