NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF MECHANICAL ENGINEERING
MECHATRONICS ENGINEERING PROGRAM

ML452 – INDUSTRIAL ELECTRICAL INSTALLATIONS

I. GENERAL INFORMATION

CODE	**:**	ML452 Industrial Electrical Installations
SEMESTER	**:**	8-10
CREDITS	**:**	3
HOURS PER WEEK	**:**	4 (Theory–Practice)
PREREQUISITES	**:**	ML140 Electrical Circuits
CONDITION	**:**	Elective

II. COURSE DESCRIPTION

Introduction. Electric conductors. American series and European series. Cables. Electrical raceways. Calculation and selection of conductors for current capacity. Using tables. Calculation and selection of conductor voltage drop. Electric boards. Motor protection against short circuit. Motor protection against overload. Selecting motor thermal switch. Differential protection. Grounding. Reactive compensation. Generators. DC power applications. Installation of electric motors. Lightning protection.

III. COURSE OUTCOMES

1. Understands and applies complex numbers through basic operations.
2. Determine and explain the different parameters of voltage and current in DC and AC circuits.
3. Determines, analyzes and explains the power consumed by a resistor and the power generated by a source within DC and AC circuits.

IV. LEARNING UNITS

1. INTRODUCTION

General concepts of an electric power system / Power generation, transformation, transformer substation, power distribution / Representation of an electrical system using a single-line diagram / Peruvian Electric System.

2. ELECTRICAL CONDUCTORS

Conductors. Materials for electrical conductors. American series (AWG). Wires. Commercial US wires. Code wires. TW, THW and THHW conductors. Classification of conductors according to their constitution. European series. Nomenclature. Most common wires: NYY, NKY and N2YSY. Comparison between copper and aluminum. Description of a typical power wire. Technical specifications of the electrical conductors.

3. ELECTRICAL PIPES

Electrical pipes. Conduit tubes. Heavy metal, light heavyweight and lightweight conduit tubes. Nominal diameters and lengths. Rigid plastic conduit pipe (PVC). Flexible conduit pipe. Pipelines. Pipelines bank. Trays. Examples of pipe selection.

4. CALCULATION OF POWER BY CURRENT CAPACITY AND VOLTAGE DROP

Feeder circuit for motors. Single-line diagram. Circuit elements. Old and modern single-line diagrams. Calculating of motor feeders for current capacity. Current tables for conductors according to the CNE. Current design. Temperature correction factor. Calculation and selection of conductors for current capacity. Feeder calculations for a motor group. Calculation of voltage drop feeders. Percentage of voltage drop.

5. PROTECTION OF ELECTRIC MOTORS

Motor protection against short-circuit. Fuses. Advantages and disadvantages. Features of fuses. Melting curves of the fuses. NH fuses. Standardized values of short-circuit current. Overload protection. Switches. Features of thermomagnetic switches. Working areas of a thermomagnetic switch. Thermal relay. Dimensioning of the thermomagnetic protection. Selectivity between two fuses. Selectivity between two circuit breakers. Differential protection.

6. GROUNDING

Grounding. Effects of electricity on the human body. Contact voltage. Step voltage. Transfer potential. Elements for calculating a grounding network. Determining the required length of the conductor for the control of the gradient. Grounding rods. Nature of the land. Formulas for grounding calculations. Methods for reducing electrical resistance.

7. DC APPLICATIONS AND ELECTRICAL BOARDS

DC power applications. Installation of electric motors. Start types for motors. Control devices. Mufflers. Electric boards. Considerations for selecting switchboards. Considerations for the location of boards. Control panel. Transfer board.

8. REACTIVE COMPENSATION

Reactive compensation. Compensation methods: individual compensation, compensation for groups, centralized compensation and mixed compensation. Selecting of the capacitor size. Example of equipment selection for centralized compensation.

9. GENERATORS

Generators. Settings. Diesel engine. AC generator. Applications of generators. Peak energy. Main energy. Total energy. Example of selection and sizing of the generator.

10. LIGHTNING PROTECTION

Lightning protection. Lightning rod. System of lightning protection. Lightning rod types. Procedure of lightning selection. Installation of a lightning protection system.

V. METHODOLOGY

The course is developed in theory and practice sessions. In the theory sessions, the instructor introduces the concepts, theorems and applications. In the practical sessions, various problems are solved and their solutions are analyzed and the progress of the course project is controlled according to the course syllabus is developed. In all sessions the active student participation is encouraged and the qualifications are obtained as follows:

a) Develop a paper on any topic of the syllabus that the student group can choose depending on what they would like to deepen. This monograph is presented and discussed in the week that chapter unfolds in class. At the time of exposure each group shall be prepared with an assessment test which will be taken in the last 10 minutes of exposure.

b) Develop an industrial electrical installation project to be developed during the semester group: it is a real case taken from a company in order to perform calculations parallel to the progress of the course.

VI. EVALUATION FORMULA

The Average Grade PF is calculated as follow:

PF = (P1 + P2 + P3 + P4) / 4

P1: Practice 1, **P2**: Practice 2
P3: Monograph **P4**: Project

VII. BIBLIOGRAPHY

1. **National Electric Code** (From 2006 to Present).
   Ministry of Energy and Mining. Peruvian Government.
2. **Norms of the National Direction of Electricty**
   Ministry of Energy and Mining. Peruvian Government.
3. **ENRIQUEZ HARPER**
   Guide for the Design of Industrial, Domestic and Commercial Electrical Installation.