



**NATIONAL UNIVERSITY OF ENGINEERING  
COLLEGE OF MECHANICAL ENGINEERING  
MECHANICAL-ELECTRICAL ENGINEERING  
PROGRAM**

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**ML432 – INTERNAL ELECTRICAL INSTALLATIONS**

**I. GENERAL INFORMATION**

CODE	: ML 432 Interior Electrical Installations
SEMESTER	: 6
CREDITS	: 3
HOURS PER WEEK	: 4 (Theory - Practice)
PREREQUISITES	: MC 512 Electric Drawing
CONDITION	: Mandatory

**II. COURSE SUMMARY**

The course prepares the student in the application of the concepts, methods and techniques of planning and design of the Interior Electrical Installations. Analysis of electrical charges. Quality of electrical energy. The Electrical Supply. Interior lighting. Calculation of Feeders and Derived Circuits. Protection of Interior Installations. Emergency systems. Verification and testing of indoor electrical installations. Maintenance of these facilities and their periodic evaluation. Buildings with LEED Certification. Intelligent energy meters. Energy efficiency.

**III. COMPETENCES**

The student:

1. It organizes data for the adequate deduction of the reality of the electrification of the country, its per capita consumption kW / h / inhabitant / year, analyzing and interpreting the reality of the electrification of Peru in the regional and world order.
2. Explain and determine the magnitude of a domestic electrical installation and an internal electrical installation such as UNI that has 21 substations on its campus.
3. Understand and apply applicable criteria to determine whether a house is intelligent or whether a building is intelligent, in relation to its use of electrical energy in a rational and environmentally friendly way.
4. Interprets the concept of the radius of attention of an Electrical Substation, knowing its components and circuits of exit that it attends in the UNI.

5. The knowledge of the Electrical Risk, the use of Personal Protective Equipment PPE, concept and interpretation that accompanies him in his personal and professional life is internalized.

#### IV. LEARNING UNITS

##### **1. Introductory Class and Planning of the Projects of the Interior Electrical Installations. Electrical Engineering in the Construction Industry / 8 HOURS**

- 1.1 Level of electrification, local, national and international.
- 1.2 Urban Enabling Process, Electrical Enablement.
- 1.3 Process of Electrification of a lot, of a house.
- 1.4 Location of the course in professional activity and engineering of the construction.
- 1.5 Evolution of the housing construction process.
- 1.6 ELECTRICAL INSTALLATIONS. Definition.
- 1.7 Introduction to project planning and development.
- 1.8 Definition of a project and its parts.
- 1.9 Characteristics of indoor electrical installations.
- 1.10 Technical norms and legal prescriptions.

##### **2. Reading of Architecture Plans and Analysis of Loads Electrical in the Interior Electrical Installations./8 HOURS**

- 2.1 Architectural Project.
- 2.2 Architectural Plans: Location, Elevation, Cuts, Details.
- 2.3 Electrical load analysis in I.E.I.
- 2.4 Identification and Characteristics of the loads.
- 2.5 Definition of loads: lighting, moving loads, special loads.
- 2.6 Installed power, demand factor, simultaneity factor.
- 2.7 Load Diagram.
- 2.8 Reduction of electricity consumption.

##### **3. Continuation of reading of plans and Quality of Electric Power / 8 HOURS**

- 3.1 Symbology
- 3.2 Differences in the content of architectural plans and plans of Interior Electrical Installations.
- 3.3 Frequent use of typical scales.
- 3.4 Quality of Electric Power
- 3.5 Tension Depressions
- 3.6 Voltage Lifts
- 3.7 Sub and Over3 Voltages
- 3.8 Transient overvoltages
- 3.9 Unbalance
- 3.10 Voltage drop
- 3.11 Harmonic Distortions
- 3.12 Flicker
- 3.13 Microchips
- 3.14 Interruptions
- 3.15 Frequency Deviations

**4. Electrical components and materials of a project. Electrical supply. / 8 HOURS**

- 4.1 Legend of a plan of Interior Electrical Installations
- 4.2 Terminology
- 4.3 Symbology
- 4.4 Electrical Supply
- 4.5 Electrical rating.
- 4.6 Right of loading.
- 4.7 Terms of service
- 4.8 Types.
- 4.9 Locations.

**5. Electrical energy requirements for environments of a housing or building. Interior lighting / 8 HOURS.**

- 5.1 Location of the General Board and Sub-Board.
- 5.2 Location of the lighting (control) switches.
- 5.3 Lighting forecasts.
- 5.4 Basic lighting concepts.
- 5.5 Light sources and accessories.
- 5.6 Lighting by environments.
- 5.7 Operating Principles of Fiber Optic Lighting.

**6. Continuation of the requirements of electricity by environments of a housing or building. Feeder and derived circuits. /8 HOURS**

- 6.1 Location of Outlets.
- 6.2 Electrical Outlet Predictions.
- 6.3 Other outputs.
- 6.4 Types of conductors.
- 6.5 Electrical Distribution.
- 6.6 Types of installations, materials.
- 6.7 Calculation of feeder and derived circuits.

**7. Basic wiring rules. Continuation of feeder and derived circuits. /4 HOURS**

- 7.1 Typical application examples.
- 7.2 Calculation of Feeder and Derived Circuits.
- 7.3 Special cases.

**8. Development of a project of interior electrical installations. Protection of interior facilities. /8 HOURS**

- 8.1 Location of the General Distribution Board.
- 8.2 Lighting circuits.
- 8.3 Outlet circuits.
- 8.4 Special outputs.
- 8.5 Protection of Electrical Installations, Basic Definitions.
- 8.6 Devices.
- 8.7 Selection and coordination.

8.8 Ground Fault Protection.

**9. Grounding. Continuation of the development of project of interior electrical installations. /8 HOURS**

- 9.1 Grounding.
- 9.2 Supporting calculations.
  - Selection of conductors.
  - Selection of pipes.
- 9.3 Summary table of loads.
- 9.4 Unify diagram.
- 9.5 Technical Specifications and Notes.

**10. Electronics and computing applied to the design of the I.E.I. utilizable computer accessories. /8 HOURS**

- 10.1 Applications in interior lighting.
- 10.2 The AutoCAD and its application.
- 10.3 Concept of Intelligent Buildings. (Intelligent Buildings, Smart Homes, Structured Cabling).
- 10.4 Word Processors and Spreadsheets
- 10.5 Internet (Web Pages and E-mail)
- 10.6 Selection and calculation of electrical conductors.
- 10.7 Calculation of illumination.
- 10.8 Drawing, Viewing and Plotting Drawings- Understanding of files.

**11. Emergency systems and communications. Continuation of useful computer accessories / 4 HOURS**

- 11.1 Basic Definitions.
- 11.2 Generating sets.
- 11.3 Uninterruptible power supply (U.P.S.).
- 11.4 Communication systems
- 11.5 Analysis of unit prices and budgets.
- 11.6 Administration of the work.

**12. Electrical installations checks and tests. Maintenance and periodic evaluation of interior electrical installations. / 4 hours**

- 12.1 Inspection, testing and measurements.
- 12.2 Insulation resistance measurement.
- 12.3 Testing.
- 12.4 Guidelines for maintenance
- 12.5 Periodic Evaluation, application of the CNE - USE

**13. Procedure followed by INDECI for the evaluation of electrical installations / 16 hours**

- 13.1 Evaluation of Electrical Boards

- 13.2 Evaluation of Unincorporated Ferromagnetic Switches in Electrical Boards.
- 13.3 Wiring.
- 13.4 Sockets and Sockets.
- 13.5 Lighting and Illumination.
- 13.6 Grounding System.
- 13.7 Emergency Lighting.
- 13.8 Generating Set.
- 13.9 Electric Motors.
- 13.10 Substations.
- 13.11 Lifts, hoists, escalators and electric lifting equipment.
- 13.12 Air conditioning.
- 13.14 Electronic Installations.
- 13.15 Emergency Lights Equipment.
- 13.16 Safety Conditions of the immediate environment.

## V. LABORATORIES AND PRACTICAL SPERIENCES

Laboratory 1: Use in the Laboratory of an Electrical Load Simulation System in a Learning Module.

Laboratory 2: Follow-up of a work in process of execution of the part of Electrical Installations, in this cycle: the New Medical Department of the UNI. Knowing in the field an installation process and the use of the corresponding Workbook.

## VI. METHODOLOGY

The course is developed in sessions of theory, practice and laboratory of the Workshop of Electrical Installations of the Faculty, as well as in the field. It presents the basic concepts and the applications of all the components of an interior electrical installation.


The student is informed of the NATIONAL CODE OF ELECTRICITY USE, a fundamental tool in the case of Internal Electrical Installations, each student receiving a computer copy, as well as the Interpretation Manual of the National Code of Electricity Utilization. Committing the student to choose a topic that will address in the classroom sustaining it properly.

## VII. EVALUATION FORMULA

- a) Evaluation System, Qualified Practices
- b) Sub-system of Evaluation, monographic work

VIII. BIBLIOGRAPHY

Law of Electrical Concessions D.L 25844 DS009-93-EM LAW 28832  
REGULATION OF THE CONCESSIONS  
NATIONAL CODE OF CNE-U  
NATIONAL CODE OF CNE-S INTERPRETATION  
Norm DGE "TERMINOLOGY IN ELECTRICITY"  
Norm DGE "GRAPHIC SYMBOLS IN ELECTRICITY"  
FASCICULOS PREPARED BY THE TEACHER



LAW OF ELECTRIC  
ELECTRICITY - USE  
INTERPRETATION HANDBOOK  
ELECTRICITY - SUPPLY  
HANDBOOK

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JCRA

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