# NATIONAL UNIVERSITY OF ENGINEERING
## COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING
## ELECTRICAL ENGINEERING PROGRAM

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# SYLLABUS - EE346 ELECTRICAL INSTALLATIONS II

## I. GENERAL INFORMATION

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| **CODE** | **:** | EE346 |
| **SEMESTER** | **:** | 9 |
| **CREDITS** | **:** | 4 |
| **HOURS PER WEEK** | **:** | 5 (Theory – Practice) |
| **PREREQUISITES** | **:** | EE345 Electrical Installations I |
| **CONDITION** | **:** | Compulsory |
| **INSTRUCTOR** | **:** | Carlos Huayllasco |

## II. COURSE DESCRIPTION

The aim of this course is to introduce the fundamental principles of operation and control of power electrical systems in steady state. Students complete basic studies common systems for voltage and power control, economic operation and reliability of electrical power systems.

## III. COURSE OUTCOMES

1. Describe and explain the components of an electrical distribution system and understand their integrated functioning.
2. Properly select the structure, topography and materials of aerial and underground electrical distribution systems.
3. Describe the elements of a power substation, their protection and monitoring.
4. Design a complete electrical installation system to satisfy technical and economical requirements.

## IV. LEARNING UNITS

### 1. INTRODUCTION TO ELECTRICAL DISTRIBUTION SYSTEMS

Norms and terminology / Components of an electrical installations / Aerial and underground installations / Characteristics of a distribution system / Economic considerations.

### 2. BASIC CONCEPTS OF ELECTRICAL DISTRIBUTION SYSTEMS

Maximum demand / Demand factor / Simultaneity factor / Diversity factor / Load factor / Losses factor.

### 3. ELECTRICAL DISTRIBUTION SCHEMES

Primary distribution topographies: radial and ring / Secondary distribution topographies: radial and mesh.

**4. NORMALIZED VOLTAGES**

Normalized voltages: 380V/220V systems, 440V/220V systems / Ground return / Primary network voltages.

**5. AERIAL NETWORKS**

Electrical conductors, materials, pre-assembled conductors / Location of distribution networks and electrical stations, circuits arrangement and brackets / Minimum safety distance / Primary and secondary networks / Electrical design: minimum section, resistances and reactance, rush support / Energy losses / Mechanical design / Design examples / Insulators, types, materials, electrical requirements and insulation levels / Mechanical requirements / Brackets: types and specifications / Bracket materials: reinforced concrete, metallic, wood / Foundations according to material type.

**6. UNDERGROUND NETWORKS**

Underground cables: characteristics and materials / Electrical design / Mechanical design / Installations.

**7. POWER DISTRIBUTION SUBSTATIONS**

Power dimensioning / Transformers / Grounding / Noise control / Substation types: aerial, in-box, compact / Protection against over-voltage and over-current / Lightning rods / Complementary elements: insulators, bars, boards, relays.

**8. NETWORK PROTECTION SYTEMS**

Protection elements: switches, fuses, relays / Protection coordination.

## V. PRACTICAL EXPERIENCES

Quizzes applied to real cases are carried out in class.

## VI. METHODOLOGY

This course is carried out in two modes: a) Theory sessions: Active methodology is used to favor students' learning, with participation during readings, oral interventions and discussions in group dynamic. b) Practice sessions: Quizzes are taken with the aim of developing skills in calculation competences. At the end of the semester, student teams present and defend a design project report which includes planes and simulations.

## VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

$$PF = (( P1 + P2 + P3)/3 + EP + EF)/3$$

EP: Mid-Term Exam EF: Final Exam P#: Quizzes

## VIII. BIBLIOGRAPHY


1. **ENERGY AND MINING SECRETARY - PERU**
   National Electric Code, 2002

2. **ZOPPETTI,**
   Distribution Networks
   McGraw Hill Editorial, 2000