



NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING

TELECOMMUNICATIONS ENGINEERING PROGRAM

EE445 – CAPSTONE PROJECT

I. GENERAL INFORMATION

CODE	: EE445 – Capstone Project
SEMESTER	: 9
CREDITS	: 04
HOURS PER WEEK	: 05 (Theory – Practice)
PREREQUISITES	: EE354, EE432
CONDITION	: Mandatory

II. COURSE DESCRIPTION

The course becomes a guide for the student to complete the preparation of an end-of-degree project, which allows him to develop research papers, in the search to get his future baccalaureate and degree, and prepare original technical and scientific reports. The course is based on a scientific methodology based on research of a solution of a problem in the institution and society. It seeks to sensitize the student with the problem of project management and information analysis.

III. COURSE OUTCOMES

At the end of the course the student will:

- Understand the scientific research process that is currently being developed in universities and research centers worldwide. It includes the fundamentals and stages of the scientific research methodology.
- Include the preparation of original technical and scientific reports considering the current requirements in the electrical sector and in the academic area.
- Prepare and propose a research work project in the search to achieve its future baccalaureate and degree.
- Produce timetables based on graph theory using the CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique) diagram techniques. Develop linear optimization models to solve CPM problems and project crashing.
- Include the collection and analysis of information through survey and sampling techniques. Develop statistical hypothesis tests for engineering cases.

IV. LEARNING UNITS

1. THE SCIENTIFIC KNOWLEDGE

Science, Epistemology and Scientific Method / Elements and Stages of the Scientific Method / Characteristics and Application of the Scientific / Technical Method, Science and Technology / Nature of Scientific Activity / Nature of Technology / Motivation to Develop Research Work.

2. TECHNICAL REPORT

Guidelines for the Preparation of technical reports / Content of a technical report / Examples of technical reports in the electrical sector.

3. SCIENTIFIC RESEARCH PROJECT

Scientific Research / Research Features / Research and Development. Scientific Research Project / Scientific-technical elements, project management and control / Research Lines / Differences between Model and Research Design / Type of Research Design / The Idea / The Research Project Model / The Research Theme / Knowledge Review / State of the Art / Bibliographic References / IEEE Format / The Problem of Investigation / Identification of the Problem / Title of the Problem / Formulation of the Problem / General and Specific Objectives of the Investigation / Functions of the Theoretical Framework / Background of the Problem / Definitions / Importance and Requirements of the Hypothesis / Types of Hypotheses / Concepts and Variables / Classes of Variables / Operationalization of Variables.

4. SCHEDULE AND BUDGET

Project Schedule / Schedule Types / Graph Models (or Networks) / CPM Diagrams (Critical Path Method) / Project Crashing (CPM) / Probability Distribution / PERT Diagrams (Program Evaluation and Review Technique).

5. INFORMATION COLLECTION AND ANALYSIS

Information Collection Techniques / Primary and Secondary Information / Construction and Survey Design / Sampling Techniques / Sample Size / Frequency Distribution and Histograms / Random Sampling / Sampling Distribution / Introduction to Statistical Inference / General Procedure of Hypothesis Tests / Hypothesis Test I / Hypothesis Test II.

V. LABORATORIES AND PRACTICAL EXPERIENCES

- Research project.
- Technical report related to the research project (reproduce a scientific article that is part of the research project).
- CPM and PERT diagrams.
- Population and sample, statistical inference.

VI. METHODOLOGY

The course takes place in theory and practice sessions. In the theory sessions, the teacher presents the concepts and applications. In the practical sessions, topics of interest to the students are developed for the development of the research project. It is suggested that the student develop the computational works using Matlab simulation software to solve problems and analyze their solution. In all sessions the active participation of the student is promoted. In the middle of the course the student must present and present a research project.

VII. EVALUATION FORMULA

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

The final average is equal to the practices average, (four practices are taken, and the one with the lowest grade is eliminated)

VIII. BIBLIOGRAPHY

- TAMAYO M. "The process of scientific research". Editorial Limusa, Mexico, 2004.
- WINSTON W. L. "Operations Research: Applications and Algorithms." Duxbury Press, 2003
- MONTGOMERY D., RUNGER G. "Probability and Statistics applied to Engineering". Limusa Wiley, 2003.
- MUÑOZ C. "How to prepare and advise a thesis investigation". Editorial Prentice Hall, Mexico, 1998.