NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF INDUSTRIAL AND SYSTEMS ENGINEERING
SYSTEMS ENGINEERING PROGRAM

ST235 – SYSTEMS ENGINEERING PROJECT I

I. GENERAL INFORMATION

CODE	**:**	ST235 Systems Engineering Project I
SEMESTER	**:**	9
CREDITS	**:**	2
HOURS PER WEEK	**:**	4 (Theory–Practice)
PREREQUISITES	**:**	GP235 Financial Management ST204 Software Engineering Workshop I
CONDITION	**:**	Compulsory
DEPARTMENT	**:**	Systems and Telematics

II. COURSE DESCRIPTION

To be awarded the Systems Engineer Professional Title PE, students must complete and defend an engineering project which is developed and completed in two courses: ST235 Systems Engineering Project I and ST236 Systems Engineering Project II. The following steps are considering for completing the project:

1. Formulation of project/research proposal.
2. Development of an engineering prototype implementing the proposed solution.
3. Experimentation and testing (data collection and prototype optimization).
4. Analysis of results and generation of conclusions.
5. Written report and oral defense in front of a specialized jury.

In the first course, ST235 Systems Engineering Project I, students must define the project proposal and initial prototype: project theme, problem formulation, project objectives and goals, bibliography search and revision, analysis of the state of the art, research structure and components, problem solution models, definition of measurement instruments, required resources, working schedule, costs and budgets, feasibility analysis, development of prototypes.

III. COURSE OUTCOMES

At the end of the course, students:

1. Analyze and identify problems requiring solution based on information and communication technologies.
2. Identify related markets and population for selecting samples for analysis.
3. Formulate project objectives or research hypothesis as appropriate.
4. Select a proper instrument for data collection and gathering. Define collection method.
5. Identify and apply statistical methods for data analysis.
6. Develop initial prototypes to be analyzed and optimized..
7. Formulate project schedule and budgets.

IV. LEARNING UNITS

1. KNOWLEDGE GENERATION

Epistemology / Knowledge / Gnosis / Types of knowledge / Explicit knowledge / Tacit knowledge / Decision making / Knowledge generation / Knowledge dissemination / Knowledge management.

2. SCIENTIFIC KNOWLEDGE

Reasoning and thinking / Abduction, induction and deduction / Inductive reasoning / Deductive reasoning / Hypothesis and testing / Science / Scientific method.

3. **TECHNOLOGICAL RESEARCH METHODS**
   Technic and technology / Technological research methods / Problem definition / Solution proposal.

4. **SOLUTION MODELS**
   Problem definition / Black box / Grey box / White box / Solution formulation / Solution models.

5. **EXPERIMENTATION**
   Experiment design / Independent and dependent variables / Hypothesis formulation / Hypothesis evaluation / Statistical methods for hypothesis evaluation.

6. **ANALYSIS OF RESULTS**
   Results statistical analysis / ANOVA test / Chi-square test.

V. LABORATORY AND PRACTICAL EXPERIENCES

Report 1. Conceptual Framework. Bibliography search. Proposals of project themes. Selection of project theme. Bibliography revision of the state of the art. Revision of similar works.
Report 2. Solution Models. Identification and definition of main concepts, variables, and procedures. Identification of applicable solution methods /
Report 3. Prototype 1. Identification of data sources and data sets. Sampling. Evaluation of data sources. Prototype development. Revision of first prototype.
Report 4. Prototype 2. Development of prototype. Revision of prototype.

VI. METHODOLOGY

The course points to the formulation and development of prototypes that represent the solution to an engineering problem based on the application of information systems and technologies. The course is developed in a workshop fashion with students working individually and in teams for developing a solution to a problem or need to be satisfied. The instructors revise biweekly the advances of the project and provide advising for the appropriate project development. In the course student identify the problem and develop initial solution prototypes using proper methodologies, software tools, and engineering norms and standards. At the end of the course, students submit and defend a report in front of a jury.

VII. EVALUATION FORMULA

The Final Grade PF is calculated as follows (evaluation system: D):

$$\boldsymbol{PF} = (\boldsymbol{P1} + \boldsymbol{P2} + \boldsymbol{P3} + \boldsymbol{P4})/\boldsymbol{4}$$

P: Grade of each partial report.

VIII. BIBLIOGRAPHY

1. **HERNANDZ R., FERNANDEZ C., BAPTISTA P.**
   Research Methodology.
   McGraw Hill Editions, 2012

2. **ARIAS Fernando**
   Introduction to Research Methodology.
   Trillas Editions, 2010.

3. **GRAJALES Tevni**
   Elaborating a Research Proposal
   Montemorelos University Editions, 2012.