



# NATIONAL UNIVERSITY OF ENGINEERING

## COLLEGE OF INDUSTRIAL AND SYSTEMS ENGINEERING

### SYSTEMS ENGINEERING PROGRAM

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## HS121 – METHODOLOGY OF SCIENTIFIC RESEARCH

### I. GENERAL INFORMATION

<b>COURSE CODE</b>	: HS121 Methodology of Scientific Research
<b>SEMESTER</b>	: 2
<b>CREDITS</b>	: 3
<b>HOURS PER WEEK</b>	: 4 (Theory – Practice)
<b>PREREQUISITES</b>	: HS111 Oral and Written Communication
<b>CONDITION</b>	: Mandatory

### II. COURSE SUMMARY

The course provides the student with several techniques that allow him to develop his life plan, considering different aspects, such as educational, financial, attitudinal, family, etc. This step is essential before proceeding with the choice of a research project, which should be in accordance with the developed life plan. Then, the course develops the fundamentals of the bibliographic search for technical information, through the use of tools such as Google Scholar. Finally, the principles are given to select and develop a scientific / technical problem. Hypotheses are developed and tools are provided to test them rigorously.

### III. COURSE OUTCOMES

The student:

1. Develops a life plan considering various aspects: educational, financial, attitudinal, family, etc
2. Seeks and evaluates the relevance of bibliographic information of a technical nature through the use of specialized search engines
3. It identifies and defines scientific / technical problems that can be carried out and that are in accordance with its life plan and the national reality.
4. Develops a hypothesis as a possible solution to the problem.
5. Evaluates the hypothesis raised using rigorous statistical tools.

### IV. LEARNING UNITS

#### 1. DEVELOPMENT OF A LIFE PLAN / 12 HOURS

Labor demand for mechanical engineers and related branches in Peru / Situation of the FIM graduates in the Peruvian labor market / Most important economic sectors in Peru / Development of the life plan using the XMind tool / Development of a personal / Development of a CV.

## **2. BIBLIOGRAPHIC SEARCH AND SELECTION OF RESEARCH SUBJECT / 12 HOURS**

Bibliographic search of technical information using Google Scholar / Evaluation of the quality and relevance of the information obtained / Selection of a research topic according to the life plan and the national reality / Differences and similarities between research projects and engineering projects.

## **3. DEVELOPMENT OF HYPOTHESIS TO SOLVE THE PROPOSED PROBLEM / 12 HOURS**

Failure modes and effects analysis (FMEA) / Root cause analysis (RCA) / Brainstorming methodology / Cause-effect diagrams / Process-system diagrams / 5 Porter forces / Pareto diagram / Diagram of Decision tree / Force field analysis

## **4. HYPOTHESIS TEST / 16 HOURS**

Sample selection / Quantitative data collection / Analysis of quantitative data using MS Excel / Pearson correlation coefficient / Analysis of variance (ANOVA) / Reporting of results / Preparation of presentations-oral and written reports.

## **V. METHODOLOGY**

The theoretical basis will be developed with the help of texts corresponding to the course, home tasks will be implemented with the purpose of reinforcing the concepts taught in class, as well as a final work with exposition.

## **VI. EVALUATION FORMULA**

The Final Grade (PF) is calculated with the following formula:

$$PF = (EP + EF + PP) / 3$$

ME: Mid-term exam      EF: Final Exam

PP: Average of quizzes

## **VII. BIBLIOGRAPHY**

- 1. Hernández Sampieri R, Fernández Collado C, Baptista Lucio M.** Metodología de la investigación. McGraw Hill, 2010.r. CRC Press
- 2. Kumar R.** Research Methodology, SAGE publications, 2011.
- 3. Dandy G, Walker D, Daniell T, Warner R.** Planning and Design of Engineering Systems. Taylor & Francis, 2008.
- 4. Mind Tools.** The Mind Tools EBook. Mind Tools Limited, 2007.
- 5. Trevelyan JP.** The Making of an Expert Engineer. CRC Press, 2014.