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

SYLLABUS - ST114 DECISION THEORY

I. GENERAL INFORMATION

CODE	:	GP113
SEMESTER	:	
CREDITS	:	3
HOURS PER WEEK	:	4 (Theory – Practice)
PREREQUISITES	:	ST123 Operations Research II
CONDITION	:	Elective
INSTRUCTOR	:	Cesar Canelo
INSTRUCTOR E-MAIL	:	ccanelo@uni.edu.pe

II. COURSE DESCRIPTION

The course prepares students for the modeling, analysis and evaluation of the decision making process under risky and uncertain conditions. The decisional process is analyzed with a scientific approach considering mono-objective and multi-objective situations in diverse scenarios. Concepts and methods based on decision trees and game theory are applied for the modeling, analysis and evaluation of strategies to solve min-max and max-min problems. Software is used to solve diverse problems.

III. COURSE OUTCOMES

1. Understand the decision making process identifying variables, relation models, defining objectives and goals.
2. Identify the scenarios and conditions of the problem (certain, uncertain, risky) and apply proper methods for modeling, analysis and evaluation.
3. Apply Utility Theory for solving decisional problems understanding its advantages and limitations.
4. Apply decision trees methods for the modeling and analysis of decision problems under risky conditions.
5. Formulate and solve two-players games applying max-min and min-max criteria.
6. Apply multi-attribute decision models.

IV. LEARNING UNITS

1. DECISIONAL PROCESS / 8 HOURS

Identification of situations prone to change, priorities and terms / Objectives identification, information gathering, resources and restrictions / Information analysis / Model construction and validation / Proposal of alternatives and prediction of results / Level of objectives satisfaction / Implementation, deployment and control / Scientific approach in the decision making process, causality, measurement scales, validity and reliability of scales, formulation and validation of measurement instruments / Decisional process in organizations, mission,

vision, SWOT, strategic planning, objectives, goals / Steps in the life of an organization / Evaluation models: mono-objective, multi-objective / Dimensional analysis: one-dimensional, multi-dimensional.

2. SCENARIOS / 4 HOURS
Decision scenarios: certainty, risky, uncertainty.

3. RISKY SCENARIOS / 8 HOURS
Expected value assessment model, expected monetary value, Gauss curve - Actual curve, expected value limitations / Evaluation matrix / Other models for risk management: sensitivity analysis, expectation-variation methods, most probable future methods, Hurwicz / Utility theory, concepts, lottery examples, utility function determination and its use and limitation in the decisional process.

4. DECISION TREES / 8 HOURS
Decision trees for risky situations / Decision trees with sampling, sampling strategies, strategies numbering.

5. UNCERTAIN SCENARIOS / 4 HOURS
Decision models in uncertain conditions / Min-max, Max-max, Laplace, Savage.

6. GAME THEORY / 12 HOURS
Two-players games, non-zero sum games, Nash equilibrium / Max-min and Min-max criteria for evaluating pure and mix strategies / Game evaluation using 2xN and Nx2 matrixes.

7. MULTI-ATTRIBUTE DCISION MODELS / 8 HOURS
Multi-attribute decisions, criteria for attribute selection / selection of measurement scales / Models: weighted alternatives evaluation, Brown Gibson models / Analytic hierarchy process: concepts, construction of decision hierarchies / importance assessment of attributes and sub-attributes / Assessment of limitations of analytic hierarchy applications / Software for analytic hierarchy processes, Expert Choice.

V. LABORATORIES AND PRACTICAL EXPERIENCES

Solution of diverse real-world problems: modelling, analysis, evaluation of decision alternatives

VI. METHODOLOGY

This course is carried out in theory, practical and lab sessions. In theory sessions, the instructor introduces theoretical concepts and applications. In practical sessions, different cases, exercise and problems are solved, as well as projects related to work measurement are developed. At the end of the course, students must hand over the prototype design and expose a paper. In all sessions, students' active participation is encouraged.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

$$PF = (EP + 2\,EF + PC)/4$$

EP: Mid-Term Exam EF: Final Exam PC: Average of four Quizzes

VIII. BIBLIOGRAPHY

1. **GALLAGHER CH. A. AND WATSON H. J.**
Quantitative Methods for Decision Taking Process in Administration.

McGraw Hill Editorial (2000)

2. **GOULD, EPPEN, SCHMIDT**
   Operations Research in Administration Sciences.
   Prentice Hall Editorial (2000)

3. **SHAMBLING JAMES**
   Operations Research: A Fundamental Approach
   McGraw-Hill Editorial (2003)