University of Puerto Rico. Mayagüez Campus
College of Engineering.
Industrial Engineering Department

Course Syllabus

General Information

Course Number: InIn 6030
Course Title: **Advanced Economics for Engineers**
Credit-Hours: Three

Course Description

Formulation of economic problems in terms of quantifiable models. Use of deterministic, probabilistic, risk and multi-attribute techniques to evaluate design alternatives and to select an acceptable solution.

Prerequisites

Authorization of the Director of the Department

Textbook and References

- **Canada, J. R., Sullivan, W. G., and White, J. A., 2005, Capital Investment Analysis for Engineering and Management, 3rd Edition, Prentice Hall.**
- Bussey, L. E., and Eschenbach, T. G., 2005, The Economic Analysis of Industrial Projects, Oxford University Press.
- Herrmann J.W., 2015, Engineering Decision Making and Risk Management, John Wiley and Sons, Inc.
- K. K. Humphreys, 2004, Project and Cost Engineers Handbook, 4th Edition, CRC.
- Newman D.G., Lavelle, J.P., and Eschenbach, T.G., 2014, Engineering Economic Analysis, 12th Edition, Engineering Press, Inc.

Purpose

This is an elective course for the industrial engineering graduate programs. The purpose of the course is to prepare students to use the time value of money and it effects in engineering decisions under deterministic, probabilistic, and risk environments and multi attribute techniques to evaluate design alternatives and to select an acceptable solution. The course is open to students of other engineering programs with prior knowledge of time value analysis techniques.

Course Goals

At the completion of each respective section of the course the student will be able to:

- Recognize, describe and gather financial, income and cost estimates data necessary for project evaluation. Use it to calculate a capital cost and all the necessary cash flows to determine the before or after tax, with or without inflation net present, annual and future worth as well as the internal rate of return, benefit cost ratio, payback and break-even point. Interpret the mathematical result and based on a certainty environment generate and document a recommended alternative selection. Understand and explain the importance of the recommended selection.
- Analyze the sensitivity of the selection to changes of the different financial, income and cost estimates used. Recognize the advantages and limitations of this analysis.
- Recognize the uncertainty environment and see some principles of choice to generate and document a recommended alternative selection. Understand and explain the importance of the recommended

selection.

- Recognize, describe and gather risk data necessary for a more complex project evaluation. Use decision trees, risk principles and Monte Carlo simulation to recommend an alternative selection. Interpret the mathematical result based on a risk environment generate and document a recommended alternative selection. Understand and explain the importance of the recommended selection.
- Recognize, describe and gather multi-attribute data necessary for an even more complex project evaluation. Use of basic techniques, utility models, the analytic hierarchy process and goal programming to recommend an alternative selection. Understand and explain the importance of the recommended selection.

Requirements

All students are expected to :

- Complete all lessons.
- Do all assigned readings, case studies, projects and related homework.
- Come to class prepared to participate in class discussions and use a calculator to solve practice problems. Come to class all the time and on time.
- Satisfy all assessment criteria to receive credit for the course.

Department and Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies)

Absence from examinations: Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero of "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies).

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Disabilities: All the reasonable accommodations according to the Americans with Disability Act (ADA) Law will be coordinated with the Dean of Students and in accordance with the particular needs of the student.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

Campus Resources

General Library and University Computer Center is available to obtain professor's reference materials. The University's Counseling Office has a tutorial program for students who need extra help.

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General Topics

Lecture	Topic	Reading
1 – 3	Capital Investment Foundations	
	• Introduction	Ch. 1: pp 1 – 31
	• Cost Concepts and Cost Estimating	Ch. 2 – 3: pp 32 – 98
	Capital Investment Analysis Applications	
	• Computations Involving Interest	Ch. 4: pp 99 – 137
	• Review of Deterministic Evaluation Techniques (AW, PW, IRR, B/C)	Ch. 5 – 6: pp 138 – 215
4	**Fundamentals Exam (Lectures 1-3)**	
5	Cost Estimation Techniques – Students' Presentations	
6 - 10	Capital Investment Analyses in an Uncertain World	
	• Introduction to Risk and Uncertainty	Ch. 12: pp 381 – 401
	• Sensitivity Analysis	Ch. 13: pp 402 – 362
	• Simulation Approaches	Ch. 14: pp 428 – 445
	• Other Methods	Ch. 15: pp 446 – 468
	• Decision Tree Analysis	Ch. 16: pp 469 – 494
11	**Midterm Exam (Lectures 5-10)**	
12-15	Multiple Attribute Decision Making	Ch. 19: pp 465 – 482
	• Introduction and Basic Techniques	Professor's notes
	• Other Techniques	
	• The Analytic Hierarchy Process	
	Final Exam	

*All readings from Canada, Sullivan, Kulonda, and White, 2005

Revised by: Dr. Viviana I. Cesaní – January 2017

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