INTERAMERICAN UNIVERSITY OF PUERTO RICO
METROPOLITAN CAMPUS
FACULTY OF ECONOMICS AND ADMINISTRATIVE SCIENCES
SCHOOL OF ECONOMICS
INTERNATIONAL BUSINESS PROGRAM, PH.D.

SYLLABUS

I. GENERAL INFORMATION

TITLE: **QUANTITATIVE METHOD I**
CODE: **BADM 7201**
CREDITS: **3 (THREE)**
ACADEMIC TERM:
PROFESSOR:
OFFICE HOUR:
PHONE NUMBER:
MAIL ADDRESS:

II. COURSE DESCRIPTION:

This course presents quantitative methods necessary for understanding mathematical models as used in quantitative research, entrepreneurial and managerial decision making. The course focuses on mathematical methods used in economic and managerial modeling like differential and integral calculus, optimizing techniques, linear algebra and linear programming. The models will be applied in various managerial areas like human resources, labor relations, marketing and organizational behavior.

III. COURSE OBJECTIVES

After completion of this course the student should be able to attain the following objectives:

1. Construct mathematical models of managerial situations applying functional mathematical analysis and set theory.
2. Evaluate the use of linear algebra in managerial situations and to understand economic interrelations.
3. Apply differential and integral calculus and optimization techniques to situations in managerial decision making.
4. Apply linear programming in entrepreneurial and managerial decisions.

IV. COURSE CONTENT

Part I. Foundations of mathematical analysis

A. The number system
B. Economic models
    1. Variables, parameters, constants and coefficients
    2. Equations
    3. Endogenous and exogenous variables
C. Set theory
    1. Basic set operations
        a. Union
        b. Intersection
        c. Complement
        d. Joint vs. disjoint sets
D. Mathematical Framework of Analysis
    1. Functions
        a. Introduction to functions
        b. Polynomial and rational functions
        b. Exponential and Logarithmic Functions
    2. Mathematical Models and Data Analysis
    3. Equilibrium Analysis
E. Applications
    1. Breakeven model
    2. Demand and supply model

Part II. Linear Models and Matrix Algebra

A. Introduction to Matrix algebra
    1. Matrices and vectors
    2. Matrix operations and concepts
        a. Matrix addition and multiplication
        b. Determinants, minors and cofactors
        b. Matrix inverse
        d. Singularity
    5. Excel functions for matrices operations

B. Solving System of Equations

    1. Solving 2 x 2 systems
    2. Generalization to higher dimensions
    3. The Leontief System
        a. Intersectoral transactions matrix
        b. Coefficient matrix
        c. Leontief matrix
        d. Inverse of Leontief matrix
        e. Final demand and final output
    4. Marcov chains

1. State matrix
1. Transition matrix
3. Applications

Part III. Differential Calculus and Integral Calculus

A. Comparative Static Analysis and Derivatives
1. The Nature of Comparative Statics
2. Limit of a function
3. Continuity and differentiability

B. Rules of differentiation; univariate functions.
1. Power
2. Product
3. Quotient
4. Chain
5. Inverse function
6. Logarithmic
7. Exponential

C. Rules of differentiation; multivariate functions
1. Derivatives of higher order
2. Cross derivatives

D. Total Differentials and Total Derivatives
1. Channel maps
2. Direct and indirect effects

E. Applications
1. Consumers Utility Functions
2. Cost Functions
3. Revenue Functions
4. The Market Model
5. Market penetration

Part IV. Optimization Analysis

A. Derivatives and Extreme Values
1. Stationary points
2. First and second order conditions for maximum or minimum
3. The nth derivative test for extreme points

B. Constrained Optimization
1. Using the substitution technique
2. Using the Lagrange multiplier technique
3. Gradient vector
4. Hessian matrix
5. Bordered Hessian
6. Comparative statics and envelope theorem

E. Applications

1. Cost minimization for a given output
2. Profit Maximization
3. Optimum timing
4. Utility maximization and consumer demand
5. Least cost combination of inputs with Cobb Douglas production function

Part V. Integral Calculus

A. Definition of Integrals
    1. Antiderivative
    2. Riemann sum
    3. Fundamental Theorem of Calculus
    4. Properties of integrals
B. Rules for Integration: Indefinite Integrals
    1. Power
    2. Substitution
    3. By parts
C. Definite Integrals
D. Improper integrals
E. Applications
    1. Investment and capital accumulation
    2. Compound interest and present value
    3. Economic growth: Domar Model
    4. Population accumulation

Part VI. Linear Programming

A. Mathematical Optimization

1. Decision variables
2. Objective function
3. Restrictions
4. Boundaries of decision variables

B. Graphical Solution

1. Inequalities
2. Isocurves
3. Viability Set
4. Corner solutions

C. General Solution sing Excel Solver

1. Optimization of objective function
2. Dual and shadow prices interpretation

3. Sensitivity Analysis
    a. Optimality Range
    b. Viability Range

D. Applications

1. Production decisions
2. Resource allocation
3. Optimal factor combination
4. Diet problem
5. Transportation
6. Investment planning
7. Capital Budgeting

V. COURSE ACTIVITIES

A. Power Point presentations by professor and student feedback
B. Class discussion of exercises
C. Communication among students and professor via e-mail

VI. EVALUATION CRITERIA

A. Partial Examinations: There will be two partial examinations.
B. Final Examination
C. Model construction project

All examinations will consist of questions that require detailed problem-solving work. Approximately 40% of the exam questions are based on the examples discussed in class presentations. Another 60% of the exam questions are based on homework problems.
All examinations are closed notes. However, you are allowed to bring in two 3.5 inch index card, upon which you may write useful formulas, equations, and so forth for each of the mid-term exams, and three 3.5 inch index cards for the final. In addition, please bring a calculator with exponential and logarithmic functions (including y^x). The use of Excel will be needed for the solution of some exercises.

There will be no exam repositions or make-ups.

The final examination is scheduled to last for four hours. Final examination will be comprehensive and will cover the entire course contents with emphasis in the economic applications of methods.

For the model construction project the student will be required to construct a mathematical model of some issue or problem concerning his concentration interest in the Doctorate Program and apply the maximum of the mathematical analysis and techniques presented in class.

Final Grade

The total course score will be determines by weighting the two partial exams by 20% each, the final exam by 50% and the model construction project by 10%.
The final grade distribution will be based upon the following scale:

100 -90----A
89- 80----B
79- 70----C
69 – 0 ---F

VII. SPECIAL NOTES

Auxiliary services or special needs
Students who require special assistance or ancillary services must request them at the beginning of the course or as soon as he/ she acquires knowledge of their need, through the corresponding register in _____.

Dishonesty, fraud and plagiarism
dishonesty, fraud, plagiarism and any other inappropriate behavior with regard to the academic work constitute major infringements sanctioned by the Reglamento General de Estudiantes,. Major infringement, according to the Reglamento General de Estudiantes, may have as a consequence, among other sanctions. the suspension from the University for a defined period of time greater than one year or permanent expulsion from the University,.

Use of electronic devices
Cell phones and any other electronic device that could disrupt the processes of teaching and learning or alter the environment conducive to academic excellence will de deactivated. Pressing situations will be addressed, as appropriate. Handling of electronic devices to access, store or send data during evaluations or examinations is prohibited. .

VIII. EDUCATIONAL RESOURCES

Recommended Texts:

Angel L. Ruiz, "Estimación de una Función Producción Cobb-Douglas para la Economía de Puerto Rico", Economic Research Unit, Department of Economics, University of P.R., **Serie de Notas de Clase, Num.4**.

Angel L. Ruiz, "The Input-Output Model", Economic Research Unit, Department

of Economics, University of Puerto Rico, **Serie de Ensayos y Monografías**, Num. 40.

XI. BIBLIOGRAPHY

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Blöchlinger, A. (October, 2012). Validation of Default Probabilities, Journal of Financial & Quantitative Analysis; Vol. 47 Issue 5, p1089-1123, 35p

Bottazzi, G. & Secchi, A. (August 2011). A new class of asymmetric exponential power densities with applications to economics and finance. Industrial & Corporate Change;, Vol. 20 Issue 4, p991-1030, 40p, 11

Chvatalova, Z.& Simberova, I.(December, 2011). Economics phenomena via mathematical modeling in maple system. Business, Management & Education / Verslas, Vadyba ir Studijos; Vol. 9 Issue 2, p260-275, 17p

Focardi, S. M., Fabozzi, F. J.2 (Spring 2010). The reasonable effectiveness of mathematics in economics. Economist, Vol. 55 Issue 1, p19-30, 12p

Hiptmair, R. Li, J. (2013). Annali di Matematica Pura ed Applicata; ISSN:03733114; 16181891. Issue: Number Preprints p1-22, 22p . LC Classification:20144; 10015 Accession Number:26843626, Database: E-Journals

Jun L, Ehud P. & Avanidhar S. (September2010), Information, Expected Utility, and Portfolio Choice. Journal of Financial & Quantitative Analysis; Vol. 45 Issue 5, p1221-1251, 31p

Leach, P. (2013). Derivatives of differential sequences. Journal of Engineering Mathematics; 20130101, Issue: Number Preprints p1-12, 12p. LC Classification:20179; 10018. Accession Number:28660514. Database: E-Journals

Lignola, M.& Morgan, J. (October 2012). Approximate values for mathematical programs with variational inequality constraints. Computational Optimization & Applications; Vol. 53 Issue 2, p485-503, 19p

Rai, Birendra K., So, C. K. & Nicholas, A. (September, 2012). A primer on mathematical modeling in economics. Journal of Economic Surveys; Vol. 26 Issue 4, p594-615, 26p

Tian, J. (December 20-11). Inequalities and mathematical properties of uncertain variables. Fuzzy Optimization & Decision Making; Vol. 10 Issue 4, p357-368, 12p