SCHOOL	Economics
ACADEMIC YEAR	2013/2014
DEGREE	Economics and Finance
SUBJECT	Mathematics for Economics and Finance
ACTIVITY TYPE	Caratterizzante
DISCIPLINARY FIELD	Mathematics
SUBJECT CODE	11251
MODULES SUBDIVISION	NO
MODULES	1
SCIENTIFIC SECTOR	SECS-S/06
TEACHER	Andrea Consiglio Professor Università di Palermo http:/www.unipa.it/consiglio
ECTS	10
STUDY LOAD (in hours)	190
LECTURES (in hours)	60
REQUIRED COURSES	None
COURSE YEAR	I
ROOM	Room "Mineo" - 2° Floor
STUDY METHODS	Formal lectures and workshop
ATTENDANCE	Compulsory
ASSESSEMENT	Written exam: Intermediate Test 50% - Final Test 50%.
MARKS SCALE	Min-max: 18/30-30/30
LECTURES PERIOD	
LECTURES SCHEDULE	
OFFICE HOURS PER TUTORING	Check the web site: http://portale.unipa.it/persone/docenti/c/andrea.consiglio

INTENDED LEARNING OUTCOMES

Knowledge and understanding

Knowledge of the definitions and main theorems for unconstrained and constrained optimization.
Understanding the implications of such theorems for specific optimization models (linear and quadratic models).
Knowledge and understanding of the main financial optimization models

Applying knowledge and understanding

Knowledge on how to apply theorems to find the critical points of a function of several variables.
Implementing a GAMS model to solve a portfolio selection problem

Making judgements

Reflect on theories discussed and ability to properly evaluate the pitfalls of the mathematical models to describe the economic and financial system.
Understand the real problem and choose the appropriate portfolio problem.

Communication skills

Knowledge of the mathematical jargon to communicate the main outcomes of a mathematical model.

Learning skills

Conduct research and analysis in the field economics and finance using mathematical models.

LEARNING OBJECTIVES

1) To extend the concepts of derivatives to n-dimensional space

2) To define a constrained and unconstrained optimization problem 3) To compute the maxima and minimaof constrained and unconstrained optimization problem 4) To extend the implicit function theorem to n-dimensional space 5) To determine how change an equilibrium point as response to changes in the endogenous variables 6) To distinguish between linear and nonlinear programming 7) To implement a GAMS model to solve a economic or financial problem

	CALCULUS IN N-DIMENSIONAL SPACE
# OF HOURS	**LECTURES**
1	Presentation of the objectives of the course
2	Level curves. Partial derivatives. Gradient and Hessian of a function. Total Differential.
3	Positive and negative (semi)definite matrix. Leading principal minors and principal minors of order k. Test for definiteness of a matrix. First order condition (FOC) of stationary points.
2	Second order optimality conditions (SOC). Convex and concave functions.
3	Equality constrained optimization problems. The Lagrangian function and FOC. SOC of an equality constrained optimization model. Bordered Hessian.
2	Constrained optimization with inequality constraints. Karush-Kuhn-Tucker theorem.
2	Envelope theorem. Economic meaning of the lagrange multiplier.
2	Partial and general equilibrium model. Endogenous and exogenous variables. Behavioural and definition equations. Implicit function theorem for functions in R^2.
3	Implicit function theorem for function of several variables. Linearization of a non-linear system of equations. Implicit function theorem for system of functions.
2	Linear programming models. Resource allocation model. Standard form. Duality. Dual form with equality constraints.
2	Weak duality theorem. Corollaries. Equilibrium theorem. Complementary slackness conditions. Shadow prices.
24	
	WORKSHOP
10	Compute the gradient and the Hessian, determine definitess of a matrix, find the unconstrained and equality constrained minima or maxima of a function of several variables, solve a minimization problem with linear inequalities, comparative statics for macro and micro economic models, determine the dual linear model from the primal one.
TEXTBOOKS	C. P. Simon and L. Blume. Mathematics for Economists. Norton & Company, New York, 1994.

	FINANCIAL OPTIMIZATION
# OF HOURS	**LECTURES**
2	The Markowitz model. The objective function and the constraints.
1	The efficient frontier for a portfolio selection problem
1	The Sharpe Model
1	The Mean Absolute Deviation model. Derivation of the linear constrained model for MAD.
1	The tracking model using MAD.
1	Value-at-Risk and Conditional Value-at-Risk of a portfolio. Conditonal VaR model. Analysis of the equations of the CVaR model.
1	Log and Exponential utility function. The Utility Model.
1	Fitting the term structure of interest rate
1	Dedication model
10	
	WORKSHOP
2	Introduction to GAMS. Description of the GAMS IDE. Create a project.
2	SET statement. Enumeration of a set. Indices. SCALAR and PARAMETER statement. The DISPLAY statement.
1	Representation of the data through a PARAMETER or a TABLE
1	Data assignment. Read data from a file.
2	Implementation in GAMS of the efficient frontier. The CARD, ORD and LOOP statement.

	The SMIN and SMAX statement. Model and solver status.
1	Building an efficient frontier. The GDX utility.
1	Implementation of the Sharpe model. Build the efficient frontier. Portfolio selection with constraint in the total amount to short.
1	Dealing with vector equations in GAMS. Building and efficient frontier using the MAD model. The PUT statement. Control statement FOR.
1	Implementation of the tracking model. Tracking an index. The WHILE statement.
1	The $-statement to select optional definitions. Implementation of the CVaR model and construction of the efficient frontier.
1	Implementation of the Utility model.
1	Implementation of the term structure fitting model. Constraints on forward rates
1	Implementation of the Dedication model
16	
TEXTBOOKS	A. Consiglio, S. Nielsen and S.A. Zenios. Practical Financial Optimization. Wiley Finance, 2003.