COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
QUANTITATIVE METHODS IN FINANCE	**ESYE573**	**1**	**3+0**	**3**	**10**

Prerequisites	

Language of Instruction	English
Course Level	M. Sc.
Course Type	Elective
Course Coordinator	
Instructors	Assist.Prof. Halis Sak
Assistants	
Goals	This course aims to teach main concepts and numerical methods of option pricing, portfolio risk analysis, and bond pricing.
Content	Statistical models for stock prices, basics of simulation and R, Options, Monte Carlo methods and variance reduction techniques, Option pricing by simulation, Pricing exotic options, Binomial trees, Quantifying the risk of stock portfolios: Market and Credit Risk, Mortgage Backed Securities, Interest rate models and Bond pricing, and Final Project.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1. Ability to write an option on a financial instrument	12	1, 3	A, C, D
2. Ability to work with big data using R and implement numerical methods like optimization, root finding etc.	4	1, 3	A, C, D
3. Ability to develop and code Monte Carlo simulation algorithms in risk management and option pricing	5	1, 3	A, C, D
4. Ability to develop variance reduction methods on Monte Carlo methods, in risk management and option pricing applications, to increase the efficiency	3	1, 3	A, C, D
5. Ability to price options using binomial trees	1	1, 3	A, C, D

Teaching Methods:	1: Lecture, 2: Paper Discussion, 3: Lab, 4: Case-Study

Assessment Methods:	A: Testing, B: Paper Summary, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Statistical models for stock prices, basics of simulation and R	Textbook
2	Statistical models for stock prices, basics of simulation and R	Textbook
3	Options	Textbook
4	Monte Carlo methods and variance reduction techniques	Textbook
5	Option pricing by simulation	Textbook
6	Pricing exotic options	Textbook
7	Binomial trees	Textbook
8	Quantifying the risk of stock portfolios: Market and Credit Risk	Textbook
9	Quantifying the risk of stock portfolios: Market and Credit Risk	Textbook
10	Mortgage Backed Securities	Textbook
11	Mortgage Backed Securities	Textbook
12	Interest rate models and Bond pricing	Textbook
13	Interest rate models and Bond pricing	Textbook
14	Final Project	

RECOMMENDED SOURCES	
Textbooks	Monte Carlo Methods in Financial Engineering by Paul Glassermann; Quantitative Risk Management by Alexander McKNeil, Rüdiger Frey and Paul Embrechts; Stochastic Simulation: Algorithms and Analysis by Soren Asmussen and Peter Glynn
Additional Resources	Supplementary reading materials will be available during the term

MATERIAL SHARING	
Documents	Papers on relevant subjects provided
Assignments	6 Homeworks

Exams	1 Midterm, 1 Final Exam

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	33
Assignment	1	27
Class Participation	1	13
Term Project	1	27
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		25
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		75
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5
1	Ability to reach knowledge in breadth and depth through scientific research in Systems Engineering field; to have extensive knowledge about current techniques and procedures together with their constraints.					**X**
2	Ability to complement and apply knowledge by scientific methods utilizing limited or missing data; to use knowledge in different disciplines effectively by blending them.					
3	Ability to formulate Systems Engineering problems; to develop novel and original ideas and procedures for their solutions and to use innovative procedures in solutions.					**X**
4	Awareness of new and developing applications in Systems Engineering; ability to investigate and learn these applications when required.					**X**

5	Ability to design and apply analytical, and modeling and experimental based research; to solve and interpret complex situations encountered in this process.						**X**
6	Ability to lead multi-disciplinary teams; to develop solution approaches in complicated situations and to take responsibility.						
7	Ability to develop novel and/or original ideas and methods; to develop innovative solutions for the design of systems, parts or the processes.						
8	Ability to communicate orally or in writing the process and the results of Systems Engineering studies systematically and openly in national or international platforms.						
9	Ability to master a foreign language (English) at the European Language Portfolio B2 General Level to communicate orally or in writing.						
10	Ability to recognize social, scientific and ethical values in the process of collection, interpretation and publishing of data, and in all professional activities.						
11	Ability to visualize social and environmental dimensions of Systems Engineering applications and to observe these dimensions in professional practice.						
12	Ability to develop appropriate methodology and procedures for the modeling, improvement, control and design of complex systems for a specified target.						**X**

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14x3)	14	3	42
Midterm examination	1	2	2
Homework	6	10	60
Project (Preparation plus presentation)	1	35	35
Hours of studying for the exams (Midterm and Final)	1	100	100
Final examination	1	3	3
Total Work Load			239
Total Work Load / 25 (h)			9,56
ECTS Credit of the Course			10