

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

Director: ÖZGÜLER, Bülent, Prof. Dr., B.S., M.S., Middle East Technical University, Ph.D., University of Florida.

GENERAL INFORMATION: The vision of the Graduate School of Natural and Applied Sciences at Bahçeşehir University is to facilitate the training and graduation of students who will make significant contributions to their academic fields as well as students who will be instrumental to the success of their companies. The School expects that in doing so it will contribute to the welfare of society and become one of the most respected graduate program among all available.

The mission of the Graduate School of Natural and Applied Sciences at Bahçeşehir University is to articulate and promote the role and value of graduate education to society at large, both within universities and beyond. The School develops and sustains high standards that ensure good quality graduate education and research. The School motivates and inspires its graduate students and faculty to excel in their chosen field of expertise.

There are presently thirteen programs offered by the Graduate School of Natural and Applied Sciences at Bahçeşehir University. These are *Actuarial Sciences, Applied Mathematics, Architecture, Computer Engineering, Electrical and Electronics Engineering, Embedded Video Systems, Engineering Management, Industrial Engineering, Information Technologies (IT), IT Service Management, Interior Design, Supply Chain and Logistics Management, Urban Systems and Transportation Management*. Most programs offer options of specialization in different areas through a wide range of elective courses. The programs on Actuarial Sciences, Applied Mathematics, Interior Design, Supply Chain and Logistics Management, Urban Systems and Transportation Management are presently offered only in Turkish, all others being offered in English. The programs can be with or without thesis. The thesis program requirements consist of successful completion of 7 courses (21 credits), a seminar course, and a written and defended Masters Thesis. The non-thesis program requirements consist of successful completion of 10 courses (30 credits), and a written Graduate Project. The program durations vary typically between 3-4 semesters.

The admission requirements of a program are that an applicant must have a four year bachelor degree in a field encompassing or related to the area of the applied program and must have scored a minimum GRE score or its equivalent. The English programs also require a minimum TOEFL score or its equivalent. The minimum scores are announced by each program prior to the application deadlines.

**M.S. PROGRAM in ACTUARIAL SCIENCES
(in Turkish)**

ASSOCIATE PROFESSORS

DİMİTRİYADİS, Irini (*Coordinator*): B.S., M.S., Ph.D., Boğaziçi University.

INSTRUCTORS

AKAT, Muzaffer: B.S., Boğaziçi University, M.S., Ph.D., Stanford University.

ADJUNCT PROFESSORS

AKAN, Mustafa: B.S, Robert College, M.B.A., Boğaziçi University, Ph.D., Northwestern University.

JAMES, Marion: B.S., M.S., City University.

SOYSAL, Yasemin: B.S. Hacettepe University, M.S, Boston College.

UYANIK, Atilla: B.S., M.S., Ph.D., Marmara University.

YALÇIN, Aylin: B.S., Middle East Technical University, M.S., City University Cass Business School.

YAMAN, Canan: B.S., M.S., Boğaziçi University.

GENERAL INFORMATION: The program in Actuarial Science is conducted in Turkish, without a thesis and may be completed in three semesters. The program is enriched by seminars and lectures given by actuarial or insurance academics and experts both from Turkey as well as from abroad. We aim at engaging a broad network of scientists and practitioners of the profession so as to be well informed of the latest issues at an international level.

The basic aim of the program is to train students to be competent in technical issues and to speak the same language with their colleagues in a unified insurance market. The program curriculum is designed to cover material for both national as well as international actuarial exams. The basic purpose is to equip the student with the capacity for a holistic approach to problems in their field. Another aspect of the program is that the student may gain expertise in financial and risk management subjects through a wide range of elective courses available.

Potential candidates of the program are those working or desiring to work in the insurance sector as people designing, developing and managing insurance products or those who want to enter the actuarial exams. Considering the fact that Actuarial Science is basically a technical subject, it is preferred that applicants should have an undergraduate degree in mathematics, statistics, actuarial science, engineering, business administration or economics. Having practical experience is not necessary although it proves to be helpful.

CURRICULUM

Required Courses:

AKTB 5001	Statistical Models in Actuarial Sciences	(3-0)3
AKTB 5003	Actuarial Mathematics I – Life Insurances	(3-0)3
AKTB 5004	Actuarial Mathematics II – Risk Analysis	(3-0)3
AKTB 5007	Actuarial Mathematics III – Advanced Life Insurance Products and Retirement Systems	(3-0)3
AKTB 5999	Project	Non-Cr

Restricted Elective Courses (any three of the following):

AKTB 5113	Life Models	(3-0)3
AKTB 5114	Problem Solving in Actuarial Sciences	(3-0)3
AKTB 5115	Advanced Topics in Actuarial Sciences	(3-0)3
AKTB 5116	Retirement Systems and Investment Planning	(3-0)3
AKTB 5118	Actuarial Management and Financial Assessment of Insurance Companies	(3-0)3
AKTB 5138	Pricing Non-Life Insurance Products	(3-0)3
AKTB 5216	Accounting of Insurance Companies	(3-0)3
MAT 5708	Stochastic Processes	(3-0)3
MAT 5711	Advanced Statistical Models	(3-0)3
MAT 5801	Introduction to Financial Mathematics	(3-0)3
MAT 5802	Risk Analysis	(3-0)3
MAT 5805	Financial Mathematics	(3-0)3
MAT 5811	Stochastic Computations in Finance	(3-0)3
MAT 5812	Computing Models in Finance	(3-0)3
MAT 5832	Financial Risk Analysis	(3-0)3

COURSE DESCRIPTIONS

AKTB 5001 Statistical Models in Actuarial Sciences (3-0)3

Modeling of claim number, claim amount and total claims distributions. Effect of reinsurance, deductibles and inflation on these distributions, methods of parameter estimation, application of regression and factor analysis to actuarial data.

AKTB 5003 Actuarial Mathematics I – Life Insurances (3-0)3

Analysis of mortality tables, life insurance and life annuities, reserves, gross premiums, non-forfeiture benefits, non traditional life products, new techniques for survival models, scenario analysis and profit testing.

AKTB 5004 Actuarial Mathematics I – Risk Analysis (3-0)3

Review of loss distributions, calculation of risk premiums, the effect of initial reserves, premium loadings on the solvency of the insurer, one and multi period ruin models, Lundberg's upper bound, reinsurance models and the effect on the probability of ruin, introduction to credibility and experience rating, computation of loss reserves and IBNR, chain ladder, Bonheuter-Ferguson and other techniques.

AKTB 5007 Actuarial Mathematics I – Advanced Life Insurance Products and Retirement Systems (3-0)3

Stochastic models in life insurance, modern life insurance products, financial risk in products with a guarantee, interface between finance and actuarial science; the analysis of insurance risk as a financial derivative. Cash flow analysis of insurance funds, their sensitivity to changes in mortality and investment returns.

AKTB 5113 Life Models (3-0)3

Life tables, mathematical analysis of survival models, survival distributions, parametric estimation procedures with complete and incomplete data, group survival estimates, AIDS statistics and HIV carrier survival estimates.

AKTB 5114 Problem Solving in Actuarial Sciences (3-0)3

A holistic approach to insurance problem solving shall be introduced. Consumer choice theory, utility theory, risk measures and the determination of risk premiums, the use of advanced statistical and optimization methods in insurance, and a comparison of financial and actuarial models shall be introduced. This course will be supported by invited project

managers and researchers from our country and abroad.

AKTB 5115 Advanced Topics in Actuarial Sciences (3-0)3

The course is designed to treat profit, liquidity and solvency issues in life insurance, policy lapses, business follow-up triangles, standard table comparisons, estimated and realized expenses, analysis of financial, mortality and longevity risks, product design and the calculation of embedded value.

AKTB 5116 Retirement Systems and Investment Planning (3-0)3

This is a continuation of AKTB 5007 where the basics of pension systems in the world are introduced. Attention shall be given to the development of individual pension plans, analysis of occupational pension schemes and to the related fund management, modern annuity products in relation to private pension systems.

AKTB 5118 Actuarial Management and Financial Assessment of Insurance Companies (3-0)3

Profitability and solvency, actuarial methods for the assessment of solvency, ALM models, sensitivity analyses, discounted value of future cash flows, calculation of present worth, preparation of actuarial balance sheets and financial reporting.

AKTB 5138 Pricing Non-Life Insurance Products (3-0)3

This course aims at treating basic methodologies in pricing non-life insurance

problems; loss ratios, loss reserving, reinsurance decisions, experience rating, classical and modern credibility methods, Bayesian models, Bühlmann and Bühlmann and Straub models; uses of GLM in insurance modeling, basics of motor insurance, and health insurance.

AKTB 5216 Accounting of Insurance Companies (3-0)3

Basic concepts of the accountancy system, balance accounts and income table accounts, legislation and the framework for uniform chart of accounts for an insurance company, understanding the structure and content of insurance and reinsurance company accounts for GAAP with case studies. Defining technical provisions (unearned premium reserves, outstanding claim provisions and other technical reserves) for accounting and financial reporting, understanding the transfer of revenue, profit and losses from the technical account department to the non-technical account department, reinsurance arrangements and their representation in accounting, preparation of financial statements.

AKTB 5999 Project Non-Cr

Students in the M.S. program with non-thesis option prepare a project about the topic they selected under the supervision of a faculty. Projects are mostly application oriented and students are expected to do an extensive library search on their project topic and develop an application.

M.S. PROGRAM in ARCHITECTURE

PROFESSORS

BAYÜLGEN, Cengiz: M.Arch., B.Arch., Ph.D., Yıldız Technical University.
EYÜCE, Ahmet: B.Arch., Middle East Technical University, M.Arch., Ph.D., Ege University.
KUNT, Aydın: B.Arch., M.Arch., Ph.D., Mimar Sinan Fine Arts University.
ULUENGİN, Mehmet Bülent: B.Arch., M.Arch., Mimar Sinan Fine Arts University, Ph.D., Yıldız Technical University.

ASSOCIATE PROFESSORS

EYÜCE, Özen (*Coordinator*): M.Arch., Middle East Technical University, M.Arch., Ege University, Ph.D., Dokuz Eylül University.
SOYGENİŞ, Sema: B.Arch., M.Arch., Istanbul Technical University, M.Arch., State University of New York, Ph.D., Istanbul Technical University.

ASSISTANT PROFESSORS

ÇİÇEK, Ali: B.Arch., M.Arch., Ph.D., Mimar Sinan Fine Arts University.
KIRIŞ, İrem Maro: B.Arch., M.Arch., Istanbul Technical University, Ph.D., Yıldız Technical University.
TOPÇU, Ümran: B.Arch., M.Arch., Mimar Sinan Fine Arts University, Ph.D., Istanbul Technical University.

GENERAL INFORMATION: Master of Architecture Program consists of two options: in Turkish non-thesis and in English with thesis. Both of the programs are for the graduates of a four-year architectural education. Programs are conducted with an intense educational program carried out in one weekend per month.

The mission of the Master of Architecture program is to provide those students, who are equipped with the basic knowledge pertaining to the design of the new buildings in undergraduate programs, with contemporary knowledge and specialization to handle the prospective situation in creation of livable physical environments. Development of appropriate skills and acquisition of knowledge on contemporary changes and developments in technology; their reflections in theory of form and space; and their applications in various cultures and geographies through the theoretical inputs and scientific researches are the prime concerns of this program.

In master of architecture program with thesis, three semester of study with an advanced digital design studio, backed up with theoretical courses is required. In master of architecture program without thesis, the four semester of study includes primarily three design studios and a Graduation Project. These studios will be backed up with a limited number of a compulsory lecture courses to develop a theoretical background in accordance with the program's aims and contemporary applications. In both programs, in addition to the required courses, electives will be added from rich list of courses according to the specialization area of the student. A large variety of electives will be offered to give opportunity to create alternative specialization areas.

CURRICULUM

Required Courses:

ARCH 5110	Contemporary Architectural Theory	(3-0)3
ARCH 5005	Architectural Design Studio	(3-0)3
ARCH 5801	Research Methods	(3-0)3
ARCH 5887	Seminar	Non-Cr
ARCH 5888	Thesis	Non-Cr

Restricted Elective Courses (any six of the following):

ARCH 5112	Art and Architecture	(3-0)3
ARCH 5121	Readings on Architecture	(3-0)3
ARCH 5122	Architecture and Globalization	(3-0)3
ARCH 5123	Architectural Types and Typology	(3-0)3
ARCH 5124	Turkish Architecture I	(3-0)3
ARCH 5125	Turkish Architecture II	(3-0)3
ARCH 5221	Conceptual Terminology in Architecture	(3-0)3
ARCH 5222	Space Concepts and Spatial Organizations	(3-0)3
ARCH 5223	Architecture in Istanbul	(3-0)3
ARCH 5224	Traditional Architecture	(3-0)3
ARCH 5225	Research on Special Topics in Architecture	(3-0)3
ARCH 5227	Selected Periods in Architectural History	(3-0)3
ARCH 5229	Selected Examples	(3-0)3
ARCH 5231	Culture and Space Studies	(3-0)3
ARCH 5232	Urban Dwelling	(3-0)3
ARCH 5301	Behavior of Structures and Materials	(3-0)3
ARCH 5302	Contemporary Structural Systems	(3-0)3
ARCH 5341	Architectural Tectonics	(3-0)3
ARCH 5342	Architecture of Industrial Buildings	(3-0)3
ARCH 5501	Computer Aided Design	(3-0)3
ARCH 5611	Architecture of Tourism	(3-0)3
ARCH 5614	Waterfront Architecture	(3-0)3
ARCH 5701	Contract Management	(3-0)3

COURSE DESCRIPTIONS

ARCH 5005 Architectural Design Studio (3-0)3

Within the scope of this studio, students are asked to design of a new spatial organization according to contemporary understanding of form giving processes and spatial approaches in design using advanced digital techniques.

ARCH 5110 Contemporary Architectural Theory (3-0)3

The objective of this course is to develop awareness on the architectural theories of the

20th century and the contemporary world concentrating on certain themes, through readings and discussions. The course comprises of lectures, readings, discussions and presentations comprising of the ideas of the Western architects and theoreticians.

ARCH 5112 Art and Architecture (3-0)3

The aim of the course is to promote advanced study in the history of art and architecture in its cultural contexts. Appreciation of visual culture, theories and criticism.

ARCH 5121 Readings on Architecture (3-0)3

This course comprises the understanding and appreciation of a selected concept used in architectural discourse through selected readings and interpretations related to the subject.

ARCH 5122 Architecture and Globalization (3-0)3

The course aims presentation and interpretation of architecture produced in the 'Globalization Era', through key examples, with a perception of the built environment both as physical and as social/cultural expression. Urban settings, metropolis, globalism will be key issues open to discussion and interpretation.

ARCH 5123 Architectural Types and Typology (3-0)3

This course is concerned with taxonomic classification of characteristics common to groups of buildings including shape and form, organization of parts, construction and structure, symbolic meaning, and program/use. Typology in architecture is about origins -finding the essence of an architectural work in place and time and also about creating conceptual models or paradigms for future designs.

ARCH 5124 Turkish Architecture I (3-0)3

Advanced in-depth studies on Turkish Architecture: modernization and westernization projects, foreign architects, architecture schools, their effects in architectural discourse during the Republican Period.

ARCH 5125 Turkish Architecture II (3-0)3

Contemporary Turkish Architecture; advanced research on practice and practicing architects.

ARCH 5221 Conceptual Terminology in Architecture (3-0)3

This course comprises the appreciation and dimension on the conceptual terminology of architecture and theory of architecture based on readings and interpretations of the subject.

ARCH 5222 Space Concepts and Spatial Organizations (3-0)3

The scope of this course includes discussions about the basic vocabulary of architectural

space and spatial organizations such as introversion, extroversion, interrelations, interdependence, character and etc.

ARCH 5223 Architecture in Istanbul (3-0)3

Understanding architecture in relation social, political and technological dynamics of a multi-layered city, modernization project and its effects on the physical environment, field studies; on the spot teaching in characteristic parts of the City, reflecting different historical periods or different worldviews.

ARCH 5224 Traditional Architecture (3-0)3

The course includes researches on the organization of traditional settlements, characteristics of building form and space. The process of evolution of space organizations and building production traditions are also within the scope of this course.

ARCH 5225 Research on Special Topics in Architecture (3-0)3

The aim of this course is to carry out a research and documentation work in specific fields of architecture or research on selected topics in contemporary architectural discourse.

ARCH 5227 Selected Periods in Architectural History (3-0)3

A special study will be carried out on a specific period in architectural history.

ARCH 5229 Selected Examples (3-0)3

A study of selected examples of adaptive reuse from Turkey and abroad; Design and construction processes, functional changes; additions are the key issues in this course.

ARCH 5231 Culture and Space Studies (3-0)3

This course aims at discussing the relations of space and culture in the light of environment and behavior studies; philosophical and theoretical parameters in design problems, and effects of cultural factors on the shaping of physical environment are the key issues of this course.

ARCH 5232 Urban Dwelling (3-0)3

Discussions on the basic spatial need of human being: differences between 'house' and 'home'; transformations in housing environments; social and spatial problems of

urbanization and suburbanization; housing policies, area development, and gentrification.

ARCH 5301 Behavior of Structures and Materials (3-0)3

The purpose of course is to develop in the students an experts understanding of the basics of structural behaviors and also the behavior of materials under different loading conditions.

ARCH 5302 Contemporary Structural Systems (3-0)3

Structural properties and potentials of large-span structural systems such as trusses, cable systems, etc.; architectural tectonics of spanning structures.

ARCH 5341 Architectural Tectonics (3-0)3

Technological advances in materials and methods of construction; Material, detailing, construction process and their effects on design are the key concepts of this course.

ARCH 5342 Architecture of Industrial Buildings (3-0)3

Architecture of production spaces, characteristics of spaces in relation to production line, plan layouts, spanning structure, construction and detailing.

ARCH 5501 Computer Aided Design (3-0)3

Advanced computer based techniques for the visualization of designs to communicate with others: clients, etc. and two-and three-dimensional digital representation, i.e., painting, drafting, multi-media, hyper-media, modeling, and basic VRML; issues related to rendering, animation, and scripting.

ARCH 5611 Architecture of Tourism (3-0)3

Tourism industry: definitions and concepts; types of tourism, development and change during history; tourism industry and statistical data; tourism planning process and policies; related regulations; investment, management, marketing and architectural design processes and relations.

ARCH 5614 Waterfront Architecture (3-0)3

Definitions of the concept of waterfront according to natural, physical and social aspects; Architecture of waterfront; waterfront management; tourism architecture and sustainability of waterfronts.

ARCH 5701 Contract Management (3-0)3

In this course, contracts and related documents for building design and construction process prepared and used between the parts, their legal aspects will be dealt with.

ARCH 5801 Research Methods (3-0)3

This course aims to help students understand science and the scientific method, and looks at research in architecture and urban environments. It also aims to provide practical skills in finding and using sources of research information, research management, and basic data analysis techniques and representing the findings.

ARCH 5887 Seminar Non-Cr

A non credit course; presentation of a selected subject; prepared and presented to a jury prior to Thesis.

ARCH 5888 Thesis Non-Cr

Submission and presentation (defense) of a thesis as the culmination of student's research on a subject approved by the Chair.

**M.S. PROGRAM in APPLIED MATHEMATICS
(in Turkish)**

PROFESSORS

AVCI, Yusuf: B.S., Istanbul University, M.S., Ph.D., Stanford University.
KURUOĞLU, Nuri (*Coordinator*): B.S., Ege University, M.S., Ph.D., Fırat University.
ÖZDAMAR, Ertuğrul: B.S., M.S., Ph.D., Ankara University.

ASSOCIATE PROFESSORS

DİMİTRİYADİS, Irini: B.S., M.S., Ph.D., Boğaziçi University.

ASSISTANT PROFESSORS

ÖZUĞURLU, Ersin: B.S., Istanbul Technical University, M.S., Carnegie Mellon University, Ph.D.,
University of Wisconsin-Madison.

INSTRUCTORS

AKAT, Muzaffer: B.S., Boğaziçi University, M.S., Ph.D., Stanford University.
ALTAY, Nejla: B.S., Boğaziçi University, M.S., Fatih University.
SIRMA, Ali: B.S., Boğaziçi University, M.S., Ph.D., Gebze Institute of Technology.
SOLAK, Ebru: B.S., Middle East Technical University M.S., Universität Göttingen, Ph.D., Universität
Würzburg.

GENERAL INFORMATION: The graduate program in Applied Mathematics is run in Turkish and can be completed with or without a thesis. The program may be completed in 3 semesters if desired. The basic aim of the program is to give a chance to the mathematics graduates to gain expertise in mathematical modeling and management of economical and technological systems of our modern world. Students interested in the program can follow one of the tracks given below:

- Mathematics (M)
- Scientific Computing (S.C)
- Financial Mathematics (F.M)

The program will be open to students who want to strengthen their mathematical background and have an undergraduate degree in Mathematics, Mathematics and Computer Sciences, Statistics, Education in Mathematics, Business Administration/Economics, Mathematical Engineering, Physics and Physics Engineering or any other Engineering program.

CURRICULUM

Required Courses:

MAT	5301	Discrete Mathematics (M)	(3-0)3
MAT	5303	Group Theory (M)	(3-0)3
MAT	5401	Linear Algebra and Applications (M; S.C; F.M)	(3-0)3
MAT	5501	Real Analysis (M)	(3-0)3
MAT	5601	Numerical Analysis (M; S.C; F.M)	(3-0)3
MAT	5103	Software Engineering Mathematics (S.C)	(3-0)3
MAT	5604	Partial Differential Equations (S.C)	(3-0)3
MAT	5606	Numerical Solutions of Partial Differential Equations (S.C)	(3-0)3
MAT	5702	Probability Theory (F.M)	(3-0)3
MAT	5801	Introduction to Mathematical Finance (F.M)	(3-0)3
MAT	5802	Risk Management (F.M)	(3-0)3

Restricted Elective Courses (any three of the following):

MAT	5301	Discrete Mathematics	(3-0)3
MAT	5302	Abstract Algebra	(3-0)3
MAT	5303	Group Theory	(3-0)3
MAT	5304	Number Theory	(3-0)3
MAT	5305	Introduction to Cryptology	(3-0)3
MAT	5306	Applications of Finite Fields	(3-0)3
MAT	5401	Linear Algebra and Applications	(3-0)3
MAT	5402	Differential Geometry	(3-0)3
MAT	5403	Kinematics	(3-0)3
MAT	5404	Topology	(3-0)3
MAT	5501	Real Analysis	(3-0)3
MAT	5502	Complex Analysis	(3-0)3
MAT	5503	Advanced Analysis	(3-0)3
MAT	5504	Functional Analysis	(3-0)3
MAT	5505	Advanced Mathematical Analysis	(3-0)3
MAT	5602	Fundamentals of Applied Mathematics	(3-0)3
MAT	5604	Partial Differential Equations	(3-0)3
MAT	5605	Numerical Solution of Ordinary Differential Equations	(3-0)3
MAT	5606	Numerical Solution of Partial Differential Equations	(3-0)3
MAT	5607	Boundary Value Problems	(3-0)3
MAT	5608	Mathematical Programming and Modeling	(3-0)3
MAT	5609	Numerical Optimization	(3-0)3
MAT	5701	Mathematical Statistics	(3-0)3
MAT	5702	Probability Theory	(3-0)3
MAT	5703	Theory of Statistics	(3-0)3
MAT	5704	Applied Statistical Analysis	(3-0)3
MAT	5705	Advanced Probability Theory	(3-0)3
MAT	5706	Biostatistical Methods	(3-0)3
MAT	5707	Time Series Analysis	(3-0)3
MAT	5708	Stochastic Processes	(3-0)3
MAT	5709	Nonparametric Statistics	(3-0)3
MAT	5801	Introduction to Mathematical Finance	(3-0)3
MAT	5802	Risk Management	(3-0)3
MAT	5802	Financial Mathematics	(3-0)3
MAT	5811	Stochastic Calculus for Finance	(3-0)3
MAT	5812	Numerical and Simulation Methods for Option Pricing	(3-0)3
MAT	5815	Fixed Income and Credit Derivatives	(3-0)3

Elective Courses (any three of the following):

These are courses that may be taken from different graduate programs of our University. Examples of such courses are Data Mining, Data Structures and Algorithms, Operations Research, Financial Mathematics and the like.

COURSE DESCRIPTIONS**MAT 5301 Discrete Mathematics (3-0)3**

Foundations of discrete mathematics, logic and proof, sets, functions, sequences, algorithms, complexity of algorithms; integers and divisibility, prime numbers, matrices, relations, equivalence relations, order relations; graph theory, trees, Boolean algebra.

MAT 5302 Abstract Algebra (3-0)3

Divisibility, fundamental theorem of algebra, greatest common divisor, division algorithm, some arithmetical functions, congruence systems, Fermat's theorem, Chinese remainder theorem, factorization in polynomial rings, field extensions, normal extensions, Galois theory.

MAT 5303 Group Theory (3-0)3

Fundamental concepts of group theory, finite groups, C groups, symmetric groups, unitary groups, applications to physics and other sciences.

MAT 5304 Number Theory (3-0)3

General introduction to numerical sets: Definitions and properties of natural numbers, integers, rational numbers, real numbers, complex numbers. Divisibility in integers: Concept of divisibility and properties of divisibility of integers, fundamental theorem of arithmetic, canonical representation of integers. Arithmetic functions: integer value function, tau, sigma, Möbius and Euler functions. Congruence: definition and properties of congruence, prime and reduced remainder systems, Euler and Fermat theorems, linear congruence equations, Chinese remainder theorem, high order congruence equations. Quadratic congruence systems, quadratic remainders, Legendre symbols, Gauss lemma, quadratic reciprocal theorem, Jacobi symbols, primitive roots and

indices. Diophantine equations, continuous fractions, quadratic forms, Pell equations, distribution of prime numbers, algebraic numbers, algebraic integers, units and primes in a numerical set, ideals, algebra in ideals, prime ideals.

MAT 5305 Introduction to Cryptology (3-0)3

Historical introduction to cryptography: general principles, services, mechanisms and attacks. Classical coding methods, symmetric coding methods. Block Ciphers: diffusion, confusion, Feistel structure. Introduction to finite groups and number theory. Cryptographic criteria. Public key cryptography, and hash functions. Discrete logarithm. RSA, key management, Diffie-Hellman key switch, elliptic curve cryptography. Digital signatures, verification protocols, digital signature criteria.

MAT 5306 Applications of Finite Fields**(3-0)3**

Groups, rings and fields. Polynomials. Field extensions. Characterization of finite fields. Roots of irreducible polynomials. Norms and basis. Representations of elements of finite fields. Wedderburn theorem. Irreducible polynomials. Construction of Irreducible Polynomials.

MAT 5401 Linear Algebra and Applications (3-0)3

Vector spaces, inner product spaces, orthonormal vector systems, concepts of basis and dimension, linear transformations, vector spaces of linear transformations. Matrices, matrices and linear transformations, rank of a linear transformation, solutions of linear system of equations, permutations and

determinants. Matrix polynomials, eigenvalues and eigenvectors, diagonalization of matrices, quadratic forms, special transformation in inner product spaces.

MAT 5402 Differential Geometry (3-0)3

Affine space, Euclidean space, topological space, topological manifolds, differentiable manifolds, tangent vectors and tangent spaces, vector fields, directional derivative and covariant derivative, cotangent space, 1-forms, gradient, divergence and rotational functions, curvature theory, Serret-Frenet vectors, curvatures of curve and geometric interpretations, curvature axis, curvature sphere, spherical curves, involute and evolute curves, pairs of Bertrand curves, hypersurfaces, shape operator and fundamental forms.

MAT 5403 Kinematics (3-0)3

Affine space, Euclidean space, coordinate systems and change of coordinates, Isometries of Euclidean spaces, motion and motion groups, 1-Parametered motions, derivative equations, velocity and acceleration, pole point and pole curves, Euler-Savary Theorem, envelopes, high order velocity, acceleration and acceleration poles, closed motions, areas of orbits, Holditch Theorem, spherical and spatial kinematics.

MAT 5404 Topology (3-0)3

Topological spaces, neighborhoods, basis, subspace topology, Product and quotient topologies, Compactness, Tychonoff theorem. Heine-Borel theorem, Urysohn's lemma, Tietze extension theorem, Stone-Cech compactification, Alexandroff single point compactification, Convergence of sequences and nets, connectedness, metrizable spaces.

MAT 5501 Real Analysis (3-0)3

Lebesgue measure. Measure theory and integration. Point set topology, Radon-Nykodym theorem, outer measure. Fubini's theorem.

MAT 5502 Complex Analysis (3-0)3

Complex numbers, metric spaces, Topology of complex numbers, Main properties and examples of analytical functions, complex integration, maximum modulus theorem, Cauchy integral formula, linear integrals, conformal mappings.

MAT 5503 Advanced Analysis (3-0)3

General measure and integration theory, general convergence theorems, Radon-Nikodym theorem, outer measure, Caratheodory extensions theorem, product measures; Fubini's theorem, Riesz representation theorem.

MAT 5504 Functional Analysis (3-0)3

Linear spaces, basis, norms, completeness, linear transformations, continuity, Hahn-Banach theorem, separation of convex spaces, uniform boundedness, compactness, unbounded and closed operators, kernels and image spaces, weak, strong and uniform convergence, Hilbert spaces, projections, Riesz representation theorem, Fourier series.

MAT 5505 Advanced Mathematical Analysis (3-0)3

Power series, directional derivative and gradient, extreme values and Lagrange multipliers, multivariable integration; uniform convergence of functions, open mapping theorem, closed graph theorem, functions defined via integrals.

MAT 5601 Numerical Analysis (3-0)3

Eigenvalue problems, Generalized eigenvalue problems, prediction of eigenvalues, Hyman method, Reducing to Frobenius form. Ordinary differential equations, initial, boundary value problems, Finite difference methods. Iterative methods for linear system of equations.

MAT 5602 Fundamentals of Applied Mathematics (3-0)3

Applications of linear algebra: network structures, least squares method, matrix factorization in eigenvalue problems, optimization problems, Lagrange multipliers, numerical solutions of linear and nonlinear systems, solutions of ordinary and partial differential equations.

MAT 5603 Software Engineering Mathematics (3-0)3

Logic: propositions, logical connectives, rules of inference. Sets, elements of a set, set of sets, Cartesian product. Sequences; sequence operators; sequence of functions; structural induction. Principle of induction, recursions.

MAT 5604 Partial Differential Equations (3-0)3

Cauchy-Kowalevski theorem. First order linear and nonlinear equations, second order elliptic, parabolic and hyperbolic equations, existence uniqueness theorems. Well-posed problems, Green's function.

MAT 5605 Numerical Solution of Ordinary Differential Equations (3-0)3

Definition of differential equations, definition of initial value problems in ordinary differential equations. Elementary theory, fundamental concepts of ordinary differential equations. Series and numerical methods. Review of single and multi-step methods for ODE, Runge Kutta methods, error measurement and Runge Kutta Fehlberg method, multi-step methods, higher order differential equations and their numerical solutions.

MAT 5606 Numerical Solution of Partial Differential Equations (3-0)3

Finite difference methods: stability, convergence and qualitative properties; initial and boundary conditions, nonsmooth boundaries, parabolic equations. Explicit and implicit methods, stability, accuracy, variable coefficients, derived boundary conditions, solutions of tridiagonal systems, elliptic equations, iterative methods, speed of convergence; hyperbolic equations; Lax-Wendroff method, variable coefficients, conservation laws, stability and finite elements method.

MAT 5607 Boundary Value Problems (3-0)3

Numerical methods for solutions of ordinary differential equations, boundary value problems for ordinary differential equations, boundary value problems for partial differential equations, Fourier integrals and transforms, numerical methods.

MAT 5608 Mathematical Programming and Modeling (3-0)3

Modeling techniques, modeling in linear programming, solution techniques and modeling in linear programming, sensitivity

analysis in linear programming, dynamical programming.

MAT 5609 Numerical Optimization (3-0)3
Linear programming. Modeling, solution methods. Duality theory in linear programming; nonlinear programming: first and second order conditions for unconstrained optimization problems, Lagrange multipliers, convexity in mathematical programming, Kuhn-Tucker theorem; discrete optimization.

MAT 5701 Mathematical Statistics (3-0)3
One-sample and two-sample problems. Multivariate normal distribution. Mean and covariance estimates. Maximum likelihood estimation of mean vector and variance-covariance matrix, determining the outliers and normality check. Confidence intervals, Behrens-Fisher problem, test for a subvector, tests for linear restrictions, principle component analysis. Factor analysis, classification analysis, discriminant analysis, clustering analysis, correlation analysis, multivariable regression analysis, robust multivariable methods.

MAT 5702 Probability Theory (3-0)3
Random variables, axioms of probability, expected value, characteristic functions, moments, distributions and distribution functions, moment generating functions, sums of random variables, sequences of random variables, independence, convergence and statistical applications. Introduction to abstract probability spaces and measure theory.

MAT 5703 Theory of Statistics (3-0)3
General introduction to statistics, statistical modeling, features of random sampling, data reduction, properties of point estimators, hypothesis testing, interval estimation and decision theory.

MAT 5704 Applied Statistical Analysis (3-0)3

This course is designed for statistical analysis and applications. It includes the concepts of population and sampling, sampling techniques, classification of variables, definition of the data, sampling distributions, estimation of the population mean and variance, confidence intervals, testing of the population mean and variance, applications of correlation and regression analysis.

MAT 5705 Advanced Probability Theory (3-0)3

Sigma algebras, measure theory and probability; Lebesgue and Lebesgue-Stieltjes measures and distribution functions; measurable functions, random variables, integration theorems; comparison of Lebesgue and Riemann integrals. Jensen's, Holder's (Schwartz) and Minkowski inequalities, L_p spaces; Jordan-Hahn and Lebesgue measures and Radon-Nikodym theorem, signed measures; convergence of sequence of random variables, uniform integrability; product spaces and Fubini theorem. Independence, conditional expectation, conditional probability. Sums of random variables: law of large numbers and three series theorem. Martingales and Martingale convergence theorem, Poisson approximation, stochastic orderings.

MAT 5706 Biostatistical Methods (3-0)3

Usage of SPSS program in medical problems, clinical experiments, cases analysis and forecasts. Logistic and Poisson regression, applications of generalized linear methods to medical data.

MAT 5707 Time Series Analysis (3-0)3

Autocovariance and autocorrelation functions, trends, seasonal and uniform effects, stationary processes, forecast and spectral analysis.

MAT 5708 Stochastic Processes (3-0)3

Introduction to simple financial models. Discrete time financial models, introduction to discrete stochastic processes. Brownian motion and introduction to stochastic calculus. Characteristics of stochastic processes, classification of processes, Poisson process, Markov chains, continuous-time Markov chain, stationary processes, Black-Scholes formula and pricing of financial derivatives.

MAT 5709 Nonparametric Statistics (3-0)3

Single sample case. Chi-square test, Kolmogorov-Smirnov test, Run test. Correlated two sample case, Mc-Nemar test, Sign test, Walsh test. Uncorrelated two sample tests, Chi-square test, Median test, Mann-Whitney test, Wolfowitz test, Correlated k-sample case, Cochran q-test, Friedman test. Uncorrelated k-sample case, Kruskal Wallis

test. Nonparametric correlation coefficients, Spearman correlation coefficient, Kendal correlation coefficient, concordance coefficient and related hypothesis tests.

MAT 5801 Introduction to Mathematical Finance (3-0)3

The aim of this course is to provide an introduction to the mathematical modeling of financial markets with particular emphasis on the pricing of derivative securities and the management of risk. Topics covered will include an introduction financial instruments and markets, fixed-income securities and rates of return, utility functions and optimal investment, simple models of random variation in prices, the fundamental concepts of arbitrage, replication, and completeness, and the use of arbitrage-free models for the valuation of securities and for the management of risk.

MAT 5802 Risk Management (3-0)3

This course presents the most important mathematical concepts, methods and models used to value assets; select, maintain and optimize portfolios; and to manage risks. Topics covered include the following: returns, risks and utilities; quantification of risk-variance, shortfall risk, value at risk; portfolio analysis, diversification, correlations, principal components, sensitivity measures (greeks); asset valuation and pricing methods as capital markets theory, capital asset pricing model, efficient frontiers, arbitrage pricing theory, consumption/ accumulation and equilibrium models; risk management techniques — diversification, immunization, insurance/reinsurance, hedging; optimal asset allocation, portfolio optimization and dynamic delta hedging.

MAT 5805 Financial Mathematics (3-0)3

Basic micro and micro economic principles, time value of money, simple and compound interest, accumulated value and present value, solution of interest problems, basic and general annuities, profit ratios, discounted cash flow, investment planning, amortization tables and loan funds, evaluation of investment returns, basic rules for portfolio diversification.

MAT 5811 Stochastic Calculus for Finance (3-0)3

This course introduces martingales, Brownian motion, Ito integrals and Ito's formula. This is done within the context of the Black-Scholes option pricing model and includes a detailed examination of this model. The course also develops Girsanov's Theorem, which is used for change-of-measure arguments in finance. Applications presented are risk-neutral pricing and its connection with partial differential equations, currency options and forward measures in fixed-income models. Jump processes and their application to option pricing will be introduced.

**MAT 5812 Numerical and Simulation
Methods for Option Pricing (3-0)3**

This course covers numerical methods relevant to solving the partial differential equations, which arise in option pricing. Exact solutions including Black Scholes and its relatives, finite difference methods, the connection with binomial models, interest rate models, early exercise, and techniques for calibration will be explained. This course initially presents standard topics in simulation including random variable generation, variance reduction methods and statistical analysis of simulation output. The course then addresses the use of Monte Carlo simulation in solving applied problems on derivative pricing discussed in the current finance literature. Application areas include the pricing of American options, pricing interest rate dependent claims, and credit risk.

**MAT 5815 Fixed Income and Credit
Derivatives (3-0)3**

First half of this course introduces the most important securities traded in fixed income markets and the valuation models used to price them. Payoff characteristics and quotation conventions will be explained for treasury bills and bonds, STRIPS, defaultable bonds,

mortgage-backed securities like Collateralized Mortgage Obligations and derivative securities like swaps, caps, floors, and swaps. Basic concepts will be explained such as the relation between yields and forward rates, duration, convexity, and factor models of yield curve dynamics. Second half of the course provides techniques for modeling credit risk. Pricing techniques for credit derivatives like Credit default swaps, basket default swaps and collateralized debt obligations (CDO's) will be examined.

MAT 5832 Financial Risk Analysis (3-0)3

The content of this course consist of two parts. First part is pricing of financial derivative securities: option pricing with binomial and trinomial trees, Black-Scholes formula, exotic options, swaps, volatility, dynamical hedging strategies. Second part is financial risk measurement: market risk, credit risk, liquidity risk, model risk. This course also covers utility theory and insurance, individual risk theory, prioritization of risks.

MAT 5887 Graduate Seminar Non-Cr

This course is designed to provide students with a chance to prepare and present a professional seminar on subjects of their own choice.

MAT 5888 M.S. Thesis Non-Cr

Program of research leading to M.S. degree arranged between the student and a faculty member. Students register to this course in all semesters while the research program or write up of thesis is in progress.

MAT 5999 Project Non-Cr

M.S. students working on a common area choose a research topic to study and present to a group under the guidance of a faculty member.

M.S. PROGRAM in COMPUTER ENGINEERING
(in English)

PROFESSORS

KURU, Selahattin: B.S., Istanbul Technical University, M.S., Boğaziçi University, Ph.D., Carnegie Mellon University
ÖZGÜLER, A. Bülent (*Coordinator*): B.S., M.S., Middle East Technical University, Ph.D., University of Florida.

ASSISTANT PROFESSORS

GÖKÇÖL, Orhan: B.S., M.S., Ph.D., Istanbul Technical University.
KURŞUN, Olcay: B.S., M.S., Boğaziçi University, M.S., Ph.D., University of Central Florida.
UĞURDAĞ, H. Fatih: B.S., Boğaziçi University, M.S., Ph.D., Case Western Reserve University.
UĞURDAĞ, Sezer: B.S., M.S., Boğaziçi University, Ph.D., University of California-Santa Cruz.

INSTRUCTORS

AYTEKİN, Tevfik: B.S., Bilkent University, M.S., Hacettepe University, M.A., Ph.D., Middle East Technical University.
ERMİŞ, Orhan: B.S., M.S., Bahçeşehir University.
KALELİ, Fatih: B.S., M.S., Bahçeşehir University.
KAPTAN, Selvihan N.: B.S., M.S., Bahçeşehir University.
MİMAROĞLU, Selim: B.S., Hacettepe University, M.S., Ph.D., University of Massachusetts.
SARISARAY, Pınar: B.S., Karadeniz Technical University, M.S., Bahçeşehir University.

GENERAL INFORMATION: The program in Computer Engineering is conducted in English and can be completed with or without a thesis. The program may be completed in 3 semesters if desired. The Master of Science in Computer Engineering Program aims to provide its students with an ability to use new technologies towards developing creative work models that can be used for local solutions. It also aims to enable the students with an expertise on uses of data mining techniques that are designed for receiving inquiries from large databases and for analysis, planning, and management of an IT project. A student who successfully completes the program will be equipped with knowledge that can be used to increase the efficiency and effectiveness of companies and to create a healthy use of resources.

In the program, courses are gathered around four different specialization areas:

- Computer Sciences Specialization Area (CMPE): This is a module that targets those who are interested in basic computer engineering program and who want to gain competency in image processing, network security, and encryption.
- Artificial Intelligence Specialization Area (AI): This is a module that targets those who wants to learn about finance, insurance, telecommunication and analysis methods and application in the industrial sector of data modeling and analysis.
- Corporate Software Systems Specialization Area (ECS): Today the software development processes leave their place to management of software projects. This module aims to provide an experience that will create a difference in planning, administration and realization of many corporate software projects such as insurance software, hospital automation systems, etc.

- Embedded Video Systems Specialization Area (EVS): Information about this area will be provided under a specific heading.

CURRICULUM

Required Courses:

CMPE 5888	Master Thesis	Non-Cr
CMPE 5887	Seminar	Non-Cr
CMPE 5999	Project	Non-Cr
SE 5888	Master Thesis	Non-Cr
SE 5887	Seminar	Non-Cr

Restricted Elective Courses:

CMPE 5034	Computer Arithmetic	(3-0)3
CMPE 5101	Data Mining I	(3-0)3
CMPE 5102	Data Mining II	(3-0)3
CMPE 5121	Introduction to Network Security and Cryptography	(3-0)3
CMPE 5122	Advanced Cryptography	(3-0)3
CMPE 5123	Advanced Computer Networks and Mobile Communications I	(3-0)3
CMPE 5124	Advanced Computer Networks and Mobile Communications II	(3-0)3
CMPE 5125	Multimedia Communications and Networking	(3-0)3
CMPE 5126	Image and Video Processing	(3-0)3
CMPE 5128	3-D Computer Graphics	(3-0)3
CMPE 5131	Bioinformatics I	(3-0)3
CMPE 5132	Bioinformatics II	(3-0)3
CMPE 5133	Artificial Neural Networks I	(3-0)3
CMPE 5134	Artificial Neural Networks II	(3-0)3
CMPE 5135	Formal Languages & Automata Theory	(3-0)3
CMPE 5136	Expert and Knowledge Based Systems	(3-0)3
CMPE 5138	Algorithm Analysis	(3-0)3
CMPE 5204	Embedded Systems	(3-0)3
CMPE 5211	HDL-Based Digital Design Project	(3-0)3
CMPE 5220	Digital Design Automation	(3-0)3
CMPE 5550	Computer Vision and Pattern Recognition	(3-0)3
SE 5103	Advanced System Analysis and Design I	(3-0)3
SE 5104	Advanced System Analysis and Design II	(3-0)3
SE 5141	Software Quality and Risk Management	(3-0)3
SE 5142	Specification and Design	(3-0)3
SE 5143	Distributed Database Systems I	(3-0)3
SE 5144	Software Project Management	(3-0)3
SE 5145	Extensible Markup Language (XML)	(3-0)3
SE 5146	Distributed Database Systems II	(3-0)3
SE 5148	Web Services	(3-0)3
EEE 5104	VLSI Test and Verification	(3-0)3
EEE 5215	ASIC / SOC Design	(3-0)3
EEE 5511	Real-Time Signal Processing	(3-0)3
EEE 5521	Image Processing	(3-0)3
EEE 5522	Image and Video Compression	(3-0)3
EEE 5531	Video Processing	(3-0)3
EEE 5532	Mathematical Tools for Video Processing	(3-0)3
MATH 5040	Applied Linear Algebra	(3-0)3
MATH 5102	Numerical Methods	(3-0)3
MATH 5103	Software Engineering Mathematics	(3-0)3

COURSE DESCRIPTIONS

CMPE 5034 Computer Arithmetic (3-0)3

Computer arithmetic algorithms are at the heart of many digital ICs in the video market as well as communications and processor markets. A thorough grasp of these algorithms is needed in order to implement fast and small chips. Topics include 2's complement fixed point representation, basic addition and subtraction, fast adders, prefix graphs, priority encoders, carry-save trees, barrel shifters, MAC operation, division schemes, LUT based computation, floating-point numbers and operations.

CMPE 5101 Data Mining I (3-0)3

Introduction to data mining, data warehouse and OLAP technology for very large databases. Factor analysis for feature extraction. Considering classification algorithms: CART, ID3, neural networks, naive Bayes. Handling cluster analysis with nearest neighbor, expectation maximization, partitioning algorithms, hierarchical cluster analysis. Comparing association rules in large databases.

CMPE 5102 Data Mining II (3-0)3

Syntax, semantics and structure in HTML, text documents and data, the computational aspects of information extraction (IE) and integration from unstructured and semi-structured sources, regular expressions, regular tree expressions, XPath, XSLT, XQuery and hidden Markov model (HMM), horn rules, description logic, frame logic, topic maps, inductive logic programming, Meta-Data, ontologies, XML, RDF, DAML+OIL, the enabling tools, techniques and languages for semantic Web mining, Web Agents and Web Crawlers, mining ontologies from the Web, ontologies to build focused Web crawlers, domain-specific semantic search engines to improve Web searching, applications in E-Commerce and bioinformatics, how to do research in semantic web mining

CMPE 5121 Introduction to Network Security and Cryptography (3-0)3

Introduction into the field of cryptography and network security. Data and network security, different attacks on cryptographic systems,

concepts of public and private key cryptography. Secret key schemes, DES and IDEA. The public key schemes RSA and ElGamal, and systems based on elliptic curves. Signature algorithms, hash functions, key distribution schemas.

CMPE 5122 Advanced Cryptography (3-0)3

Authentication applications; support application-level authentication and digital signatures. Widely used services Kerberos, X.509 directory authentication service. Electronic mail security issues. Pretty Good Privacy (PGP), S/MIME schemes. IP security (IPSEC) concept, IP security architecture, authentication and key management. Web security and standardized schemes SSL/TLS and SET. Intrusion prevention mechanisms; IDS (intrusion detection system), firewalls, NFAT (network forensics analysis tools).

CMPE 5123 Advanced Computer Networks and Mobile Communications I (3-0)3

Introduction to networking, virtual private networking (VPN) theory and practice. VPN theoretical sessions and VPN lab applications, Current technologies and applications in industry, bandwidth utilization technologies in WAN networking wireless structure.

CMPE 5124 Advanced Computer Networks and Mobile Communications II (3-0)3

Mobile and wireless applications, voice technologies like voice over ATM (VoATM) voice over IP (VoIP) and voice over frame relay (VoFR). Theoretical sessions and practical applications on Cisco routers. Other applications in industry (e-business servers carrier infrastructures) conceptual approach to e-business applications and other up-to-date application areas.

CMPE 5126 Image and Video Processing (3-0)3

A top-down analysis of video processing applications, algorithms, tools, and fundamentals. Applications include digital TV, computer games, cinema special effects, 3D TV, medical imaging, and forensics.

Algorithms include motion estimation, filtering and restoration, deinterlacing and enhancement, interpolation and super resolution, stereo and 3D video processing, coding, and compression standards.

CMPE 5128 3-D Computer Graphics (3-0)3
Introduction to computer graphics, where computer generated pictures are used, graphics display devices, overview of graphics systems; getting started: drawing figures, device independent programming and OpenGL, anatomy of an OpenGL application, use of OpenGL in C++, basic 2-D shapes, representation of objects on the computer screen; computer graphics elements: drawing shapes, graphics output primitives, attributes of graphics primitives, geometric transformations, 2D viewing, clipping, three-dimensional viewing, OpenGL 3D viewing and projections, introduction to illumination models and shading in OpenGL, GUI design for graphics applications, introduction to computer animation and game programming.

CMPE 5131 Bioinformatics I (3-0)3
Sequence alignment, database searching, RNA structure prediction, microarray sequence analysis, gene prediction, repeat detection, and protein folding prediction, analysis of the algorithms behind each of these algorithms, dynamic programming, hidden Markov models, finite state automata, grammars, Karlin-Altschul statistics, and Bayesian statistics.

CMPE 5132 Bioinformatics II (3-0)3
Analyze and evaluate biological datasets to determine which data are important for model construction. Apply appropriate mathematical techniques to systems model building. Evaluate the predictive power of the computational and mathematical models. Use the models to suggest new experiments.

CMPE 5133 Artificial Neural Networks I (3-0)3
Introduction to neural networks, artificial neural networks, single layer perception, Hebbian learning, decreasing slope learning, general delta rule, learning in multi layer perceptions, feedback, learning with momentum, composite slope learning, prejudice and variety, radial basis perception

applications, radial basis function networks, introduction to self organizing systems.

CMPE 5134 Artificial Neural Networks II (3-0)3

Dynamic neural networks and their applications to control and chaos prediction. Neuro fuzzy systems; cooperative neuro-fuzzy systems, neural networks for determining membership functions, Adeli-Hung algorithm, learning fuzzy rules using neural nets, identifying weighted fuzzy rules using neural nets. Evolutionary computing; genetic programming and algorithms.

CMPE 5135 Formal Languages and Automata Theory (3-0)3

Introducing formal languages and automata. Languages: using generators (e.g., grammars/regular expressions) and using recognizers (e.g., finite state machines). Along with presenting the fundamentals, this course will develop and examine relationships among the various specification methods for the regular languages and the context-free languages, in detail.

CMPE 5136 Expert and Knowledge-Based Systems (3-0)3

Expert systems have developed as an outgrowth of research in artificial intelligence. They contain knowledge gleaned from human experts and can perform some tasks as well as and sometimes better than their human counterparts. Fuzzy sets provide a natural basis for employing uncertainty in expert systems. This course covers fuzzy sets theory and fuzzy logic, fuzzy set applications to decision making and process control, expert systems theory and architecture, and expert systems applications.

CMPE 5138 Analysis of Algorithms (3-0)3

Rigorous analysis of the time and space requirements of important algorithms, including worst case, average case, and amortized analysis. Techniques include order-notation, recurrence relations, etc. Analysis of the key data structures: trees, hash tables, balanced tree schemes, priority queues, Fibonacci and binomial heaps. Algorithmic paradigms such as divide and conquer, dynamic programming. Exploring selected advanced algorithms.

CMPE 5204 Embedded Systems (3-0)3

This course is a hands-on course that requires software work as well as board-level work where the student connects multiple building blocks to each other. This course sits at the intersection of fields such as microprocessors, digital design, operating systems, assembly programming, software design, and industrial automation.

CMPE 5887 Seminar Non-Cr

The purpose of this seminar is to equip the student enrolled in a program with a thesis with the necessary background for preparing a thesis. Although not compulsory, it is expected that the student prepares a pre-research document on her/his thesis subject and make a presentation at the end of the term.

CMPE 5888 Master Thesis Non-Cr

The Master Thesis is a study that students enrolled in a program with a thesis have to carry out under the leadership of an advisor on a subject related to the program followed. The thesis has to be prepared in line with academic ethic rules, presented to and approved by a thesis committee. The student has to register to this course for at least two terms.

MATH 5101 Engineering Mathematics (3-0)3

Linear vector spaces, matrices, systems of linear algebraic equations, eigenvalues and eigenvectors, matrix functions, power series solutions, special functions, complex integration, Laplace transforms, introduction to topology.

MATH 5102 Numerical Methods (3-0)3

The course studies algorithms and computer techniques for solving mathematical problems. Topics covered include solution of linear systems of equations, interpolation, curve fitting and singular value decomposition.

MATH 5103 Software Engineering Mathematics (3-0)3

Propositional logic, propositions; logical connectives; deductive reasoning; hypothetical reasoning, predicate logic. Sets, membership; extension; comprehension; power sets; Cartesian products; types. Definitions: basic types; declarations; abbreviations; axioms; generics; consistency. Relations: domains and ranges; projections; inverses; compositions;

iteration; closure functions: partial functions; injections; surjections; lambda notation; overriding; enumerations. Sequences: order and multiplicity; sequence operators; sequences as functions; structural induction; bags. Free types: constants and constructor functions; embedding; closure; induction principles.

SE 5103 Advanced System Analysis and Design I (3-0)3

Course emphasizes the tasks, activities and end results of a software system engineering effort and the various methodologies and techniques that can be utilized in software engineering effort. A number of software systems, such as information, Web-based or data warehouse systems, and activities in the SLCP (software life-cycle process), including variations of requirements analysis, systems design and systems implementation.

SE 5104 Advanced System Analysis and Design II (3-0)3

A guide for the transition from programming-in-the-small to programming-in-the-large. Major design methods and available computer-aided software engineering (CASE) tools, the proper application of design methods, and techniques for estimating the magnitude of the development effort. UML based software development models. Developing object oriented software systems by designing distributed objects.

SE 5141 Software Quality and Risk Management (3-0)3

This course focuses on the methods and techniques in software testing and quality assurance. The topics include unit, subsystem, system, regression, performance, and load testing; test specification; test management; software validation and verification; software quality factors; software quality assurance tools. Objectives include testing objectives and strategies; test automation; unit testing; integration testing; system and acceptance testing; performance and load testing; test case design; web and GUI testing; and white and black box testing.

SE 5142 Specification and Design (3-0)3

Schemas; overview of the schema language; patterns and structure; declarations and predicates; schema semantics; bindings and

types. Schema operators; mechanisms for schema combination; abstract data types; state-based specification; encapsulation of data members; composition of operations. Applications; case studies and exercises.

SE 5143 Distributed Database Systems I (3-0)3

Communication paradigms: client/server protocols, remote procedure call (e.g., Java RMI), multicast protocols handling asynchronous communication and failures. Distributed transaction management requires enhanced concurrency control methods. Comparing algorithms proposed by researchers and commercial solutions. Replicating data to increase fault-tolerance and the performance of databases.

SE 5144 Software Project Management (3-0)3

Fundamental elements include integration, scope, time, cost, quality, human resources, communications, risk, and procurement management as defined in the Institute of Electrical and Electronics Engineers (IEEE) Standard for project management. Various approaches to software project planning, software project estimating, networks and scheduling, tracking and control, and technical and support processes are analyzed.

SE 5145 Extensible Markup Language (XML) (3-0)3

Motivation for XML, representing data in XML. XML Schemas; defining the structure and content of a document; a type system for

XML. XSLT; translating XML documents to various multimedia formats; functional programming in XSL. XPath; locating XML content within an XML document. XML in context; bibliography databases, domain specific languages.

SE 5146 Distributed Database Systems II (3-0)3

Introduction to distributed database management, database distribution architectures, distributed database design, distributed query processing, distributed query optimization, distributed transaction management, distributed concurrency control, distributed reliability protocols, multi-database systems, mobile distributed database management.

SE 5887 Seminar Non-Cr

The purpose of this seminar is to equip the student enrolled in a program with a thesis with the necessary background for preparing a thesis. Although not compulsory, it is expected that the student prepares a pre-research document on her/his thesis subject and make a presentation at the end of the term.

SE 5888 Master Thesis Non-Cr

The Master Thesis is a study that students enrolled in a program with a thesis have to carry out under the leadership of an advisor on a subject related to the program followed. The thesis has to be prepared in line with academic ethic rules, presented to and approved by a thesis committee. The student has to register to this course for at least two terms.

**M.S. PROGRAM in ELECTRICAL AND ELECTRONICS ENGINEERING
(in English)**

PROFESSORS

ÖZGÜLER, A. Bülent (*Coordinator*): B.S., M.S., Middle East Technical University, Ph.D., University of Florida.
SEZER, Erol: B.S., M.S., Ph.D., Middle East Technical University.
ÜÇTÜĞ, Yıldırım: B.S., M.S., Ph.D., Middle East Technical University.

ASSOCIATE PROFESSORS

ERDEM, A. Tanju: B.S., Boğaziçi University, M.S., Ph.D., University of Rochester.

ASSISTANT PROFESSORS

BİLİR, Bülent: B.S., Boğaziçi University, M.S., Istanbul Technical University, Ph.D., University of Missouri-Columbia.
EREN, Levent (*Associate Dean*): B.S., M.S., Ph.D., University of Missouri-Columbia.
SOYSAL, Alkan: B.S., Middle East Technical University, M.S., Ph.D., University of Maryland.

INSTRUCTORS

ŞİMŞEK, Ergün: B.S., Bilkent University, M.S., Massachusetts University, Ph.D., Duke University.

GENERAL INFORMATION: The program in Electrical and Electronics Engineering aims to recruit students who desire to increase their knowledge and experience, become more successful in the industry, or make an advanced level academic research and interdisciplinary studies.

The program is conducted in English and can be completed with or without a thesis and its duration can be 3 semesters if desired. The program aims to:

- Provide graduates with an internationally accepted level of knowledge and skill in the field
- Educate students who are able to conduct unique and advanced research in the field
- Provide graduates who can continuously develop himself/herself
- Contribute to industry-university cooperation

The potential candidates should have a bachelor degree in electrical and electronics engineering. Candidates from other engineering fields may have to take some preparatory classes.

CURRICULUM

Required Courses:

EEE	5887 Seminar	Non-Cr
EEE	5888 Master Thesis	Non-Cr
EEE	5999 Project	Non-Cr

Restricted Elective Courses:

CMPE	5125	Multimedia Communications and Networking	(3-0)3
EEE	5001	Linear System Theory	(3-0)3
EEE	5014	Random Processes and Estimation Theory	(3-0)3
EEE	5021	Chaos Theory and Fractals	(3-0)3
EEE	5025	Adaptive Filters	(3-0)3
EEE	5026	Wavelets, Filter Banks, and Sub-band Coding	(3-0)3
EEE	5104	VLSI Test and Verification	(3-0)3
EEE	5204	Embedded Systems	(3-0)3
EEE	5211	HDL-Based Digital Design Project	(3-0)3
EEE	5215	ASIC / SOC Design	(3-0)3
EEE	5220	Digital Design Automation	(3-0)3
EEE	5401	Power System Analysis	(3-0)3
EEE	5402	Power System Stability and Dynamics	(3-0)3
EEE	5412	Power Generation	(3-0)3
EEE	5430	Advanced Computer Methods for Power Systems	(3-0)3
EEE	5511	Real-Time Signal Processing	(3-0)3
EEE	5521	Image Processing	(3-0)3
EEE	5522	Image and Video Compression	(3-0)3
EEE	5531	Video Processing	(3-0)3
EEE	5532	Mathematical Tools for Video Processing	(3-0)3
EEE	5540	Speech Processing	(3-0)3
EEE	5550	Computer Vision and Pattern Recognition	(3-0)3
EEE	5600	Introduction to Information and Coding Theory	(3-0)3
EEE	5705	Nanophotonics	(3-0)3
EEE	5720	Microwave Radiation and Scattering	(3-0)3
EEE	5721	Advanced Microwave Antennas	(3-0)3
EEE	5931	Special Topics I	(3-0)3
EEE	5932	Special Topics II	(3-0)3
MATH	5101	Engineering Mathematics	(3-0)3
MATH	5102	Numerical Methods	(3-0)3
MATH	5040	Applied Linear Algebra	(3-0)3

COURSE DESCRIPTIONS

EEE 5001 Linear System Theory (3-0)3
Dynamical system concepts. State-space representations. Linear and time-invariant systems: solution, impulse response, transfer functions. Controllability, observability, realizations. Discrete and sampled-data systems. State feedback. Observer design. Dynamical output feedback. Introduction to LQG optimal control.

EEE 5014 Random Processes and Estimation Theory (3-0)3
Probability and random variables, averages, moments and characteristic functions, random sequences and convergence, important random processes, stationarity and ergodicity, linear

systems with random inputs, power and higher order spectra, factorization and whitening, entropy and channel capacity. Hypothesis testing and decision, signal detection and estimation in noise, matched filter, parameter estimation, waveform estimation, linear estimation and optimum filtering, Kalman and Wiener filters.

EEE 5021 Chaos Theory and Fractals (3-0)3
Determinism and non-linearity, sensitivity to initial conditions, chaos in the real world, complexity, Sierpinsky's triangle, Koch snowflake, Mandelbrot set.

EEE 5025 Adaptive Filters (3-0)3
Basic theory of adaptive filter design and implementation. Stationary processes, linear optimum (Wiener) filtering, linear prediction, linear adaptive filtering, steepest descent, LMS algorithm, nonlinear adaptive filters, and neural networks. Analysis of performance and applications.

EEE 5026 Wavelets, Filter Banks, and Sub-band Coding (3-0)3
Coding, advanced digital signal processing algorithms and applications. Topics: multi-rate systems, filter banks, sub-band coding, and wavelet transforms. Applications include speech, audio, image, and video compression, and digital communications.

EEE 5104 VLSI Test and Verification (3-0)3
Although digital ICs are designed with a software-like methodology in many ways today, their test is quite different and involves two distinct parts; test (also called manufacturing test) and verification (test of the design). The course introduces theory as well as the state of the art in digital VLSI Test and verification.

EEE 5125 Multimedia Communications and Networking (3-0)3
Presents an overview of multimedia communication systems and computer network protocols as well as multimedia communication systems, overview of network protocols, client-server and P2P models, important Internet applications, multimedia compression standards, MPEG-2 transport layer, video streaming, and error resilience in video communications.

EEE 5204 Embedded Systems (3-0)3
Examples and applications of ES, common CPU architectures used in ES, peripherals, tools for ES software development, debugging, embedded software architectures, real-time scheduling, performance analysis and optimization, reliability and power issues.

EEE 5211 HDL-Based Digital Design Project (3-0)3
This course aims to take on students that are able to write basic RTL in Verilog and/or VHDL and implement designs on FPGA boards. This is a project based course that will

assign advanced and unique design projects to students and will allow them to give full demos of their designs at the end of the semesters. Lectures will be problem solving sessions for students and will also equip them with advanced digital design concepts, methods, and tricks.

EEE 5215 ASIC/SOC Design (3-0)3
The purpose of this course is to get students ready for a career in a digital ASIC (Application Specific Integrated Circuit) and SOC (System on Chip) design team and make them understand the whole design process from front-end to back-end and all the way to fabrication. The student will walk away with a bigger picture of the whole ASIC flow from this course and will learn the impact and interaction of each stage on another.

EEE 5220 Digital Design Automation (3-0)3
Today digital ICs are at the border of a billion transistors per chip. Such large chips can only be designed with the help of design automation tools. At such complexity, even software tools struggle even when running on GHz processors with GB's of RAM. Hence, we have to develop clean-cut algorithms which are also efficient in run-time and memory use. This course lets the student understand the CS problems behind digital IC design automation tasks, offers algorithms, a chance to implement them as well as a look the EDA (Electronic Design Automation) sector.

EEE 5401 Power Systems Analysis (3-0)3
Component of power systems, transmission lines, transformers, system modeling, network calculations, power-flow solutions and control, economic dispatch, fault analysis, system protection, and stability.

EEE 5402 Power Systems Stability and Dynamics (3-0)3
Dynamic and transient stability of power systems, bifurcation and stability analysis with classical models, synchronous machine modeling using Park equations, multi-machine models of power systems, automatic voltage regulators, governors and stabilizers, low-frequency oscillations, sub-synchronous oscillations, and voltage collapse.

EEE 5412 Power Generation (3-0)3

Introduction, engineering economics, thermodynamics and power plant cycle analysis, fossil fuels, coal and limestone handling, combustion processes, steam generators, circulation water systems, cycle performance impacts, power plant atmospheric emissions control, electrical systems, plant control systems, gas turbine, fluidized bed combustion, nuclear power, hydroelectric power, power plant planning and design.

EEE 5430 Advanced Computer Methods for Power Systems (3-0)3

Data storage of power systems, construction of bus admittance and bus impedance matrices, sparsity programming, triangular factorization, power-flow studies, programming for power-flow of a real power system, programming for economic generation dispatch.

EEE 5511 Real-Time Signal Processing (3-0)3

Many electronic devices today –including cellular phones, multimedia players, and so on –utilize DSP (Digital Signal Processing) algorithms to do what they do. These algorithms need to run at a certain speed (no more no less), which is dictated by the particular application. Achieving this requires certain techniques and representation. This is what this course presents.

EEE 5521 Image Processing (3-0)3

Image formation and reproduction, Image sampling and quantization, two-dimensional systems and transforms, Image enhancement, Image filtering and restoration, image reconstruction, image segmentation and analysis, random image models and power spectra, image coding, image compression standards.

EEE 5522 Image and Video Compression (3-0)3

Information theory concepts, scalar and vector quantization, bit allocation and distortion, entropy coding, predictive coding, transform coding, sub-band and wavelet coding, model based coding, image and video compression standards, image and video communication.

EEE 5531 Video Processing (3-0)3

Presents the fundamental concepts and applications of video processing. Video

fundamentals include an analysis of video capture and display, video Fourier spectrum, human visual system, spatio-temporal sampling, video rate conversion, two-dimensional and three-dimensional motion and structure estimation, information theory and channel capacity concepts. Applications include motion-compensated frame interpolation, deinterlacing and superresolution from video, enhancement and restoration of video, video segmentation, image and video coding, and image and video compression standards.

EEE 5532 Mathematical Tools for Video Processing (3-0)3

HMM for motion analysis, POCS for restoration, condensation and Kalman filtering for object tracking, dynamic programming for contour tracking, wavelets for compression, fuzzy logic for segmentation, splines and meshes for representation, EM and SVD for estimation SA and ICM for optimization, AAM and PCA for recognition, watermarking for digital rights management.

EEE 5540 Speech Processing (3-0)3

Speech production and representation, digital signal processing, random processes, short-time Fourier analysis, Cepstral processing, linear predictive coding, speech recognition, hidden Markov models, acoustic and language modeling, speech and audio compression, text-to-speech synthesis.

EEE 5550 Computer Vision and Pattern Recognition (3-0)3

Hypothesis testing and Bayesian decision, feature extraction, geometry descriptions and transforms, parameter estimation and supervised learning, unsupervised learning and clustering, non-parametric estimation, linear discriminant functions, expectation-maximization techniques, hidden Markov models.

EEE 5600 Introduction to Information and Coding Theory (3-0)3

Entropy and its properties, joint and conditional entropy, source coding, Kraft inequality, optimum and maximum likelihood decoding, Huffman coding, Lempel-Ziv coding, channels and channel capacity, linear block codes, error detection and correction, syndrome decoders and parity check theorem,

bit error rate, cyclic codes, convolutional codes, the Viterbi algorithm.

EEE 5705 Nanophotonics (3-0)3

Recent developments in micro- and nano-photonic materials, devices and microscopy. Computational electromagnetics. Photonic crystals. Optical properties of metal nanostructures. Surface plasmons. Micro-resonators. Optical tweezers. Scanning near-field optical microscopy. Term-long research project.

EEE 5720 Microwave Radiation and Scattering (3-0)3

Fundamentals of radiation and scattering. Solution methods of electromagnetic scattering problems. Quasi-static and quasi-optic approximations of electromagnetic theory. Eikonal and transport equations. Reflection diffraction from the curve scattering surfaces. Edge diffraction. Applications.

EEE 5721 Advanced Microwave Antennas (3-0)3

Fundamentals of microwave antenna theory. Microstrip, horn, slot and paraboloidal reflector antennas. Dielectric lens antennas. Frequency selective surfaces. Adaptive antenna, switched light beam antenna, smart antenna.

EEE 5887 Seminar Non-Cr

The purpose of this seminar is to equip the student enrolled in a program with a thesis with the necessary background for preparing a thesis. Although not compulsory, it is expected that the student prepares a pre-research document on her/his thesis subject and make a presentation at the end of the term.

EEE 5888 Master Thesis Non-Cr

The Master Thesis is a study that students enrolled in a program with a thesis have to carry out under the leadership of an advisor on a subject related to the program followed. The thesis has to be prepared in line with academic ethic rules, presented to and approved by a thesis committee. The student has to register to this course for at least two terms.

MATH 5040 Applied Linear Algebra (3-0)3

Review of matrix algebra. Vector spaces: Linear independence, basis, dimension, direct sum decomposition. Linear transformations, matrix representation of linear transformations. Projections. Linear equations, rank and inverse, LU decomposition. Invariant subspaces, characteristic and minimal polynomials, Jordan form. Function of a matrix. Normed vector spaces: Norm, convergence, Cauchy sequences, operator norms. Inner product spaces: Orthogonality, Fourier series, normal operators. Least-squares problem, pseudoinverse. Differential equations: Existence and uniqueness theorem, linear differential equations, periodically varying differential equations.

MATH 5101 Engineering Mathematics (3-0)3

Function of a complex variable: Continuity, differentiation, analytic functions. Integration in the complex plane. Complex series. Laplace and z-transforms. Conformal mapping. Vector spaces and linear transformations. Hilbert spaces. Distributions.

MATH 5102 Numerical Methods (3-0)3

Gauss and Gauss-Seidel methods, Newton-Raphson method, Kuhn-Tucker method, modified Euler's method, Runge-Kutta methods, LU decomposition, Sparsity techniques.

M.S. PROGRAM in EMBEDDED VIDEO SYSTEMS
(in English)

PROFESSORS

AYDIN, Nizamettin: B.S., M.S., Yıldız Technical University, Ph.D., Leicester University.

ASSOCIATE PROFESSORS

ERDEM, A. Tanju: B.S., Boğaziçi University, M.S., Ph.D., University of Rochester.

ASSISTANT PROFESSORS

UĞURDAĞ, H. Fatih (*Coordinator*): B.S., Boğaziçi University, M.S., Ph.D., Case Western Reserve University.

UĞURDAĞ, Sezer: B.S., M.S., Boğaziçi University, Ph.D., University of California-Santa Cruz.

GENERAL INFORMATION: Embedded Video Systems (EVS) is a two-year Master of Science program with 8 different options. A student can decide to pursue a Masters Degree in Electrical or Computer Engineering, can decide between Video or Chip Track, and can decide to do a thesis or take two more courses and do a project. The program is conducted with collaboration of Vestel, which provides scholarships, summer jobs and real life thesis/project problems.

The Video Track aims to produce engineers competent in video algorithms and literate in digital and embedded design. They are expected to engineer video algorithms that are real-time implementable in digital ICs or embedded systems. The Chip Track aims to produce digital and embedded design engineers that are more than literate in video algorithms. They should be able to offer alternatives to the video engineers when their algorithms are not exactly implementable. Every student is required to demonstrate that he/she took an equivalent of every prerequisite course in his/her track. If not, the student will take such courses during the first year.

CURRICULUM

Required Courses:

CMPE 5204	Embedded Systems	(3-0)3
CMPE 5211	HDL-Based Digital Design Project	(3-0)3
EEE 5521	Image Processing	(3-0)3
EEE 5531	Video Processing	(3-0)3
CMPE/EEE 5887	Seminar	Non-Cr
CMPE/EEE 5888	Master's Thesis	Non-Cr
CMPE/EEE 5999	Project	Non-Cr

Restricted Elective Courses (any three of the following):

CMPE	5034	Computer Arithmetic (for Chip track)	(3-0)3
CMPE	5125	Multimedia Communications and Networking (for Video track)	(3-0)3
CMPE	5220	Digital Design Automation (for Chip track)	(3-0)3
CMPE	5550	Computer Vision and Pattern Recognition (for Video track)	(3-0)3
EEE	5014	Random Processes and Estimation Theory (for Video track)	(3-0)3
EEE	5104	VLSI Test and Verification (for Chip track)	(3-0)3
EEE	5215	ASIC / SOC Design (for Chip track)	(3-0)3
EEE	5511	Real-Time Signal Processing (for Chip track)	(3-0)3
EEE	5522	Image and Video Compression (for Video track)	(3-0)3
EEE	5532	Mathematical Tools for Video Processing (for Video track)	(3-0)3

M.S. PROGRAM in ENGINEERING MANAGEMENT
(in English/Turkish)

PROFESSORS

ALNIAK, Oktay: B.S., Ege University, M.S. Boğaziçi University, Ph.D., Gazi University.

ASSOCIATE PROFESSORS

BAYRAKTAR, Erkan: B.S., M.S., Dokuz Eylül University, Ph.D., University of Iowa.

ASSISTANT PROFESSORS

BEŞKESE, Ahmet: B.S., M.S., Ph.D., Istanbul Technical University.

BOZBURA, Faik Tunç (*Coordinator*): B.S., M.S., Ph.D., Istanbul Technical University.

INSTRUCTORS

ÜNLÜAKIN, Demet Özgür: B.S., M.S., Ph.D., Boğaziçi University.

GENERAL INFORMATION: The program in Engineering Management is a non-thesis program with Turkish and English options. The program can be completed in minimum 3 semesters and anyone with engineering or science bachelor degree can apply.

Engineering Management program aims to provide the necessary knowledge and skills to those engineering graduates to lead and manage their engineering projects in an efficient and effective manner. This program helps the engineers who want to enhance their careers by providing information about basic engineering management issues. The program includes not only solutions to general managerial problems but also special knowledge to solve engineering and technology problems with different methods. The participants will gain competency in leadership, planning, creativity and decision making that are necessary for managerial positions in companies.

The Engineering Management program targets:

- Any engineering graduate willing to enhance his/her career by gaining information and experience in engineering management,
- The engineers who are targeted at higher strategic managerial positions in their companies, and
- Participants who want to make an advanced academic research in the field.

The flexible program structure allows the students to develop either a mixed program suitable for their career plans, or they can select a specialization module designed for the needs of contemporary work life.

- **Decision Making Specialization Area:** With courses such as analytical processes, operation research and decision making techniques students can specialize on decision making.
- **Project and Risk Management Specialization Area:** This module which is developed in the perspective of the new and modern field of Risk Engineering provides opportunities

for those who want to specialize on financial, operational, project and environmental risk analysis and solutions.

- **Quality Management Specialization Area:** This module targeting those who are interested in the area of system quality evaluations and with courses such as Quality Management, Statistical Process Control, Quality Management Models ensure specialization in the field.

CURRICULUM

Required Courses:

IE	5112	Project Management in Engineering	(3-0)3
IE	5201	Principles of Engineering Management	(3-0)3
IE	5203	Statistical Data Analysis & Decision Making	(3-0)3
IE	5204	Investment Decision Making	(3-0)3
IE	5206	Decision Analysis	(3-0)3
IE	5211	Technology Management	(3-0)3
IE	5212	Quality Management	(3-0)3
IE	5231	Strategic Management	(3-0)3
IE	5303	Operations Management	(3-0)3
IE	5999	Project	Non-Cr

Restricted Elective Courses (any three of the following):

IE	5121	Strategic Management Applications	(3-0)3
IE	5124	Strategic Human Resource Management	(3-0)3
IE	5126	System Simulation	(3-0)3
IE	5211	Mathematical Programming and Modeling	(3-0)3
IE	5223	Business Management and Entrepreneurship	(3-0)3
IE	5225	Human Resources Management	(3-0)3
IE	5227	Risk Management	(3-0)3
IE	5242	Service Operations Management	(3-0)3
IE	5248	Lean Production	(3-0)3
IE	5250	Product Development & Process Management	(3-0)3
IE	5254	Applied Optimization Techniques	(3-0)3
IE	5302	Supply Chain & Logistics Management	(3-0)3
IE	5408	Intellectual Capital Management	(3-0)3
IE	5410	Customer Relationship Management	(3-0)3
IE	5412	Workforce Development	(3-0)3

M.S. PROGRAM in INDUSTRIAL ENGINEERING
(in English)

PROFESSORS

ÖZGÜLER, A. Bülent (*Coordinator*): B.S., M.S., Middle East Technical University, Ph.D., University of Florida.

ASSOCIATE PROFESSORS

BAYRAKTAR, Erkan: B.S., M.S., Dokuz Eylül University, Ph.D., University of Iowa.

ASSISTANT PROFESSORS

BEŞKESE, Ahmet: B.S., M.S., Ph.D., Istanbul Technical University.

BOZBURA, Faik Tunç: B.S., M.S., Ph.D., Istanbul Technical University.

INSTRUCTORS

ÇORUM, Adnan: B.S., Eastern Mediterranean University, M.S., Marmara University.

ÜNLÜAKIN, Demet Özgür: B.S., M.S., Ph.D., Boğaziçi University.

YÜCEL, Mehmet Hilmi: B.S., Bilkent University, M.S., Nottingham University.

GENERAL INFORMATION: The program in Industrial Engineering is conducted in English and is with a thesis. The program can be completed in at least 3 semesters. Those applicants from other areas of engineering should take scientific preparation courses for one or two semesters.

Industrial Engineering Program aims to provide necessary knowledge of modern engineering management, technology management and information management to design, plan and manage mathematical systems to solve various problems of companies in either production or service sector in an effective and efficient fashion. This program will help the students develop creative and innovative ideas about industrial applications.

Industrial Engineers and Management Engineers can apply to the program. The program due to its education in the evening provides a good opportunity to those candidates who want to complete their graduate study without a break in their professional careers. The students can prepare their thesis on topics such as operating research, production management, service systems management, quality management, information management, system simulation, project management, etc.

CURRICULUM

Required Courses:

IE	5887 Seminar	Non-Cr
IE	5888 Master Thesis	Non-Cr

Restricted Elective Courses (any three of the following):

MATH 5040	Applied Linear Algebra	(3-0)3
IE 5100	Advanced Quality Management	(3-0)3
IE 5111	Mathematical Programming and Modeling	(3-0)3
IE 5112	Project Management in Engineering	(3-0)3
IE 5121	Strategic Management Applications	(3-0)3

Departmental Electives:

IE 5100	Advanced Quality Management	(3-0)3
IE 5111	Mathematical Programming and Modeling	(3-0)3
IE 5112	Project Management in Engineering	(3-0)3
IE 5121	Strategic Management Applications	(3-0)3
IE 5126	System Simulation	(3-0)3
IE 5129	Modeling and Analysis of Manufacturing Systems	(3-0)3
IE 5142	Sequencing and Scheduling	(3-0)3
IE 5144	Advanced Optimization Techniques	(3-0)3
IE 5150	Design of Experiments	(3-0)3
IE 5160	Case Studies in Industrial Engineering	(3-0)3
IE 5211	Technology Management	(3-0)3
IE 5248	Lean Production	(3-0)3
IE 5250	Product Development and Process Management	(3-0)3

COURSE DESCRIPTIONS

IE 5100 Advanced Quality Management (3-0)3

Tools and techniques used in total quality management including quality function deployment (QFD), failure modes and effects analysis (FMEA), design of experiments (DoE), Statistical Process Control (SPC) and additional SPC techniques for variables (eg. multi-vari chart and short-run SPC), 5 S, Poka Yoke, service quality framework and SERVQUAL.

IE 5111 Mathematical Programming and Modeling (3-0)3

Large scale modeling approach, modeling and solution technique in linear programming, sensitivity analysis in linear programming, dynamic programming, nonlinear systems and modeling and solution technique, meta heuristic tools and their applications.

IE 5112 Project Management in Engineering (3-0)3

Project organization, project leader specification, engineering project design,

create project network, project network techniques: CPM and PERT, budgeting, cost analysis, project management, implementation and control.

IE 5121 Strategic Management Applications (3-0)3

The field of strategic management examines how organizations (both for-profit companies and not-for profit agencies) gain sustainable competitive advantages systematically and consistently. To be successful, the organization's strategy must permeate all departments and functional areas. As such, this course integrates knowledge and skills gained from various studies in the functional areas of business. In drawing on these tools, a general management point of view will be applied.

IE 5124 Strategic Human Resources Management (3-0)3

The value of human capital management, human capital management as strategic partner in organization, modeling and measurement of

human capital, intangible asset management in organization.

IE 5126 System Simulation (3-0)3
Introduction to simulation systems, single server queuing systems, modeling approach in simulation, simulation with ARENA, techniques for increasing model, validity and credibility, validate the output from the model, simulation of manufacturing systems.

IE 5129 Modeling and Analysis of Manufacturing Systems (3-0)3
Manufacturing systems and models, Assembly lines, Line balancing, Transfer lines and serial systems, Shop scheduling with many products, Flexible manufacturing systems, and group technology.

IE 5142 Sequencing and Scheduling (3-0)3
Deterministic models: single MC, parallel MC; flow shops and flexible flow shops; single MC, parallel MC, flow shops and flexible flow shops, open shops, genetic algorithms, TABU search, simulated annealing, beam search, hill-climbing.

IE 5144 Advanced Optimization Techniques (3-0)3
Heuristic techniques such as genetic algorithm, ant colony, simulated annealing, TABU search and their applications, applied stochastic process and fuzzy logic.

IE 5150 Design of Experiments (3-0)3
Principles of experimental design: randomization, blocking, transformations, fixed and random effects. Single factor experiments (analysis of variance), Latin squares, factorial designs, response surface methods and designs, applications of advanced experimental design.

IE 5160 Case Studies in Industrial Engineering (3-0)3
Modeling large scale projects; large scale project and applications in Industrial Engineering using with optimization, simulation, statistical and project management techniques.

IE 5201 Principles of Engineering Management (3-0)3
The practice of management as applied within technical organizations. Capitalism and opportunity; competitive advantage; creating a strategy; technology, innovation and timing; the technology entrepreneur; risk, return, and product design; corporate technology ventures; knowledge and learning; legal formation and intellectual property; marketing and sales; new enterprise organization; resource acquisition, organization and management; operations management; leadership.

IE 5203 Statistical Data Analysis and Decision Making (3-0)3
Emphasize the use of statistics as a tool for the analysis and interpretation of data. Understand how to collect and analyze data effectively and efficiently and how to draw appropriate conclusions from data to make a decision.

IE 5204 Investment Decision Making (3-0)3
Survey of material relevant to financial decision making for engineering activity, traditional engineering economy topics, fundamentals of accounting and financial planning, budgeting, and estimating.

IE 5206 Decision Analysis (3-0)3
Students integrate scientific evidence, patients' preferences, and experts' opinions to analyze managerial decisions and identify optimal alternatives. Included are applications to analysis of practice patterns, benchmarking, probabilistic risk assessment, cost analysis, conflict analysis and measurement of severity of illness. Decision analytical tools such as multi-attribute value models, Bayesian probability networks, and decision trees are covered.

IE 5211 Technology Management (3-0)3
Strategic management of technology and innovation, developing a licensing strategy, proper valuations of intellectual property, gathering and utilizing market research, marketing technology, negotiating and drafting licensing agreements, the legal hurdles, operational needs, and strategies involved.

IE 5212 Quality Management (3-0)3
Quality and quality system concepts in business, statistical quality control, statistical process control, quality assurance system and ISO 9000, quality function organization, quality deployment function, FMEA, 6-Sigma and its applications.

IE 5223 Business Management and Entrepreneurship (3-0)3
This course explains the stages of the development of technological innovations starting from a research project into establishing a business. Research and development, engineering project management, management of intellectual property, patenting, venture capital, industrial incubation, licensing, product development, outsourcing, and establishment of marketing and sales channels will be among the major topics of the course. The students will develop a business plan for their hypothetical technological innovation.

IE 5225 Human Resources Management (3-0)3
Requirement and selection system, performance management, award and compensation system, manpower planning system, employee relations, the analysis and design of work, training, employee development.

IE 5227 Risk Management (3-0)3
Objectives of risk management, demand for risk management (utility theory), analyzing tools, legal liability, risk retention/reduction, financial risk management, futures and options, enterprise risk management.

IE 5242 Service Operations Management (3-0)3
The role of services in an economy, nature of services, market positioning, service strategy, new service development, creating a service culture, the service encounter, e-service, service quality, quality improvement and productivity, location and layout: supporting facility, managing supply and demand, yield management, managing waiting lines, managing service supply relationships, growth and globalization of service.

IE 5248 Lean Production (3-0)3
Statistical methods useful in quality improvement; develop a broad understanding of lean production principles and practices; build capability to implement lean production initiatives in manufacturing operations; operate with awareness at the enterprise level.

IE 5250 Product Development and Process Management (3-0)3
Explores the methodology for managing the cohesive development and marketing of new products from idea inception to product discontinuation. Emphasis is placed on product development and support and market analysis in both traditional and entrepreneurial company settings. Concurrent engineering, reengineering, lean production processes.

IE 5254 Advanced Optimization Techniques (3-0)3
Advanced Excel applications, model building, sensitivity analysis; applied linear programming models, pricing applications, DEA and its applications.

IE 5302 Supply Chain and Logistics Management (3-0)3
A systems approach to managing the entire flow of information, materials, and services from raw materials suppliers through factories and warehouses to the end customer, topics: Building blocks of a supply chain network, performance measures, decisions in the supply chain world, models for supply chain decision-making; relation to ERP, inventory management, e-logistics.

IE 5303 Operations Management (3-0)3
As a primary business function, along with marketing and finance, the operations function provides goods and services directly to the company's customers. Through models, methods, this course explores how the operations function plays a vital role in achieving a company's strategic plans and is a major determinant of a company's financial performance. Forecasting, design, inventory management, facilities planning, location, and supply chain issues.

IE 5410 Customer Relationship Management (3-0)3

Basic theories and methodology of customer relationship management, including identifying profitable customers, understanding their needs and wants, and building a bond with them, by developing customer-centric products and services directed toward providing customer value. Hands-on experience with popular analytical CRM and data mining tools that are widely used in the industry. Issues in the customer life cycle: market segmentation, customer acquisition, basket analysis and

cross-selling, customer retention and loyalty, and practical issues in implementation of successful CRM programs.

IE 5999 Project Non-Cr

This is a study that students enrolled to a program without a thesis have to prepare under the leadership of an advisor. Some real life analysis utilizing the techniques covered in the program is expected to be carried out. A presentation of the work to an academic commission is also expected.

M.S. PROGRAM in INFORMATION TECHNOLOGIES
(in Turkish)

PROFESSORS

AYDIN, Nizamettin: B.S., M.S., Yıldız Technical University, Ph.D., Leicester University.

ASSOCIATE PROFESSORS

KARAOĞA, Adem: B.S., Istanbul Technical University, M.S., Ph.D., Istanbul University.

ASSISTANT PROFESSORS

ÇEKİÇ, Yalçın: B.S., M.S., Ph.D., Istanbul University.

EREN, Levent: B.S., M.S., Ph.D., University of Missouri-Columbia.

GÖKÇÖL, Orhan (*Coordinator*): B.S., M.S., Ph.D., Istanbul Technical University.

MİMAROĞLU, Selim Necdet: B.S., Hacettepe University, M.S., Ph.D., University of Massachusetts.

TUNGA, Mehmet Alper: B.S., M.S., Ph.D., Istanbul Technical University.

UĞURDAĞ, Sezer: B.S., M.S., Boğaziçi University, Ph.D., University of California-Santa Cruz.

GENERAL INFORMATION: The program in Information Technologies (IT) is conducted in Turkish and has thesis & non-thesis options. The program can be completed in at least 3 semesters. The main aim of the program is to teach how to design and apply basic research, applied research and development studies in the field of IT and develop various skills in the participants.

IT program provides a high quality educational opportunity with its dynamic and modular structure to those new graduates with an undergraduate degree on any area and those who yet work in IT related fields but want to gain an added value with an academically strengthened specialization. The program provides curriculum modules on four different IT related specialization areas to those coming from different backgrounds so that the students could have the opportunity to combine academic formation with various contemporary technological developments such as software, project, product development, IT management, IT hardware and software support, distance learning and e-learning. The specialization areas are as follows:

- **Management Information Systems Specialization Area (MIS):** This specialization area aims those who work on projects that rely on IT and computerization in the fields of human resources, finance, marketing, public relations etc.
- **Networks and System Administration Specialization Area (NSA):** This specialization area is suitable for those who want to develop themselves in the fields of computer networks, network management, computer system setup.
- **Software Technologies Specialization Area (ST):** This specialization area aims those who want to develop computer applications, take part in software design projects and learn about the current technologies in software development.
- **IT in Education Specialization Area (ITE):** Use of IT in education is necessary in various educational fields, especially e-learning, distance education, content development and evaluation. So this specialization area aims to provide information and teach the latest technologies to those who work in the field of education and those who use IT in education.

The potential candidates are those who work or would like to work in IT sector. The program is structured for those who do not have any IT background with basic courses and for also those who has various levels of IT background with necessary advanced level courses, project topics and thesis. The IT Program will enable the potential candidates to:

- Create a background on hardware, software development and computer Networks, by the help of courses providing basic IT infrastructure
- Specialize on an IT related area with courses directly related to the certain area which are supported by current technological applications.
- Take various courses from other programs (Computer Engineering, Engineering Management, Business Administration, etc.) that would help further specialization and Professional needs.
- Conduct academic studies for those who can provide necessary conditions, are successful in and enthusiastic about academic work
- Complete a project on a specialization area and take more courses with the non-thesis option.
- Contribute to their professional careers and workplaces by doing thesis or a projects on the industrial problems they come across in their work life and discuss about them with academicians and professionals in the area.

CURRICULUM

Required Courses:

YZM	5887 Seminar	Non-Cr
YZM	5888 Thesis	Non-Cr
YZM	5999 Project	Non-Cr

Restricted Elective Courses (any five of the following):

BLGM	5515 Foundations of Computer Networks	(3-0)3
BLGM	5519 Computer Hardware	(3-0)3
BLGM	5620 Smart Card Programming Foundations and Applications	(3-0)3
BLGM	5624 Network Security	(3-0)3
BLGM	5625 Linux & Computer Networks	(3-0)3
BLGM	5658 Local and Wide Area Networks	(3-0)3
YZM	5501 Programming with Visual Basic	(3-0)3
YZM	5503 Introduction to Data Structures and Algorithms	(3-0)3
YZM	5507 Data Modeling and Relational Databases	(3-0)3
YZM	5511 Information Systems Analysis and Design	(3-0)3
YZM	5530 Introduction to Web Programming	(3-0)3
YZM	5535 Web Applications Development with PHP & MySQL	(3-0)3
YZM	5540 Programming with ASP.NET	(3-0)3
YZM	5552 Information Technologies Systems Management	(3-0)3
YZM	5560 Database Programming with PL/SQL	(3-0)3
YZM	5601 Java Programming	(3-0)3
YZM	5604 Information Security Management	(3-0)3
YZM	5608 E-Business	(3-0)3
YZM	5610 Information Technologies Project Management	(3-0)3
YZM	5615 Information Technologies and Teaching	(3-0)3

YZM	5616	E-Learning Design	(3-0)3
YZM	5617	Internet Based Distance Learning	(3-0)3
YZM	5629	Object Oriented Design Patterns	(3-0)3
YZM	5630	Object Oriented Analysis and Design	(3-0)3
YZM	5650	Visual Design and Animation on the Computer	(3-0)3

COURSE DESCRIPTIONS

BLGM 5515 Foundations of Computer Networks (3-0)3

Basics of networks: definitions; network communication protocols; local area networks (LAN); wide area networks (WAN); open system interconnection (OSI) model; cabling, cabling tools; routers and router programming; Ethernet, Internet protocol (IP) addressing; network standards; network maintenance tools and hardware; Cisco IOS software management, network communication protocols; TCP/IP, access control lists (ACLs).

BLGM 5519 Computer Hardware (3-0)3

An introduction to computers and digital logic; hardware components and electronic parts that constitutes a computer; computer evolution and performance; digital logic; assembly; arithmetic logic unit (ALU), data bus; memory; controlling the hardware; input/output; an introduction to operating systems.

BLGM 5620 Smart Card Programming Foundations and Applications (3-0)3

What is a smart card? Smart card standards; Smart card types and hardware; communication protocols; operating systems; encryption; security in smart cards; applet development for the Java card; memory model; permanent and temporary objects; atomic operations; APDU protocols; JCE cryptography add-ons; "Europay mastercard visa (EMV)" integration; "global system for mobile services (GSM)" integration.

BLGM 5624 Network Security (3-0)3

Introduction to information security; general concepts; cryptography; encryption techniques; Threats to security; e-mail security; WE security; wireless security; IM security; database security; platform security -configuration management, patch

management; attack assessment tools; hoaxes, virus myths; spy software, trojan horse and rootkit; making the computing environment secure: firewalls and firewall topologies, attack detection and defense; data encryption techniques; security protocols (SSL, SSH, TLS, etc); identity management; security metrics; software security; security in mobile networks; compliance standards: SOX, GLBA, HIPAA, SB1386, FISMA, FFIEC.

BLGM 5625 Linux and Computer Networks (3-0)3

Computer networks and TCP/IP; network types; parts of a network; network operating system (NOS); foundations of Internet and Intranet; IP addresses and address classes; subnetting; introduction to Linux operating system; installing Linux; Linux management tools; basics of Unix command set; X- Windows; bash scripting; managing and using important server tools in Linux: HTTP (Apache), DNS, DHCP, SENDMAIL etc; network management using Linux; network commands; Linux as a server; Linux as a firewall.

BLGM 5658 Local and Wide Area Networks (3-0)3

Switching fundamentals and mid-level routing; IP addressing techniques; RIP, OSPF, EIGRP; command line interface for switching; virtual LAN (VLAN), spanning tree protocol (STP), VLAN trunking protocol (VTP), NAT and PAT configuration, DHCP configuration; WAN configuration; PPP; ISDN; DDR configuration; FR, network management standards and protocols.

YZM 5501 Programming with Visual Basic (3-0)3

An introduction to event-driven programming; Developing computer programs with Microsoft .NET and VB; data types; arithmetic

statements; program interface design and the properties of the controls; conditionals; loops; sub-programs and functions; arrays; problem solving with computer programming.

YZM 5503 Introduction to Data Structures and Algorithms

(3-0)3

C/C++ programming review; algorithm analysis; complexity; basics of data structures; recursion; linked lists; queue; hash tables; trees; sorting and searching in trees; files; selected topics (compression algorithms, encryption algorithms etc).

YZM 5507 Data Modeling and Relational Databases

(3-0)3

Defining entities and relations; modeling attributes and unique identifiers; normalizing data model; many to many relationship; recursive relationships; normalizing the data model; from data model to physical database; general properties of the relational database systems; indexing; views; denormalization; SQL fundamentals; data warehouses and modeling; OLAP; applications with Oracle database management system.

YZM 5511 Information Systems Analysis and Design

(3-0)3

Software development process –software development life cycle; software modeling languages –structural modeling languages; UML and modeling techniques; introduction to project planning and management; software engineering tools; iterative software development; requirement analysis; business requirements object model; architectural design; database design and converting objects to relational, object oriented and object-relational databases; persistence; programming and testing; test driven software development; user interface design; data engineering-data security and integrity; database operations and concurrency.

YZM 5530 Introduction to Web Programming

(3-0)3

Internet infrastructure and related technologies; internet protocols; web server; web pages; web sites; web browsers; hyper text markup language (HTML) and preparing web content with HTML; HTML forms; dynamic HTML; Cascading Style Sheet (CSS) fundamentals; XSLT; Javascript programming language

fundamentals; document object model and use of Javascript in dynamic web pages; An introduction to Flash and Action Script programming; term projects.

YZM 5535 Web Applications Development with PHP and MySQL

(3-0)3

An introduction to web applications; client and server concepts; web servers and Apache; HTML review; basics of PHP programming; PHP program structure and general properties of the language; use of PHP in HTML; PHP variables; globals; conditional statements; loops; interaction with HTML forms; functions; files; arrays; strings; introduction to relational databases and MySQL; database and table creation under MySQL; phpMyAdmin web interface for the MySQL databases; database programming in PHP; session management in PHP; cookie programming; GD graphics library; introduction to web services; PHP as an object oriented programming language; basics of class forming in PHP; OOP principles; developing class methods; modeling web applications using an OOP approach; introduction to PEAR library.

YZM 5540 Programming with ASP.NET

(3-0)3

Introduction to web applications; client and server concepts; web servers and IIS; HTML review; introduction to web applications development with ASP.NET: general principles; ASP.NET web applications interface development; web forms and controlling form elements; user-web application interaction; user controls and components; ASP.NET program structure and language properties; web services; configuration; validation; session management; cookies; ASP.NET and security; basics of web based database applications; ADO.NET; viewing dynamic data in an application; Code behind technique and VB.NET applications.

YZM 5552 Information Technologies Systems Management

(3-0)3

IT systems design and implementation; business plan; resource planning and budgeting; performance management in IT systems; risk management; operational plans; defining policies using standards; ITIL principles and foundations of IT services management; COBIT; ISO27001 information

security management; processes in IT systems and process management; support services delivered by the IT systems; helpdesk; IT and human resources management; the changing nature of the IT, its currency and its effects on the IT systems management; IT projects and management; IT software management /development standards; overview of CMMI; overview of SPICE.

YZM 5560 Database Programming with PL/SQL (3-0)3

An overview of the relational database systems; indexing; views; introduction to PL/SQL programming language; PL/SQL cursors; stored procedures; stored functions; database triggers; application examples.

YZM 5601 Java Programming (3-0)3

Anatomy of a java program; JDK; JRE; eclipse development environment; OOP fundamentals; basic data types; operators; assignments; console I/O; conditionals (if, switch); loops(for, while, do-while); methods in Java; developing methods; defining new classes; objects and classes; constructor methods; strings; arrays; abstract data types; Java applets; Java graphics and swing; selected topics like Java servlets, socket programming, and advanced OOP.

YZM 5604 Information Security Management (3-0)3

Information security: a general overview; confidentiality, integrity and availability of the information; threats to security; overview of the information security infrastructure; managing information security; CIA approach; anatomy of an information security program in an organization; legal issues; information security politics; asset classification; access controls; physical security; risk analysis and management; business continuity planning; information security management and standards; ISO27001 fundamentals; setting up an ISO27001 based information security management system; information security oriented IT management; class projects.

YZM 5608 E-Business (3-0)3

E-business and e-commerce: general introduction; e-business infrastructure; Internet; web servers; database servers; XML; effects of IT on business models and business processes; e-business marketing; basics of e-

business web sites design and deployment; e-business models; e-business project management; risk analysis; preparing business plans for the e-business projects; payment methods and technologies in e-business; e-business security; legal issues; m-business; class projects.

YZM 5610 Information Technologies Project Management (3-0)3

Introduction to project management; defining characteristics of IT projects; project management techniques that can be applied in an IT project context; managing scope, time, cost, and quality; management issues associated with packaged software implementation (e.g., ERP systems), in-house developed systems, and outsourced projects; project management software; class projects.

YZM 5616 E-Learning Design (3-0)3

Introduction to e-learning; fundamentals of the e-learning theory; e-learning applications in the world; e-learning technologies (hardware and software); examining e-learning material and associated research; visual design in e-learning; e-learning design process and ASSURE model; e-learning design: determination of student needs; standard and aim determination, strategy, technology, environment and material selection; application of technology, environment and material; ensuring student participation; assessment and revision.

YZM 5617 Internet Based Distance Learning (3-0)3

Introduction to Internet based distance learning; theoretical fundamentals; applications in Turkey, EU countries and USA; properties of human workforce; Internet based distance learning technologies (hardware and software); exploration of the Internet based distance learning education programs; associated software; researching Internet based distance learning best practices in the world; virtual schools; planning and designing internet based distance learning; application and assessment.

YZM 5629 Object Oriented Design Patterns (3-0)3

Introduction to design patterns; observer pattern; decorator pattern; factory pattern; singleton pattern; command pattern; adapter

and facade pattern; template method pattern; iterator and composite patterns; state pattern; proxy pattern; patterns in real world.

YZM 5630 Object Oriented Analysis and Design (3-0)3

Definition of a well-designed application; determination of the requirements; changes in the requirements; analysis; good design; flexible design; software architecture; design principles; iterations and tests; life cycle in object oriented analysis and design.

YZM 5650 Visual Design and Animation on the Computer (3-0)3

Design processes in interactive media: overview; definition of the “interaction” activity and examining the possibilities; class application: scenario development using manual methods; cellular phone environment; Investigation of sketch (outline) preparation by using a photograph; overview of the video sketch techniques; usability tests in interactive visual design; user tests; classification of the

concept test for the information-support systems.

YZM 5887 Seminar Non-Cr

Students in the M.S. program with thesis option give a seminar on their thesis topic. The seminar is open to all of the academicians. In the seminar, students will report their advancements in their thesis work.

YZM 5888 Thesis Non-Cr

Students in the M.S. program with thesis option prepare a masters thesis under supervision of a faculty.

YZM 5999 Project Non-Cr

Students in the M.S. program with non-thesis option prepare a project about the topic they selected under the supervision of a faculty. Projects are mostly application oriented and students are expected to do an extensive library search on their project topic and develop an application.

**M.S. PROGRAM in INFORMATION TECHNOLOGIES
SERVICE MANAGEMENT
(in English)**

ASSOCIATE PROFESSORS

BAYRAKTAR, Erkan: B.S., M.S., Dokuz Eylül University, Ph.D., University of Iowa.

KARAHOCA, Adem (*Coordinator*): B.S., Istanbul Technical University, M.S., Ph.D., Istanbul University.

ASSISTANT PROFESSORS

BEŞKESE, Ahmet: B.S., M.S., Ph.D., Istanbul Technical University.

BOZBURA, Faik Tunç: B.S., M.S., Ph.D., Istanbul Technical University.

GÖKÇÖL, Orhan: B.S., M.S., Ph.D., Istanbul Technical University.

GENERAL INFORMATION: The Information Technologies Service Management (ITSM) Program falls into the framework of IBM promoted Services Science, Management and Engineering (SSME). It is a non-thesis Master of Science program jointly offered by Bahçeşehir University and Northeastern University (NU). The curriculum of the program has been developed by a collaboration of IBM University Relations, IBM's Almaden Research Center, Bahçeşehir and Northeastern Universities.

IT Service Management (ITSM) is a discipline for managing information technology (IT) systems, philosophically centered on the customer's perspective of IT's contribution to the business. ITSM stands in deliberate contrast to technology-centered approaches to IT management and is business oriented. ITSM is process-focused; thus it ties with process improvement movement (e.g., TQM, Six Sigma, Business Process Management, CMM, S3M) frameworks and methodologies. ITSM is concerned with the "back office" of information technology management and not with technology development.

The program consists of 14 courses (a total of 34 credits) plus a graduate degree project. Students successfully complete 8 on-line NU courses (each 2 credits) , 6 courses taught by BU on-campus (each 3 credits), and write and complete a graduate project in BU in order to meet the joint program degree requirement. The normal period for the completion of the program is 4 semesters and the maximum duration period of the program is six semesters. On-line courses can be taken everywhere on a global base, but the students must attend the Final Exam either at NU in Boston or at BU in Istanbul. The program is in English and proficiency in English language is an admission requirement. Students who successfully complete the [program](#) will receive a NU-Master of Science Diploma in Project Management and a BU-Master of Science Diploma in Information Technology.

The Program will train students so that they can examine key issues such as services efficiency and services innovation in the field of information technologies with analytical rigor. Graduates of the program will have a strong understanding of both business and technology and will be able to adopt a customer oriented approach to all problems in the field of information technologies. This will ensure that services are rendered with higher quality, more effectively, and with better foresight.

CURRICULUM

Bahçeşehir University Courses:

Required Courses:

SE	5301	Introduction to IT Services Management	(3-0)3
SE	5315	Service Oriented Architectures	(3-0)3
SE	5316	Business Systems Management	(3-0)3
SE	5404	Strategic Planning During Technology Revolutions	(3-0)3
SE	5418	Operations Research in IT Services Management	(3-0)3
SE	5999	Project	Non-Cr

Restricted Elective Courses:

IE	5410	Customer Relationship Management	(3-0)3
SE	5303	Information and Services Economy	(3-0)3
SE	5604	Information Security Management	(3-0)3

Northeastern University Courses:

IT 3330	CISSP Preparation	(2-0)2
LDR 3310	Leading Teams	(2-0)2
PM 3225	Project Evaluation and Assessment	(2-0)2
PM 3200	Project Management Practices	(2-0)2
PM 3210	Project Planning and Scheduling	(2-0)2
PM 3215	Risk Management	(2-0)2
PM 3205	Portfolio Management in the Enterprise Environment	(2-0)2
PM 3220	Cost and Budget Management	(2-0)2

COURSE DESCRIPTIONS

SE 5301 Introduction to IT-Services Management (3-0)3

Foundations in IT services course provides an overview of IT Services. Topics include enterprise systems management (ESM), which is the complete and total management of a company's IT elements and/or environment. IT services, or ESM, involves two categorizations: infrastructure management -the discipline regarding services responsible for maintaining and managing the IT elements in an environment, and relationship management -the discipline containing the services that are customer facing in relation to their IT infrastructure.

SE 5315 Service-Oriented Architectures (3-0)3

The SOA overview course begins with an introduction to what business process and information technology IT architecture are and what functions business process an IT architects perform. The course then describes the concepts of service orientation to a business process or information technology. Components of service oriented architecture are described including and enterprise service bus (ESB), and service connection methods such as extensible markup language. Additionally, concepts such as component business modeling (CBM), business process

execution language (BPEL), and web services description language (WSDL the XML-based language which provides the model for describing Web Services) are also introduced.

**SE 5303 Information and Services
Economy (3-0)3**

A new, interdisciplinary field that combines social science, business, and engineering knowledge needed for organizations (private, public, or nonprofit) to succeed in the shift to the service and information-based economy. A survey of the historical, economic, and theoretical foundations of the rise of the service economy, the analysis and design of services, the technology and implementation of services, and the delivery of services.

**SE 5316 Business Systems Management
(3-0)3**

Business systems management provides an overview of the business and technological aspects of managing business processes focused to affect business impact and outcomes. The courses will use an architectural method to teach how to determine business impact of IT elements and map IT elements to business processes. The prerequisite for this course is an understanding of information technology (IT) devices and categories, and foundations in IT services.

**SE 5404 Strategic Planning During
Technology Revolutions (3-0)3**

This course will apply an inter-disciplinary approach both to a critique of traditional strategy as well as the search for something better -or at least more pragmatic- for students whose careers will inevitably (perhaps already have done so) put them in roles that require

creative thinking about business, whether from a business, engineering, or IT perspective.

**SE 5418 Operations Research in IT
Services Management (3-0)3**

Introduction to operations management: strategy and process design, forecasting and relevance for inventory control, MRP, cycle time, capacity and waiting time. Introduction to marketing and its role in businesses and organizations: the nature of exchange, value proposition and markets. The evolution of exchange and markets in the "new" economy. Introduction to decision analysis. Simulation with linear programming and other OR algorithms.

**SE 5604 Information Security
Management (3-0)3**

The main objectives of this course are to teach students how to identify and prioritize information assets, identify and prioritize threats to information assets, define an information security strategy and architecture, plan for and respond to intruders in an information system, describe legal and public relations implications of security and privacy issues, present a disaster recovery plan for recovery of information assets after an incident. ISO approach to the security management (ISO27001) will also be introduced.

SE 5999 Project Non-Cr

This is a study that students enrolled to a program without a thesis have to prepare under the leadership of an advisor. Some real life analysis utilizing the techniques covered in the program is expected to be carried out. A presentation of the work to an academic commission is also expected.

M.S. PROGRAM in INTERIOR DESIGN
(in Turkish)

PROFESSORS

EYÜCE, Ahmet: B.Arch., Middle East Technical University, M.Arch., Ph.D., Ege University..
UYSAL, Gürkut (*Coordinator*): B.Arch., M.Arch., Ph.D. Mimar Sinan Fine Arts University.

ASSOCIATE PROFESSORS

EYÜCE, Özen: M.Arch., Middle East Technical University, M.Arch., Ege University, Ph.D., Dokuz Eylül University.

GENERAL INFORMATION: Master of Interior Design Program is a thesis program and education is in Turkish. Programs are conducted with an intense educational program conducted weekends. To be accepted to the program a bachelor degree in Architecture, Interior Architecture/or Design an Industrial Design awarded by an approved institution is necessary.

The Graduate Program of Interior Design aims to contribute to the ability and skills of architects, interior and industrial designers who are equipped with the basic professional background, to redesign the existing interiors according to current and contemporary living necessities and present new living environments; and to reveal the quality and requirements of contemporary living environments. The program focuses on informing the applicants about the constantly changing and developing technological resources and producing knowledge about the spatial concepts and applications emerging in different cultures, times and spaces, based on scientific research methods.

CURRICULUM

Required Courses:

IMT	5401 Interior Design Graduate Studio	(2-2)3
IMT	5410 Contemporary Design Approaches	(3-0)3
IMT	5502 Digital Media in Interior Design	(3-0)3
IMT	5801 Research Methods in Interior Design	(3-0)3
IMT	5887 Seminar	Non-Cr
IMT	5888 Thesis	Non-Cr

Restricted Elective Courses (any five of the following):

IMT	5404 Special Topics in Interior Design	(3-0)3
IMT	5412 Color Theory and Applications	(3-0)3
IMT	5420 Selected Historical Periods of Interior Design	(3-0)3
IMT	5422 Residential Interiors	(3-0)3
IMT	5423 Traditional Turkish Houses	(3-0)3
IMT	5426 Renovation and Reuse of Historical Interiors	(3-0)3

IMT	5427	Historical Interiors of Istanbul	(3-0)3
IMT	5430	Contemporary Materials and Applications	(3-0)3
IMT	5432	Detail Design	(3-0)3
IMT	5433	Furniture and Accessories Design	(3-0)3
IMT	5436	Lighting Design	(3-0)3
IMT	5437	Acoustical Design	(3-0)3
IMT	5501	2D Graphic Communication Design	(3-0)3

COURSE DESCRIPTIONS

IMT 5401 Interior Design Graduate Studio (2-2)3

In this studio course, students are asked to formulate and present a design proposal that is related to the selected topic and is appropriate to the contemporary interior design concepts and applications.

IMT 5404 Special Topics in Interior Design (3-0)3

This course includes research and design studies in interior design, aiming to develop solutions in the formerly defined areas by starting off from the problems emerging in the field of practice.

IMT 5410 Contemporary Design Approaches (3-0)3

This course approaches and investigates the contemporary design ideas, theories (normative theories etc.) and concepts (ergonomics, anthropometry) that lead interior design and related disciplines. Their affects on the interior design is being discussed and interpreted on the existing examples in order to draw conclusions for future designs.

IMT 5412 Color Theory and Applications (3-0)3

Color theory, the significance of color in interior design, the effects of color on human life and psychology will generate the scope of this course.

IMT 5420 Selected Historical Periods of Interior Design (3-0)3

This course includes the research and design studies aiming to recognize and understand the interior design in different periods and approaches in architectural history.

IMT 5422 Residential Interiors (3-0)3

In the scope of this course, the basics of residential design, and the contemporary developments in different cultures and countries for the most significant necessity of humans, sheltering is being discussed.

IMT 5423 Traditional Turkish Houses (3-0)3

In the scope of this course, solutions to today's problems were developed by starting off from previous experiences in interior design, the space use, furniture pieces and design principles of traditional Turkish houses were discussed.

IMT 5426 Renovation and Reuse of Historical Interiors (3-0)3

In this course, the determinatives and constraints in the transformation and reuse of the buildings which become functionally and economically out of date due to the technological and social developments are being investigated and discussed.

IMT 5427 Historical Interiors of Istanbul (3-0)3

This course focuses on the favored interiors by starting off from the rich, multi-leveled and multi-cultural historical interiors (palaces, religious buildings, etc.) of Istanbul and concludes with the documentation of their construction materials and techniques, by the researches and investigations on the field.

IMT 5430 Contemporary Materials and Applications (3-0)3

In this course, the effects of technological developments, contemporary approaches and developments in construction area, on the

design of the interior space and on the formation of its character and identity, is being discussed.

IMT 5432 Detail Design (3-0)3

In the scope of this course, the effects of the details occurring in the combination of different materials on space tectonics and their applications on design projects are being studied.

IMT 5433 Furniture and Accessories Design (3-0)3

This course aims to present students the concepts, principles, materials and details related to the design and production of special furniture pieces through design applications.

IMT 5436 Lighting Design (3-0)3

The aim of this course is to give students the theoretical background of light and lighting design; and the skills to use light as a design tool in interior spaces by starting off from the effects of light in spaces.

IMT 5437 Acoustical Design (3-0)3

The aim of this course is to give students the basics of sound and acoustics by starting off from the theoretical and practical background of sound, required sound levels and sound control in interior design.

IMT 5501 Graphic Communication Techniques (3-0)3

The aim of this course is to give students the opportunity to develop their skills of presentation techniques (freehand drawing,

freehand perspective, etc.) used in interior design.

IMT 5502 Digital Media in Interior Design (3-0)3

This course includes the contemporary techniques of 2D-3D digital representations; use of these techniques during the concretization of visionary products in design process, modeling, and animations.

IMT 5801 Research Methods in Interior Design (3-0)3

In the scope of this course that takes place in the last semester, the students who are about to start their thesis, are expected to gain the skills of scientific thinking and approach to be able to conduct scientific research in the field of interior design, which includes the scientific research methods, organization, classification and evaluation of data collected.

IMT 5887 Seminar Non-Cr

This course includes the presentation of a study in the jury, which is being carried out on a selected topic which is appropriate to the discipline's field of work, and is without credit.

IMT 5888 Master's Thesis Non-Cr

The sampling, submission and the presentation of a thesis in the jury, on a subject which is formerly approved by the department. Thesis is expected to be prepared with the knowledge and skills that each student gained in previous semesters and the structure of the thesis must be appropriate to the thesis guidelines.

**M.S. PROGRAM in SUPPLY CHAIN AND LOGISTICS MANAGEMENT
(in Turkish)**

ASSOCIATE PROFESSORS

BAYRAKTAR, Erkan: B.S., M.S., Dokuz Eylül University, Ph.D., University of Iowa.

ASSISTANT PROFESSORS

BEŞKESE, Ahmet (*Coordinator*): B.S., M.S., Ph.D., Istanbul Technical University.
BOZBURA, Faik Tunç: B.S., M.S., Ph.D., Istanbul Technical University.

INSTRUCTORS

YÜCEL, M. Hilmi: B.S., Bilkent University, M.S., Nottingham University.

GENERAL INFORMATION: The program in Supply Chain and Logistics Management (SCLM) is conducted in Turkish and has thesis & non-thesis options. The program can be completed in 3 semesters.

The Program is designed in accordance with the main principles of the field and follows the developments in related areas, generates creative and innovative ideas oriented towards industrial applications and aims to create a human resource equipped with knowledge and skills on international level. The core characteristic of the program is for the participants to be able to design and manage superior and more efficient global supply chains and to have a better understanding of them. Fundamentals of Supply Chain and Logistics, practical industrial applications, purchasing methods, information sharing and partnerships/strategic collaborations, design of distribution channels and other subject matters will be discussed from various directions and it help the participants to increase their knowledge and skills.

The Program is targeting the employees who work or want to work in the following departments of companies; planning, supply chain, purchasing, inventory, distribution and logistics; executives who want to expand their horizons on Supply Chain and Logistics Management; and applicants who want to study deeper into the subject to increase the amount of their knowledge and skills.

CURRICULUM

Required Courses:

EM	5887 Seminar	Non-Cr
EM	5888 Thesis	Non-Cr
EM	5999 Project	Non-Cr

Restricted Elective Courses (any five of the following):

EM	5301	Statistical Data Analysis and Decision Making	(3-0)3
EM	5302	Supply Chain and Logistics Management	(3-0)3
EM	5303	Production and Information Management	(3-0)3
EM	5305	Regulatory Framework of Logistics	(3-0)3
EM	5306	Purchasing Management	(3-0)3
EM	5311	Transportation and Distribution Operations Management	(3-0)3

Technical Electives (at least two of the following):

EM	5300	Logistics Quality Management	(3-0)3
EM	5304	Logistics and Production Information Systems Management	(3-0)3
EM	5308	Supply Chain Facility Planning and Network Design	(3-0)3
EM	5309	Service Operations Management	(3-0)3
EM	5310	International Arbitration in Logistics Agreements	(3-0)3
EM	5321	Logistics Contract Management	(3-0)3
EM	5322	Design of Supply Chain	(3-0)3
EM	5390	Special Topics in Supply Chain and Logistics Management	(3-0)3

COURSE DESCRIPTIONS

EM 5112 Project Management in Engineering (3-0)3

Project organization, leadership, engineering design, network techniques. CPM and PERT methods, project budget, cost analysis, fund management, project application and control.

EM 5203 Statistical Data Analysis and Decision Making (3-0)3

Statistical analysis techniques, numerical decision making models, modeling decision problems, hypothesis testing, probability distributions, decision trees, linear programming.

EM 5300 Logistics Quality Management (3-0)3

Concept of quality, total quality management, 7 tools of quality, quality control in logistics systems, and statistical quality control in logistics are some of the issues to be discussed.

EM 5301 Statistical Data Analysis and Decision Making (3-0)3

The purpose is to equip the participants with analytical modeling and statistical analysis techniques to aid the managerial decision making process via computer software. The

discussed decisions include different applications from business, production and service sectors. To be able to model a decision problem from the given information, to solve this problem via computer, to comment the computer output and to apply the solution are some of the expectations anticipated from the participants. Main topics to be discussed in the course are decision analysis, statistical decision making, regression analysis, linear programming and simulation.

EM 5302 Supply Chain and Logistics Management (3-0)3

Meaning and importance of the term logistics, basic logistics decisions, strategic logistics planning, determination of customer service level, logistics costs, total cost in logistics and systems approach will be discussed and the course will be enriched with a logistics game. Supply chain concept will be highlighted and the primary work areas will be introduced.

EM 5303 Production and Information Management (3-0)3

Commodity and service production oriented strategic and tactical matters, which are demanded by the customers in today's

globalizing world with increasing competition, form the contents of this course. Main topics to be discussed during the course are design, forecast, facility location decision, facility planning, capacity and production planning, inventory planning, quality and supply chain management. Most important goal is the coordination of the resources in order to decrease the costs, and improve quality and customer relations.

EM 5304 Logistics and Production Information Systems Management (3-0)3

JIT, MRP, ERP, OPT, and the informative and technological infrastructures for these concepts to perform well will be investigated. Purposes of, and the infrastructure for information technologies used in the supply chain, global positioning systems and e-commerce are some of the topics of this course.

EM 5305 Regulatory Framework of Logistics (3-0)3

Main topics to be discussed during the course are Turkish Constitution and general code of laws, logistics related laws, arbitrage within the Turkish legal system, transportation regulations, foreign exchange regime, foreign trade regulations, customs regulations, legal sanctions and related associations.

EM 5306 Purchasing Management (3-0)3

Almost in every business sector commodity and service purchases constitute an important portion of the expenses. From this point of view for an effective cost control and strong competition potential an efficient working purchasing process is critically important. For this purpose ISO 9000 standards will be covered within the body of this course. From the moment of generation of the purchasing demand until the moment of meeting that demand all the activities will be analyzed and how to accomplish the 5 rights of purchasing (right time, right amount, right price, right quality and right source) will be discussed. Furthermore within the course period contract management process, performance follow-up and control and need for subsequent change management will be handled.

EM 5308 Supply Chain Facility Planning and Network Design (3-0)3

Selection of the storage place, storehouse design, storehouse management, arranging the storehouse, material carrying equipments and storage systems will be emphasized and models necessary for the effective usage of the systems will be discussed. Supply chain network design, verification and management of the distribution channels will be accentuated.

EM 5309 Service Operations Management (3-0)3

In this course; analysis, management and design of the efficiency and effectiveness of the operations in the service industry will be emphasized. Turkish models and sectors of the service industry (which constitutes 70% of the world economy) in Turkey, will be explained. Definition of service, determination and measurement of its strategies, quality assessment and its supply and demand conditions will also be emphasized.

EM 5310 International Arbitration in Logistics Agreements (3-0)3

Disputes in Logistics Agreements and alternative methods for dispute solutions, international arbitration concept, national legislation on arbitration and changes made on those legislations, international arrangements on arbitration (Geneva Convention), international arbitration institutions and procedures (ICC and UNCITRAL); arbitration agreements on logistics contracts, related risks and components of a valid arbitration agreement, formation of board of arbitration, exercise of jurisdiction of the arbiter and the decision making, recognition and execution of international arbiter decisions, New York Convention and its application area will be covered.

EM 5311 Transportation and Distribution Operations Management (3-0)3

Some of the topics to be covered are Introduction to Transportation Management, distribution and transportation within the logistics process, transportation costs, transport operators and intermediaries, transportation systems, modes and intermodal transportation, transportation regulations, transport operations and documentation, transportation modeling via commercial transportation software.

EM 5321 Logistics Contract Management (3-0)3

Contract and contract management, outsourcing agreements, preparation of a contract, management of the existing contracts and possible refinement methods, contract risk management, contract performance management, support subjects for the contract management, deliberation management, disagreement management are the topics to be included. Some examples and case studies will also be given.

EM 5322 Design of Supply Chain (3-0)3

Management of the whole process from the design of the new product to product supply chain network design, determination and examination of the distribution channels.

EM 5390 Special Topics in Supply Chain and Logistics Management (3-0)3

In this course, analytical and strategic information on design and management of advanced and broad logistics systems will be given. Also, design of advanced supply chain models, control of those models and their interaction with the environment will be examined.

EM 5490 Operation Research (3-0)3

Introduction to modeling, introduction to linear programming, graphic solutions, simplex algorithm, transportation models, assignment models, introduction to integer programming, traveling salesman problem, network models.

EM 5887 Seminar Non-Cr

This seminar which is included within the thesis program in general aims at preparing the participants for the graduation thesis and inform them on what an academic study must entail. Being not mandatory, the participants will be expected research on their possible topics of graduation thesis and present it at the end of the term.

EM 5888 Graduation Thesis Non-Cr

With the consultation of the academic advisor, the graduation thesis will include a thorough literature research together with a detailed application on the subjects related to Supply Chain and Logistics Management.

EM 5999 Graduation Project Non-Cr

With the consultation of the academic advisor, the graduation project will basically rely on a literature research which is supported with a simple application on Supply Chain and Logistics Management.

**M.S. PROGRAM in URBAN SYSTEMS AND
TRANSPORTATION MANAGEMENT
(in Turkish)**

PROFESSORS

ALNIAK, Oktay: B.S., Ege University, M.S. Boğaziçi University, Ph.D., Gazi University.
ILICALI, Mustafa (*Coordinator*): Ph.D., Yıldız Technical University.

ASSISTANT PROFESSORS

BOZBURA, F. Tunç: B.S., M.S., Ph.D., Istanbul Technical University.

INSTRUCTORS

CAMKESEN, Nilgün: Ph.D., Yıldız Technical University.

ADJUNCT PROFESSORS

AKBAŞ, Ahmet: B.S., M.S., Istanbul Techninal University, Ph.D., Marmara University.
CENGİZ, Hüseyin: B.S., M.S., Ph.D., Yıldız Technical University.
KARAMAN, Aykut: B.S., M.S., Mimar Sinan University, Ph.D., The University of Pennsylvania.
TEKTAŞ, Mehmet: B.S., Anadolu University, M.S., Ph.D., Marmara University.
TEKTAŞ, Necla: B.S., Anadolu University, M.S., Ph.D., Marmara University.

GENERAL INFORMATION: The program in Urban Systems and Transportation Management is conducted in Turkish and has thesis and non-thesis options. Both options can be completed in a minimum of 3 terms. To be accepted to Urban Systems and Transportation Management Program a bachelor degree in a relevant program is necessary. Graduates of any engineering program would directly begin the program. Students from other programs would begin with a preparation term in which the courses will be determined by the student advisor.

The main purpose of the program is to give a high level education and to specialize the graduate students about urban systems and transportation management. This program helps students to improve their efficiency in their duty and gives proper, innovative, creative ideas about urban systems and transportation. Program develops expertise in planning and engineering topics with a multidisciplinary viewpoint. Students in this program gains the organization, planning, decision making and management abilities and can serve in public or private companies as managers or directors.

The program targets are:

- Students who want to develop their careers and gain experience and information about urban systems and transportation,
- Employees who want to take a planning or a managerial position in companies,
- Employees who want to gain a multidisciplinary management and planning experience,
- Students who aim to do academic research.

CURRICULUM

Required Courses:

KSUY 5887	Seminar	Non-Cr
KSUY 5888	Thesis	Non-Cr
KSUY 5999	Project	Non-Cr
EM 5203	Statistical Data Analysis And Decision Making	(3-0)3
EM 5490	Operations Research	(3-0)3

Restricted Elective Courses (any five of the following):

EM 5112	Project Management in Engineering	(3-0)3
KSUY 5111	Transportation Engineering and Planning	(3-0)3
KSUY 5112	Urban Transportation Systems	(3-0)3
KSUY 5113	Urban Landscape Design	(3-0)3
KSUY 5114	Urban Systems	(3-0)3
KSUY 5115	Urban Logistics	(3-0)3
KSUY 5116	Port and Terminal Management	(3-0)3
KSUY 5117	Urban Travel Demand Modeling	(3-0)3
KSUY 5118	Geographic Information System Applications	(3-0)3
KSUY 5119	Public Area and Accessibility	(3-0)3
KSUY 5121	Transportation Systems Analysis	(3-0)3
KSUY 5122	Spatial and Social Dynamics in Metropolitan Cities	(3-0)3
KSUY 5123	Tunnel Management Systems in Road Networks	(3-0)3
KSUY 5125	Landscape Design	(3-0)3
KSUY 5126	Free Area Management	(3-0)3
KSUY 5127	Park Conversion Projects	(3-0)3
KSUY 5128	Ship Management	(3-0)3
KSUY 5129	Container Shipping In Naval Transportation	(3-0)3
KSUY 5211	Public Infrastructure Management	(3-0)3
KSUY 5212	Land Use Ethics and Management	(3-0)3
KSUY 5213	3D Modeling and Laser Scanning Technologies	(3-0)3
KSUY 5214	Material Science	(3-0)3
KSUY 5215	Intermodal Transportation	(3-0)3
KSUY 5221	Urban Morphology	(3-0)3
KSUY 5301	Traffic Management and Control	(3-0)3
KSUY 5302	Intelligent Transportation Systems	(3-0)3
KSUY 5304	Transportation Economics	(3-0)3
KSUY 5305	Transportation-I	(3-0)3
KSUY 5306	Transportation-II	(3-0)3
KSUY 5307	Disaster and Emergency Management	(3-0)3
KSUY 5308	Metropolitan Administration	(3-0)3
KSUY 5309	Urban Law	(3-0)3
KSUY 5310	City and Urban Development	(3-0)3
KSUY 5311	Waste Management	(3-0)3
KSUY 5312	Environmental Effects of Transportation	(3-0)3
KSUY 5412	Urban Economics and Finance Management	(3-0)3

COURSE DESCRIPTIONS

KSUY 5111 Transportation Engineering and Planning (3-0)3

Transportation and socio-economical development. Development of transport. Transport modes. Land transportation. Air transportation. Water transportation. Pipelines, infrastructures of transport modes. Terminals. Operating characteristics of transport modes. Performance criteria. Capacity. Traffic flexibility. Safety. Urban transport systems. Future developments in transportation. Aim of transportation planning. Outline of transportation planning process. Environmental effects of transportation. Management in transportation.

KSUY 5112 Urban Transportation Systems (3-0)3

Introduction and basic definitions, urban structure, historical development of cities, urban activities, urban transportation demand, urban transportation characteristics, urban transportation systems, characteristics and performance, urban transportation planning stages, demand management in urban transportation.

KSUY 5113 Urban Landscape Design (3-0)3

Urban landscape design, urban landscape project, urban recreation, recreation possibilities in cities, free urban areas, landscape design.

KSUY 5114 Urban Systems (3-0)3

Urban development process, human actions and urban systems, demographic change and emigration, evaluation of urban systems, urban dynamics, urban system analysis, globalization and global networks, information and telecommunication technologies.

KSUY 5115 Urban Logistics (3-0)3

Logistics theorem, evaluation of logistics, logistics management, basic logistic activities, supply chain management, outsourcing, 3PL, 4PL, simple and active logistics, e-logistics, urban logistics, importance of urban logistics, definition and contents, elements and sides of urban logistics, problems and solutions about urban transportation, logistics/transportation sectors and centers in Turkey, classification of

logistic centers, organized logistic zones, basic characteristics, services in OLZ, OLZ size determination, location selection for OLZ, feasibility study for OLZs.

KSUY 5116 Port and Terminal Management (3-0)3

Definition of ports, functions, activity fields and classification. Organizational and administrative structure of ports, applications in our country. Organization of sea and port traffic. Planning and management of port infrastructure/superstructure. Public and private firms serving in ports. Technical terms used in port management.

KSUY 5117 Urban Travel Demand Modeling (3-0)3

Basic sampling theorem, practical applications in sampling, errors in modeling and forecast, data collecting methods, network and zone systems, modern approaches for travel demand modeling, practical applications and errors, forecast methods, modern approaches for traffic assignments.

KSUY 5118 Geographic Information System Applications (3-0)3

Definitions about GIS, GIS application, geographic data types and sources, GIS components, GIS stages, planning of city and transportation, application samples.

KSUY 5119 Public Area and Accessibility (3-0)3

Disabled person definition, grouping and characteristics, legal outline, physical outline, difficulties, accessibility, actions that would be taken in public areas, international design principles.

KSUY 5121 Transportation Systems Analysis (3-0)3

Introduction: the profession of transportation systems analysis, interrelationships between transportation system and activity system. The demand for transportation: disaggregate prediction of behavior, utility functions and indifference curve, deterministic model for consumer behavior, stochastic model for consumer behavior, aggregate prediction of behavior. Transportation supply: cost

functions. Transportation system performance: understanding performance functions, carrier operations planning, network analysis, evaluation and choice, cost-benefit analysis and multi-criteria evaluation techniques of transportation projects.

KSUY 5122 Spatial and Social Dynamics in Metropolitan Cities (3-0)3

Rural area, rural settlement concepts, metropolitan settlement concepts, industrial cities, global cities, economical structure, social structure, Istanbul urban macroform, globalization effect on communal structure.

KSUY 5123 Tunnel Management Systems in Road Networks (3-0)3

Traffic system analysis in tunnels, tunnel illumination systems, tunnel ventilation systems, traffic signalization in tunnels, energy obtaining systems in tunnels, tunnel fire alarm and extinguishing systems, tunnel radio systems, tunnel automation.

KSUY 5125 Landscape Design (3-0)3

Landscape definition and types, subject of landscape architecture, relations of landscape design with planning, engineering and art, different application scales of landscape design, design elements with samples, area forms, types, landscape elements, landscape structures.

KSUY 5126 Free Area Management (3-0)3

Importance of free and green areas in emergency conditions, accessibility and permanence, distribution of free areas between zones, closeness to the risky zones in emergency conditions, establishment and management.

KSUY 5127 Park Conversion Projects (3-0)3

Earthquake parks, area selection for park conversion projects, selection criteria, planning and management, determination of necessary areas for earthquake parks.

KSUY 5128 Ship Management (3-0)3

Importance of naval transport, condition in our country and world, ship and cargo types in naval transportation, tramp and liner transportation, ship management firms, management costs, intermodal transportation and management.

KSUY 5129 Container Shipping in Naval Transportation (3-0)3

Definition and types of containers, importance of container shipping in naval transportation, container ships and types, container terminal planning, management, intermodal transportation.

KSUY 5211 Public Infrastructure Management (3-0)3

Infrastructure management, infrastructure organizations and systems, public infrastructure monitoring and evaluation, public infrastructure planning, public infrastructure programming and budgeting, public infrastructure design, project development, public infrastructure environmental impact assessment, public infrastructure construction, public infrastructure operations, public infrastructure maintenance, case studies about public infrastructure management, summary, conclusion, and future directions.

KSUY 5212 Land Use Ethics and Management (3-0)3

Location versus land use, explanations of spatial structure; Three-dimensional 'space' versus two-dimensional 'land' (Kohl), land as a source of wealth: population and urban growth (Henry George), rent and utility: dependent variables in land use models (A. Marshall)

KSUY 5213 3D Modeling and Laser Scanning Technologies (3-0)3

3D modeling and laser scanning technologies, 3D modeling in urban planning, traffic, security areas, 3D modeling from laser data, numerical area models, 3D modeling of old buildings, laser scanning techniques.

KSUY 5214 Material Science (3-0)3

Atomic structure of solids, structure of non-ideal solids, point and line defects, mechanical properties of solids, cracking and fatigue, plastic defects, theoretical strength of crystal solids, dislocation energy, strength mechanisms.

KSUY 5215 Intermodal Transportation (3-0)3

Intermodal transportation concept and definitions, combined transport, SWOT analysis, specialization in transportation, competition and collaboration in

transportation, transportation vehicle types, transportation chain, roads, railways, naval lines and airlines, combined transportation applications.

KSUY 5221 Urban Morphology (3-0)3

Description of Urban Morphology, Theoretical Basis and the schools of urban morphology, historical evaluation of cities urban forms, principle and secondary urban elements; the development of settlements; settlements and growth; plan analysis, spatial methods for studying and analyzing the urban patterns, analysis on a sample area selected from Turkey.

KSUY 5301 Traffic Management and Control (3-0)3

Traffic and transportation problems depending on population and vehicle. Effective traffic management and control. Effective use of the existing transport infrastructure in accordance of vehicle, passengers and pedestrians. Most effective Traffic Circulation Project in the cities, traffic signs to be used in necessary places with enough numbers, optimum use of Traffic lights, effective use of intelligent Traffic systems, road quality and safety, traffic awareness of drivers, passengers and pedestrians and use of IT Technologies in controlling traffic.

KSUY 5302 Intelligent Transportation Systems (3-0)3

ITS components and stakeholders, ITS system architecture and standards, advanced traffic management systems (ATMS), advanced traveler information systems (ATIS), advanced public transportation systems (APTS), commercial vehicle operations (ITS-CVO), intermodal systems, advanced vehicle control and safety systems (AVCS), automated highway systems (AHS), communication issues in ITS, status of ITS deployment in the world, EU and Turkey, ITS evaluation and future challenges.

KSUY 5304 Transportation Economics (3-0)3

Basic engineering economy principals, economic analysis principals, benefit expenditure analysis, organization techniques, environmental effect estimation, development plan phases, application of optimization methods to transportation systems, decision

making under uncertainty, risk, uncertainty and reliability concepts.

KSUY 5305 Transportation I (3-0)3

Introduction to earthworks. Volumes of fills and cuts. Mass diagram. Optimization of earth moving. Excavation methods and machines. Excavators and dampers. Introduction to railroad engineering. Train dynamics. Geometric standards of track. Gradients, curves, transition curves, location of track, superstructure elements and materials. Layout of track.

KSUY 5306 Transportation II (3-0)3

Basic concept in highway engineering. Characteristics of driver-pedestrian-vehicles. General properties of highway traffic. Geometric standards and design traffic of highways. Highway capacity. Highway location and horizontal alignment. Vertical alignment and curves. Horizontal curves. Urban roads. Intersection control and design. Soil engineering for highway design. Drainage.

KSUY 5307 Disaster and Emergency Management (3-0)3

Concepts and definitions: Emergency management, hazard, emergency, disaster, history of disaster, natural disaster, atmospheric disasters, geological disasters, hydrological disasters, seismic disasters, technological hazards, dam failures, fires, traffic incidents, hazardous materials, nuclear accidents, community hazard analysis, the four phases of emergency management, resources, participants, major functions, need to supplement resources, private sector resources, asking for help, framework of an integrated emergency management system (IEMS), four phases of emergency management: (preparedness, mitigation, response, recovery), coordination, communication, chain of command, functional groups in EM, interactions in EM, coordination among organizations, roles of participants, citizens, private sector, government, application; case study. Emergency manager proficiency.

KSUY 5308 Metropolitan Administration (3-0)3

The nature of metropolitan administration, the necessity for the metropolitan administration, the kinds of metropolitan administration, administrative cooperation in metropolitan

areas, public authorities in metropolitan areas, one-tire and two-tire metropolitan administrations should be discussed. The metropolitan areas of Paris, Roma, London, Berlin, Amsterdam, Toronto, Tokyo, Moscow and Cairo should be investigated as the main examples of metropolitan administration.

KSUY 5309 Urban Law (3-0)3

Turkish laws and regulations dealing with the planning authority, planning hierarchy, technical and social infrastructure, plan implementation tools, property rights, urban protection laws, squatter laws, the coastal law, bylaws on the areas without any plan, the exclusive environmental protection areas, tourism areas, industrial areas, agricultural areas, water pollution control areas, forest areas, land hunting areas, water product areas, national parks and disaster areas will be investigated and the implementation problems of these laws will be determined.

KSUY 5310 City and Urban Development (3-0)3

Historical perspective on city and urban development, urban development in history, socio-economical, political, and technological facts about development.

KSUY 5311 Waste Management (3-0)3

Sources and composition of solid wastes. Solid waste generation and collection rates. Integrated waste management, Waste handling and separation, storage, and processing at the source. Collection of solid waste. Transfer and transport. Materials recycling. Medical wastes management. Fundamentals of Hazardous Waste management. Technical issues in planning water reuse systems, Reuse applications: Urban reuse, industrial reuse, agricultural reuse, Funding alternatives for water reuse systems, Public information programs.

KSUY 5312 Environmental Effects of Transportation (3-0)3

Introduction, definitions, use of energy and air pollution in traffic, noise pollution in traffic, land use in transportation, accidents, congestion, other environmental effects caused by traffic, differences between transport modes from the point of these effects, evaluation of the parameters dealing with the environmental effects in the transport modes, calculation principles and evaluation of unit traffic environmental effect costs, importance of environmental effects in transport planning, measures for decreasing environmental effects.

KSUY 5412 Urban Economics and Finance Management (3-0)3

This course is concerned with the market analysis and financial feasibility of urban projects and large scale real estate developments. Demand and supply of facilities, market activities, financial viability, investment strategies, project structures. Methods of market analysis for housing, shopping, office and hotel facilities and the property cycles will be examined. Alternatives financing for urban projects, the discounted cash flow model and sensitivity analysis to evaluate project feasibility will also be discussed.

KSUY 5887 Seminar Non-Cr

The purpose of this course is to share basic researches about Urban Systems and Transportation Management program. Various applications and information that may be helpful in thesis and project would be gained with in the context of seminar course.

KSUY 5999 Project Non-Cr

Project is a study of application and research about transportation management, urban systems and urban management. As a content public transportation, urban structure, urban transportation systems, disaster management and likewise topics relevant with Urban Systems and Transportation Management may be selected.