Program Records

About the Program	Master Program in the Department of Industrial Engineering focuses on understanding, developing models and solution procedures, and providing decision support for the contemporary challenges in production and service industries as well as large-scale socio-technical systems. The department provides a strong background in modeling and optimization, simulation, and probability/statistics. Upon this background, students have the opportunity to specialize in the following three interdisciplinary focus areas: Sustainability: Producing goods and services using processes that are non-polluting, conserving of energy and natural resources, economically viable, and safe and healthful for workers, communities, and consumers. Disaster Management: Analyzing, modeling, and providing scientific decision support in the management of natural and human-induced disasters (e.g., earthquakes, landslides, and terrorism) to contribute towards improving the resilience of governments, organizations, and companies. Healthcare Systems: Improving efficiency, productivity, and patient access in healthcare systems by developing tools, methodologies, and protocols that allow for the safe, efficient, and cost-effective delivery of healthcare with improved outcomes.
Program Outcomes	- be employed as an engineer in a related field or start their own entrepreneurship endeavors, - assume positions of leadership and responsibility within an organization, - accomplish lifelong learning activities.
Qualification Awarded	Master Degree
Length of Program & Credits	2 years 120 ECTS
Level of Qualification	Second Cycle (Master) Degree; EQF-LLL: 7. Level QF-EHEA:2. Cycle
Mode of Study	Full Time
Field of Study	Engineering, Manufacturing and Construction
Admission Requirements	An undergraduate diploma; a passing or acceptable score from the English Proficiency Exam of Abdullah Gül University, YDS (Foreign Language Exam), YÖKDİL (Foreign Language Exam for Higher Education Institutions), or TOEFL; an acceptable score from the Academic Personnel and Postgraduate Education Entrance Exam (ALES - Mathematical Score Type); a passing score at the oral interview for the concerned Master's program. International students are admitted based on the criteria posted by the university.
Recognition of Credit Mobility	Course Substitution: For course substitutions, medium of instruction of a previous course must be English, its final grade must be at least 3.00 out of 4.00 and approval of a relevant University Board is required. Lateral Transfer: Spending at least one semester at the master's program currently enrolled in, taking at least 2 credit courses and passing them with at least 3.00 out of 4.00.
Graduation Requirements & Regulations	Successful completion of 7 Courses, Seminar and Ethics; a minimum grade point average (GPA) of 3.00; earning 120 ECTS credits; successful submission of a thesis.
Occupational Profiles of Graduates	Working areas of industrial engineers: Operations Research / Management Science, Logistics, Engineering Management, Consultancy, Financial Engineering, Project Management, Cost Engineering, Quality Engineering, Ergonomics, Occupational

	Safety, Accounting and Facility Management are largely consistent with job descriptions. Students who graduate from master program can work in the fields they are specialized in public and private sectors. In addition, they can work at department of logistics, occupational health and safety etc. in universities as an academician.
Access to Further Studies	Graduates may apply to third cycle (Level 8) degree programs.
Assessment & Grading Policy	Based on Abdullah Gul University Undergraduate Education and Examination Regulation rules;

Letter Grade	Coefficient	Score	Status	Letter Grade	Status
A	4.00	90-100	Pass	NA	Not Attended
A-	3,67	87-89	Pass	W	Withdrawn
B+	3,33	83-86	Pass	I	Incomplete
B	3,00	80-82	Pass	T	Transferred
B-	2,67	77-79	Pass	S	Satisfactory
C+	2,33	73-76	Pass	U	Unsatisfactory
C	2,00	70-72	Pass	P	In Progress
C-	1,67	64-69	Conditional Pass	EX	Exempt
D+	1,33	56-63	Conditional Pass		
D	1,00	50-55	Conditional Pass		
F	0,00	0-49	Failed		

Program Outcomes

PO1. Identify, formulate, and solve complex industrial engineering problems by selecting and applying appropriate tools and techniques and generate creative options in furtherance of effective decision making.

PO2. Employ critical thinking and scientific method to design an experiment to meet a need, conduct the experiment, and analyze and explain the resulting data, evaluate the effectiveness of a designed experiment and the implications of the resulting data.

PO3. Have a competency, in-depth understanding and mastery of the literature in a specialized area of industrial engineering and demonstrate that through synthesizing, developing and evaluating new, advanced technical knowledge.

PO4. Demonstrate teamwork skills, specifically function in work groups, collaborate with a variety of other people using elements of effective team dynamics to effectively and appropriately structure team work

PO5. Possess effective communication skills, specifically write technical documents clearly, concisely, and analytically and speak in groups and in public clearly, concisely, and analytically, with appropriate use of visual aids.

PO6. Contribute own knowledge and experiences to community and the broader society by participating in professional and/or community activities

TQF-HE & Program Outcomes Coverage

	Knowledge	**Skills**	**Competences**			
	Theoretical Conceptual	Cognitive Practical	Work Independently and Take Responsibility	Learning	Communication and Social	Field Specific
PO1	X	X	X			X
PO2	X		X	X		
PO3	X	X				
PO4		X	X			
PO5					X	
PO6					X	X

Institutional & Program Outcomes Coverage		IO1	IO2	IO3	IO4	IO5	IO6	IO7
	P01	X						
	PO2		X					
	PO3				X			
	PO4			X		X		
	PO5						X	
	PO6				X			X

Curriculum

1. Semester

Code	Course	T	P	Credits	ECTS
IE511	Modelling and Optimization	3	0	3	7,5
IE521	Probability Theory	3	0	3	7,5
IE534	Risk Modeling, Assessment, and Management	3	0	3	7,5
GCC1001	Introduction to Scientific Research	3	0	3	7,5
	Total	12	0	12	30

2. Semester

Code	Course	T	P	Credits	ECTS
IEXXX	Elective Courses	3	0	3	7,5
IEXXX	Elective Courses	3	0	3	7,5
IEXXX	Elective Courses	3	0	3	7,5
IEXXX	Elective Courses	3	0	3	7,5
IE500	Seminar	0	2	0	5
	Total	12	2	12	35

3. Semester

Code	Course	T	P	Credits	ECTS
IE599	MSc Thesis	0	1	0	45
IE597	MSc Special Topics	4	0	0	10
	Total	4	1	0	55

4. Semester

Code	Course	T	P	Credits	ECTS
IE599	MSc Thesis	0	1	0	45
IE597	MSc Special Topics	4	0	0	10
	Total	4	1	0	55

Curriculum Summary

%		Courses	Credit	ECTS
7	**YÖK/HEC Courses** GCC1001	1	3	10
20	**Compulsory** XXX	3	3	10
28	**Electives** XXX	4	3	10
3	**Seminar** IE500	1	0	4
7	**MSc Special Topics** IE597	2	0	5
35	**MSc Thesis** IE599	2	0	25
100,0	**TOTAL**	**13**	**21**	**144**

Program Course Code Descriptions

IE	A B C

Digit	Explanation
A	A, which denotes the year, is in {1, 2, 3, 4}
B	B, which denotes the area, is in {0, ..., 9}. See below
C	C is in {0, ..., 9}. Odd values for Fall semester and even values for Spring semester.

Value for the digit B	Area
0	Basic
1	Optimization
2	Probability
3	Stochastic
4	Economy/Finance
5	Human Factors/Ergonomics
6	Manufacturing
7	Production systems
8	Quality
9	Special topics

Courses Descriptions

Code	**IE500**
Name	**M.Sc. Graduate Seminar**
Hour per week	1 (0 + 1)
Credit	0
ECTS	5
Level/Year	Graduate
Semester	Fall and Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	This course aims to keep the graduate students up-to-date with current research in industrial engineering, operations research, and related fields and to improve their skills in communicating their research. The course will include contemporary industrial engineering and operations research issues. Seminars are given by the graduate students, the department faculty, and invited guests. Students register to this course in all semesters.

Code	**IE501**
Name	**Mathematics for Optimization**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	The course intends to teach the students the necessary mathematics background for optimization: methods of proof, sets, functions, series, and metric spaces. The course covers the following topics: introduction to complex algebra, systems of linear equations, Gaussian elimination, vector spaces and their extension to complex case, linear dependence/independence, bases, matrix algebra, determinant, inverse, factorization, Eigenvalue problem, diagonalization, quadratic forms.

Code	**IE 511**
Name	**Modeling and Optimization**
Hour per week	3(3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	The course introduces mathematical modeling comprehensively including linear programming, integer programming, network and transportation models, nonlinear

	programming, Karush-Kuhn-Tucker conditions. The course focuses on abstracting real-world systems/problems conceptually, formulating and building mathematical models that are appropriate for these systems/problems, coding and solving mathematical models by using available off-the-shelf software e.g. GAMS, CPLEX, EXCEL SOLVER, EXPRESS, GUROBI and interpreting the solutions obtained from the models in terms of real-world system.

Code	**IE513**
Name	**Linear Programming**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	This course focuses on comprehensive review of the theory, algorithms, and computational methods of linear programming. The course covers the following topics: polyhedral theory, simplex algorithm, duality theory, weak and strong duality, sensitivity analysis, simplex variants, interior point methods.

Code	**IE514**
Name	**Game Theory and Its Applications in Optimization**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE513
Coordinator(s)	
Description:	This course introduces basic concepts of the mathematical theory of games. The course covers the following topics: non-zero sum games: strategies, Nash equilibrium, response functions; matrix games, strategic form games, Nash recursion, pure and mixed equilibria; sequential games: extensive-form representation, perfect and imperfect information, sequential equilibrium, sequential rationality, subgame perfect equilibrium; modeling games as mathematical programming problems, solution characterization, solution strategies and relevant optimization techniques; applications: auction design, oligopoly competition, manufacturer-retailer bargaining, capacity/congestion pricing, and so forth.

Code	**IE515**
Name	**Discrete Optimization**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	

Description:	This course introduces the thorough theory algorithms and applications of combinatorial and integer optimization. The course covers four main parts. Part I presents the fundamentals and modeling aspects. Part II deals with how to solve the resulting relaxations, including the simplex algorithm (and interior point methods like the ellipsoid algorithm if time permits) and selected topics in polyhedral theory. Part III deals with algorithms for integer optimization including both exact methods (enumerative algorithms such as dynamic programming, and branch-and-bound; cutting plane methods, branch-and-cut) and heuristics (GRASP, feasibility pump). Finally, Part IV deals with decomposition approaches like Lagrangian relaxation (and duality results for integer optimization), Benders' decomposition and branch-and-price (delayed column generation).

Code	**IE516**
Name	**Nonlinear Programming**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	This course provides students with a thorough introduction to the theory algorithms and applications of constrained and unconstrained nonlinear programs. The course is composed of two parts. Part I presents the fundamentals and the theoretical aspects such as convex sets and functions, necessary and sufficient optimality conditions, constraint qualifications, duality theory, Lagrange multipliers and semidefinite optimization. Part II is on computational aspects such as algorithms for quadratic programming, Newton and Gauss-Newton methods, gradient projections, conditional gradient method, barrier methods, interior point methods, subgradient optimization and convergence analysis.

Code	**IE517**
Name	**Heuristic Methods in Optimization**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	This course will introduce a wide range of basic and advanced heuristic methods. The course covers the following topics: greedy heuristics, improvement heuristics, constructive heuristics, metaheuristics such as simulated annealing, tabu search, genetic algorithms, ant colony optimization, hybrid algorithms and emphasizing these heuristics' generic characteristics and limitations, and the types of problems to which they are best adapted.

Code	**IE518**
Name	**Network Models and Optimization**
Hour per week	3(3 + 0)
Credit	3

ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	This course provides students with a comprehensive knowledge of network design and network flow problems. The course will include the shortest path problem, the maximum flow problem, the minimum cost flow problem, assignment and travelling salesperson problems in telecommunication, logistics, social and computer networks. Solution methodologies for these problems such as network simplex algorithm, Lagrange relaxation, column generation and other decomposition methods are taught within the course.

Code	**IE519**
Name	**Multiobjective Optimization**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 513, E 511
Coordinator(s)	
Description:	This course intends to teach students the fundamentals of multiobjective optimization. The course covers pareto-optimality, weighting method, constraint method, goal programming, NISE method, and evolutionary methods and various multiobjective optimization algorithms.

Code	**IE521**
Name	**Probability Theory**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	This course provides students with a comprehensive knowledge on the fundamentals of probability theory. The course covers measure theory, sample space, random variables, expectations, transforms, Bernoulli and Poisson processes, finite Markov chains, limit theorems in depth.

Code	**IE522**
Name	**Simulation**
Hour per week	3 (3 + 0)
Credit	3

ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE521
Coordinator(s)	
Description:	Simulation models, input data modeling, variance reduction techniques, model validation and verification, output data analysis, comparison of alternatives, ranking and selection methods, simulation optimization

Code	**IE523**
Name	**Systems Theory**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	
Description:	This course tends to teach the students advanced simulation theory and programming practice. The course will include simulation models, input data modeling, variance reduction techniques, model validation and verification, output data analysis, comparison of alternatives, ranking and selection methods, simulation optimization.

Code	**IE524**
Name	**Data Mining**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE521
Coordinator(s)	
Description:	This course examines methods that have emerged from disciplines of statistics and artificial intelligence and proven to be of value in recognizing patterns and making predictions from an applications perspective. Applications will be surveyed and an opportunity for hands-on experimentation with algorithms for data mining using easy-to-use software and cases will be provided.

Code	**IE525**
Name	**Advanced Statistics**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE521

Coordinator(s)	
Description:	The course describes advanced statistical methods which include the discovery and exploration of complex multivariate relationships of random variates. The course covers the following topics: generalized linear models, discriminant function analysis, time series modelling, factor analysis, correspondence analysis, multidimensional scaling, cluster analysis, tree-based methods.

Code	**IE526**
Name	**Big Data Analytics**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521, IE513
Description:	This course is an introduction to concepts of machine learning and big data analytics. The course blends methods from information retrieval, statistical data analysis, data mining, machine learning, and other big-data related fields. Students work on semester-long projects involving industry-scale data sets to solve real-world problems. Students gain ability to work with very large transactional, text, network, behavioral, and/or multimedia data sets.

Code	**IE531**
Name	**Stochastic Processes**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE521
Coordinator(s)	
Description:	This course intends to teach the students about Stochastic Processes. The course covers the following topics: Wiener process, Poisson process, nonhomogeneous and compound Poisson processes, independent increments, discrete time Markov chains, continuous time Markov chains, Kolmogorov differential equations, birth-death processes and queuing applications, non-Markovian processes, regenerative processes, ergodic theorems, semi-Markov processes, Martingales, applications to reliability and inventory control.

Code	**IE532**
Name	**Stochastic Programming**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521

Coordinator(s)	
Description:	This course is designed to teach optimization in the face of uncertainty. Specifically, it presents a thorough introduction to modeling, and computational methods of stochastic programming. The course also provides how to formulate and solve the deterministic equivalent of stochastic programming problems. The course is designed to discuss extensions to problems with probabilistic constraints, stochastic integer programs and multi-stage stochastic programs. The solution methods to those problems are also discussed such as the L-Shaped method. This course also provides stochastic decomposition and variance reduction techniques.

Code	**IE534**
Name	**Risk Modeling, Assessment, and Management**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Compulsory
Prerequisites	IE511, IE521
Coordinator(s)	
Description:	The course introduces the state of the art of risk analysis, a rapidly growing field with important applications in engineering, science, manufacturing, business, healthcare, homeland security, management, and public policy. How to quantify risk and construct probabilities for real-world decision-making problems, including a host of institutional, organizational, and political issues are discussed with real-world case studies. Sample issues to study are risk management and assessment process, decision making with single and multiple objectives, fault trees, terrorism and extreme event risk modeling.

Code	**IE542**
Name	**Decision Analysis**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	Prof.Dr. İbrahim AKGÜN
Description:	This course aims at equipping the students with the capability of engineering-based decision making. This course presents decision theory, risk and uncertainty, value of information, preference measurements, prioritization of alternatives, multiple objectives and hierarchical decisions, multi-criteria decision making, utility theory, analytic hierarchy process (AHP) and analytic network process (ANP) methodologies, and various case studies.

Code	**IE544**
Name	**Financial Engineering**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE521
Coordinator(s)	
Description:	This course focuses on comprehensive investigation of risk management techniques in finance sector. The course covers the following topics; study of the mathematical theory and financial concepts for investment, hedging, portfolio management, and asset pricing used to model and analyze financial derivatives, time value of money, fundamental concepts of arbitrage, replication and completeness, cash flows, utility theory, value at risk, mean-variance portfolio theory, martingales, Brownian motion, Geometric Brownian motion and stochastic differentials (Itô calculus), with applications to discrete and continuous time stochastic models of asset prices, option pricing, the Black-Scholes pricing model, and hedging.

Code	**IE552**
Name	**Industrial Ecology**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	The course will provide you with analytical tools and methods for implementing principles of industrial ecology. The practical applications covered in the course will be based largely on current research in the area of life cycle assessment (LCA) and life cycle design. This methodology is used for comparative analyses of alternatives including materials (biobased vs petroleum based), energy systems (renewable and fossil fuels), consumer products and packaging, automotive component designs, and residential construction methods. Life cycle design focuses on integrating environmental considerations into product design. The challenge is to meet performance, cost, legal, and cultural requirements while achieving environmental improvements.

Code	**IE554**
Name	**Sustainable Energy Systems**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521
Coordinator(s)	Dr. Muhammed SÜTÇÜ
Description:	This course provides fundamental knowledge for understanding the importance of Sustainable Energy. The course covers the following topics; **g**rand challenges in energy systems, current trends in energy demand and supply and greenhouse gas emissions; a review of incumbent technologies (fossil fuels, hydro and nuclear power generation) and renewable technologies (solar, wind, biomass, hydrogen and fuel cells); optimization applications in the above subjects.

Code	**IE556**
Name	**Operations Research in Sustainability**
Hour per week	3(3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE534, IE521
Coordinator(s)	
Description:	The course focuses on operation research methods to address problems in issues where sustainability is substantial. The course covers the following topics; forestry, mining, water resources or energy related industries such as large-scale networks of gas and electricity, renewable energy systems, organic agriculture, green chemistry, sustainable mobility, sustainable development issues such as fair trade and microfinance, and advanced systems for energy management such as smart grids; design of markets for electricity, gas, or other resources, market-based approaches for environmental issues such as emissions trading.

Code	**IE562**
Name	**Disaster/Emergency Management**
Hour per week	3(3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE534, IE521
Coordinator(s)	
Description:	This course provides a comprehensive knowledge of fundamental principles and main problems of disaster/emergency management. The course covers the following topics; processes which help to reduce disaster vulnerabilities and increase resilience at every stage of the disaster management cycle, namely, disaster mitigation, preparation, response, and recovery.

Code	**IE563**
Name	**Humanitarian Logistics**
Hour per week	3(3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521, IE534
Coordinator(s)	
Description:	The course explores how logistics management principles apply when responding to humanitarian crises and how operations research and management science tools can be used in addressing the problems in humanitarian logistics. The key issues in humanitarian logistics, e.g., forecasting, needs assessment, procurement, inventory management, transportation, warehousing, and coordination, are discussed within with case studies and how operations research and management science can address those key issues are investigated.

Code	**IE 564**
Name	**Operations Research Models in Disaster Management**
Hour per week	3(3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521
Coordinator(s)	
Description:	The course provides basic conceptual understanding of disasters, types and categories of disaster, disaster management operations. The main objective of the course is to investigate application of operation research methods to address problems in disaster operations management. The models span issues in different phases of disaster management namely mitigation, preparedness, response, and recovery. Different types of several published papers are discussed with specific emphasis on future research directions.

Code	**IE565**
Name	**Operations Research and Homeland Security**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521, IE534
Coordinator(s)	
Description:	This course introduces the state of the art in the application of operations research (OR) for homeland security. How OR techniques can be used in homeland security problems such as in preventing terrorist attacks, planning and preparing for emergencies, and responding to and recovering from disasters is discussed through several real-world

	problems. Several OR models and methods, e.g., interdiction models, game-theoretic approaches, risk and decision analysis, data mining, and optimization, are studied.

Code	**IE566**
Name	**Supply Chain Risk and Vulnerability**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521, IE534
Coordinator(s)	
Description:	The course discusses current trends affecting supply chains and offers detailed guidance on how to identify and analyze the various risks to supply chain. The course covers the following topics: published operations research and management science studies addressing supply chain disruptions.

Code	**IE567**
Name	**Critical Infrastructure Planning**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521, IE534
Coordinator(s)	
Description:	This course provides fundamental knowledge for understanding the importance of Infrastructure Planning. Sustainable and resilient critical infrastructure systems are an emerging paradigm in an evolving era of depleting assets in the midst of natural and man-made threats to provide a sustainable and high quality of life with optimized resources from social, economic, societal and environmental considerations. The course covers the following topics: recent advances in simulation, modeling, sensing, communications/ information, and intelligent and sustainable technologies that have resulted in the development of sophisticated methodologies and instruments to design, characterize, optimize, and evaluate critical infrastructure systems, their resilience, and their condition and the factors that cause their deterioration.

Code	**IE572**
Name	**Inventory Planning**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	

Description:	This course is designed to teach the context and importance of inventory management. This course includes basic economic order quantity model, quantity discounts, single item inventory models: time variant demand, stochastic demand, newsvendor model, stochastic lead times, continuous and periodic review: (s, Q), (s, S), (R, S), and (R, s, S) models, ABC inventory management, models with perishable goods, coordinated replenishment, multi-echelon inventory systems.

Code	**IE574**
Name	**Supply Chain Management**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511, IE521
Coordinator(s)	
Description:	This course introduces the fundamentals of Supply Chain Management. In the content of this course, deeply focuses on stochastic inventory models, multi-echelon inventory systems, risk pooling, value of information in supply chains, bullwhip effect, designing logistic networks, distribution strategies, centralized and decentralized control, contracts, strategic alliances.

Code	**IE576**
Name	**Scheduling**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course will introduce scheduling theory and algorithms. The course covers the following topics: theory of machine scheduling, single machine deterministic models, flow shop scheduling, job shop scheduling, stochastic scheduling, models, robust scheduling.

Code	**IE582**
Name	**The Economics of Healthcare**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE501

Coordinator(s)	
Description:	This course focuses on The Economics of Healthcare. The course covers the following topics: healthcare markets, demand, production and costs of healthcare, and supply side of healthcare; evaluation of the market: market failures, the role of the government; healthcare financing: supply, demand, and failures of healthcare insurance; evaluating value in healthcare: cost-benefit analysis and cost-effectiveness analysis, health outcome measurements.

Code	**IE584**
Name	**Operations Research in Healthcare Systems**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	This course focuses on The Operations Research in Healthcare Systems. The course covers the following topics: Review and critical assessment of the literature that involves application of operation research methods to address problems in planning, control, analysis of operations and design issues arising in all areas of health and healthcare including public health, hospitals, primary care, telemedicine, disparities, community health, disease modeling, clinical management.

Code	**IE586**
Name	**Healthcare Operations Management**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE521
Coordinator(s)	
Description:	The course addresses application domains including inpatient and outpatient services, public health networks, supply chain management, and resource constrained settings in developing countries. Specific examples or case studies illustrating the applications of operations research methods across the globe, including Africa, Australia, Belgium, Canada, the United Kingdom, and the United States are discussed.

Code	**IE588**
Name	**Operations Research and Healthcare Policy**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	The course explores how Operations Research can be used for providing solutions and insights for the many problems that health policy-makers face. The research in this field is often multi-disciplinary, being conducted by teams that include not only operations researchers but also clinicians, economists, and policy analysts. A group of papers that showcases the current state of the field of Operations Research applied to health-care policy is discussed. The course covers the following topics: classical operations research tools, such as optimization, queuing theory, and discrete event simulation, as well as statistics, epidemic models, and decision-analytic models.

Code	**IE589**
Name	**Optimization in Medicine and Biology**
Hour per week	3 (3+0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE511
Coordinator(s)	
Description:	The course explores how optimization can be used for solving complex problems in medical research. The course begins with mathematical programming techniques for medical decision-making processes and demonstrates their application to optimizing pediatric vaccine formularies, kidney paired donation, and the cost-effectiveness of HIV programs. It also presents recent advances in cancer treatment planning models and solution algorithms, including three-dimensional conventional conformal radiation therapy (3DCRT), intensity modulated radiation therapy (IMRT), tomotherapy, and proton therapy. The course also discusses computational algorithms for genomic analysis; probe design and selection, properties of probes, and various algorithms and software packages to aid in probe selection and design.

Code	**IE590**
Name	**M.Sc. Graduate Seminar**
Hour per week	1 (0 + 1)
Credit	0
ECTS	4
Level/Year	Graduate
Semester	Fall and Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	This course aims to keep the graduate students up-to-date with current research in industrial engineering, operations research, and related fields and to improve their

	skills in communicating their research. Seminars are given by the graduate students, the department faculty, and invited guest speakers on contemporary industrial engineering and operations research issues. Students register to this course in all semesters.

Code	**IE597**
Name	**M.Sc. Special Topics**
Hour per week	4 (4 + 0)
Credit	0
ECTS	10
Level/Year	Graduate
Semester	Fall and Spring
Type	Compulsory
Prerequisites	
Description:	The course aims to promote research interest in various areas of industrial engineering, operations research, and related fields. Thesis related and state-of-the art papers as well as research methods, academic and professional ethics in general are discussed. Students register to this course in all semesters starting from the beginning of their second semester.

Code	**IE599**
Name	**M.Sc. Thesis**
Hour per week	2 (0 + 2)
Credit	0
ECTS	45
Level/Year	Graduate
Semester	Fall and Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	This course provides fundamental support for research program that is compulsory for M.Sc. degree. Research program is arranged between the student and a faculty member. Students register to this course in all semesters starting from the beginning of their second semester while the research program or write-up of thesis is in progress.