Program Records

About the Program	Industrial Engineering undergraduate program educates engineers who design, operate, manage and continually improve components, processes or integrated systems including components such as human, material, information, capital, tools and energy that perform the desired function in a manner that uses scarce resources in the most efficient way and meet realistic conditions (such as economic, social, political, ethical, legal, health and safety, manufacturability and sustainability). To provide its graduates with the needed skills in productive, efficient and effective design, management and analysis of manufacturing and service organizations, the curriculum starts with fundamental mathematics and science courses in the first two semesters, which are followed by courses on topics such as operations research, decision and risk analysis, business process analysis, production planning and control, quality control and management, ergonomics, inventory management, cost management, data science, facility design and management. The program follows the project-based learning paradigm in every course through cooperation with private companies as well as governmental and nongovernmental organizations. In addition, three long-term domestic and international summer internships, analyst student programs and long-term graduation projects provide students with an intensive engineering experience before graduation and prepare them to business world. The program accepted its first students in the 2013-2014 academic year and gave its first graduates in 2018.
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	Graduate / Engineer
Length of Program & Credits	4 years (excluding one year of English Preparatory Program) 240 ECTS
Level of Qualification	First Cycle (Bachelor's) Degree; EQF-LLL Level 6, QF-EHEA Level 1
Mode of Study	Full Time
Field of Study	Engineering, Manufacturing and Construction
Admission Requirements	High school diploma; Placed by National Higher Education Exam (YKS) scores; Proof of English proficiency (TOEFL or Abdullah Gül University English Proficiency Exam) For foreign students, proof the admission requirements that are announced by the university.
Recognition of Credit Mobility	Courses taken outside of the program could be transferred in accordance with the associated principals of the Abdullah Gul University Undergraduate Education and Examination Regulation rules by the respective management board.
Graduation Requirements & Regulations	Student has to complete all courses in the program curriculum with a minimum GPA of 2.00.
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.

	Industrial Engineers are needed in all sectors of the public and industry. In addition to manufacturing sectors such as Automotive, Defense, Textile, Food; Industrial Engineers are employed in service systems such as IT, Finance, Banking, Health Services and Tourism. In the public sector; They are employed in Specialist and Engineer positions in public institutions and organizations such as Ministry of Development, Energy, Economy, Health, Central Bank, Defense Industry (ASELSAN, ASPILSAN etc.), Public Economic Institutions, and Regional Development Agencies. In addition, Industrial Engineers can work as scientists and researchers in universities, institutes, and research centers.
Access to Further Studies	Graduates may apply to second cycle (Level 7 or 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.A solid background on mathematics, natural sciences, and Industrial Engineering subjects and the skill of applying theoretical and practical knowledge in these areas to complex engineering problems.

PO2.The skill of identifying, defining, formulating, and solving real-world complex engineering problems; and the skill of selecting and implementing proper analysis and modeling methods for this purpose.

PO3.The skills of designing, developing, implementing and improving integrated systems, subsystems or a complex system/process involving human, material, information, equipment, and energy to meet specific requirements under realistic constraints and conditions.

PO4.The skill of developing, selecting, and using modern techniques and tools necessary for the analysis and solution of complex problems encountered in engineering applications; the skill of using information technologies effectively.

PO5.The skill of designing and conducting experiments, identifying and collecting necessary data, analyzing and interpreting the results of the experiments to examine complex engineering problems or research topics pertaining to Industrial Engineering.

PO6.The skill of working effectively within disciplinary/multidisciplinary teams or individually.

PO7.The skill of effective oral and written communication in Turkish and in at least one more language; the skill of writing effective reports and comprehending written reports, of preparing design and production reports, of delivering effective presentations, and of giving/taking clear and unambiguous instructions.

PO8.Awareness of the necessity of lifelong learning; the skill of accessing to information, following developments in science and technology, and updating oneself continuously.

PO9.Following ethical principles; awareness of professional and ethical responsibility; knowledge about the standards in engineering applications.

PO10.Knowledge about business practices such as project management, risk management, and change management; awareness of entrepreneurship and innovation; the skill of evaluating and

criticizing contemporary trends and of designing feasible solution plans with an innovative vision; knowledge about sustainable development.

PO11.Knowledge about the local and global impacts of engineering applications on health, environment and safety and about the contemporary engineering problems; awareness of the legal consequences of engineering solutions.

PO12.To understand from various disciplines in a range from natural and social sciences to mathematics and arts and to develop conceptual and practical interdisciplinary approaches; the skill of international and multicultural communication.

TQF-HE & Program Outcomes Coverage

	Knowledge	**Skills** Cognitive		**Competences**		
	Theoretical Conceptual	Practical	Work Independently and Take Responsibility	Learning	Communication and Social	Field Specific
PO1	*	*	*	*	*	
PO2		*	*	*	*	*
PO3	*	*	*	*		*
PO4		*	*			*
PO5	*	*	*	*	*	*
PO6			*		*	
PO7	*				*	
PO8	*		*			
PO9	*			*		
PO10	*	*	*	*	*	*
PO11	*		*		*	
PO12	*		*		*	

Institutional & Program Outcomes Coverage

	IO1	IO2	IO3	IO4	IO5	IO6	IO7
PO1	*	*			*		
PO2	*	*			*		
PO3	*	*			*		
PO4	*	*			*		
PO5	*	*			*		
PO6	*			*	*		
PO7						*	
PO8		*					*
PO9							*
PO10	*	*					
PO11	*	*					
PO12	*	*	*	*	*		

"Abdullah Gul University
Industrial Engineering Program
(*For students who start their undergraduate program in* ***Fall 2019 and later***).

FIRST YEAR/FIRST SEMESTER (FRESHMAN YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
MATH 151	Calculus I	-	5	0	5	6
PHYS 101	Physics I	-	3	2	4	5
COMP 101	Art of Computing	-	3	2	4	6
ENG 101	English I	-	4	0	4	4
GLB 101	AGU Ways	-	3	0	3	4
CHEM 101	Chemistry for Engineers	-	3	2	4	5
		Total	21	6	24	30

FIRST YEAR/SECOND SEMESTER (FRESHMAN YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
MATH152	Calculus II	MATH151	5	0	5	6
BIO101*	Biology for Engineers I	-	3	2	4	5
COMP 112	Object Oriented Programming	COMP101	3	2	4	6
ENG 102	English II	ENG101	4	0	4	4
GLB XXX	Global Issues Elective I	-	3	0	3	4
IE102	Exploring Profession	-	3	2	4	5
	Total		21	6	24	30

**BIO102 can be selected if BIO101 is not offered in that semester.*

SECOND YEAR/THIRD SEMESTER (SOPHOMORE YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
MATH 203	Linear Algebra		3	0	3	5
IE 221	Probability		3	0	3	6
IE 213	Mathematical Modeling	MATH152	3	2	4	7
ECON 222	Economics for Engineers		3	0	3	4
TURK 101	Turkish I		2	0	2	2
GLB XXX	Global Issues Elective II		3	0	3	4
	Elective (Non-technical)					1
		Total			18	29

SECOND YEAR/FOURTH SEMESTER (SOPHOMORE YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
IE 222	Statistics	IE221	4	0	4	7
IE 212	Deterministic Optimization	MATH203 IE213	4	0	4	7
IE 242	Business Process Analysis and Design		3	0	3	5
COMP 204	Database Management Systems		3	0	3	6
TURK 102	Turkish II		2	0	2	2
GLB XXX	Global Issues Elective III		3	0	3	4
		Total	19	0	19	31

THIRD YEAR/FIFTH SEMESTER (JUNIOR YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
IE 375	Production and Service Systems Management I	IE222 IE212	4	0	4	6
IE 325	System Simulation	IE222	3	2	4	7
IE 335	Stochastic Models	IE221	3	0	3	5
IE 346	Engineering Economics and Cost Analysis		3	0	3	5
HIST 201	History of Modern Turkey I		2	0	2	2
GLB XXX	Global Issues Elective IV		3	0	3	4
		Total	18	2	19	29

THIRD YEAR/SIXTH SEMESTER (JUNIOR YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
IE 376	Production and Service Systems Management II	IE375	4	0	4	6
IE 345	Financial and Managerial Accounting		3	0	3	4
IE 380	Quality Control and Assurance	IE222	3	0	3	4
IE 326	Business Analytics	IE212 IE222	3	0	3	5
IE 395	Decision and Risk Analysis	IE221 IE212	3	0	3	5
HIST 202	History of Modern Turkey II		2	0	2	2
	Elective (Non-technical)				3	5
		Total			21	31

FOURTH YEAR (SENIOR YEAR)

YEAR LONG (TWO-SEMESTER LONG) COURSES

Code	Course	PreReq	T	P	Credits	ECTS
IE 499	Capstone Design Project	IE212, IE222, IE376	4	0	4	20

FOURTH YEAR/SEVENTH SEMESTER (SENIOR YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
OHS 401	Occupational Health and Safety I		2	0	2	1
IE 197	Summer Training I		-	-	-	4
	Elective				3	5
	Elective				3	5
	Elective (Non-technical)				3	5
		Total			11	20

FOURTH YEAR/EIGTH SEMESTER (SENIOR YEAR)

Code	Course	PreReq	T	P	Credits	ECTS
OHS 402	Occupational Health and Safety II		1	0	1	1
IE 297	Summer Training II		-	-	-	5
IE 397	Summer Training III		-	-	-	6
	Elective				3	4

	Elective (Non-technical)				3	4
			Total		7	20

Concentration Area Electives

Code	Course	T	P	Credits	ECTS
IE 348	Marketing Engineering	3	0	3	5
IE 351	Project Management	3	0	3	5
IE 353	Strategic Management	3	0	3	5
IE 355	Human Resources Management	3	0	3	5
IE 356	Organizational Behavior and Work Psychology	3	0	3	5
IE 357	International Business	3	0	3	5
IE358	Ergonomics	3	0	3	5
IE 374	Supply Chain Management	3	0	3	5
IE 391	Industry Applications I	3	0	3	5
IE 392	Industry Applications II	3	0	3	5
IE 393	Industry Applications III	3	0	3	5
IE 394	Industry Applications IV	3	0	3	5
IE 396	High-Tech Product Development I	3	0	3	5
IE 398	High-Tech Product Development II	3	0	3	5
IE 401	Mathematics for Operations Research	3	0	3	5
IE 404	Social Network Analysis	3	0	3	5
IE 412	Network Optimization	3	0	3	5
IE 414	Advanced Linear Programming	3	0	3	5
IE 415	Discrete Math	3	0	3	5
IE 416	Nonlinear Programming	3	0	3	5
IE 417	Heuristic Methods in Optimization	3	0	3	5
IE 418	Discrete Optimization	3	0	3	5
IE 422	Advanced Simulation	3	0	3	5
IE 425	System Dynamics	3	0	3	5
IE 426	Data Mining	3	0	3	5
IE 442	Operations Analysis and Design	3	0	3	5
IE 446	Supply Chain Economics	3	0	3	5
IE 448	International Marketing Tool:Turquality	3	0	3	5
IE 449	Financial Engineering	3	0	3	5
IE 454	Sustainable Energy Systems	3	0	3	5
IE 455	Green Buildings	3	0	3	5
IE 456	Operations Research in Sustainability	3	0	3	5
IE 457	Operations Research Applications in Energy Systems	3	0	3	5
IE 458	Smart Transportation Systems	3	0	3	5
IE 459	Smart Cities	3	0	3	5
IE 461	Manufacturing Processes	3	0	3	5
IE 462	Lean Manufacturing	3	0	3	5
IE 463	Disaster and Emergency Management	3	0	3	5

IE 464	Operations Research Models in Disaster Management	3	0	3	5
IE 465	Operations Research and Homeland Security	3	0	3	5
IE 466	Vulnerability and Resilience	3	0	3	5
IE 467	Critical Infrastructure Planning	3	0	3	5
IE 472	Production Planing and Scheduling	3	0	3	5
IE 474	Humanitarian Logistics	3	0	3	5
IE 475	Facility Layout and Location	3	0	3	5
IE 476	Logistics Engineering	3	0	3	5
IE 477	Inventory Models	3	0	3	5
IE 478	Scheduling	3	0	3	5
IE 482	Economics of Healthcare	3	0	3	5
IE 484	Optimization Models in Health Care	3	0	3	5
IE 486	Healthcare Operations Management	3	0	3	5
IE 488	Healthcare Policy Analysis	3	0	3	5
IE 489	Optimization in Medicine and Biology	3	0	3	5
IE 490	Decision Support Systems	3	0	3	5
IE 494	Industry 4.0	3	0	3	5
IE 495	High-Tech Product Development III	3	0	3	5
IE 496	High-Tech Product Development IV	3	0	3	5
IE 497	Systems Analysis and Design Project I	4	0	4	10
IE 498	Systems Analysis and Design Project II	4	0	4	10

GLB Electives

(4 GLB courses must be taken)

Code	Course Name	T	P	Credits	ECTS
GLB 102	Innovation and Entrepreneurship	3	0	3	4
GLB 201	Food and Health	3	0	3	4
GLB 202	Immigration and Population	3	0	3	4
GLB 301	Sustainability	3	0	3	4

Curriculum Summary

%		Courses	Credit	ECTS
8,3	**AGU Signature Courses** GLB101, GLBXXX	5	15	20
7,5	**YÖK/HEC Courses** ENG101, ENG102, TURK101, TURK102, HIST201, HIST202, OHS401, OHS402	8	18	18
63,3	**Compulsory** XXX	26	93	172
14,58	**Non-Technical Electives** XXX	4	12	20
	Technical Electives XXX	3	9	15
6,25	**Summer Practice** XXX	3	0	15
100,0	**TOTAL**	**49**	**147**	**240**

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	IE 102
Name	Exploring Profession
Hour per week	5 (3 + 2)
Credit	4
ECTS	5
Level/Year	Undergraduate / 1
Semester	Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	Prof. Dr. İbrahim AKGÜN
Description	This course intends to promote the development of professional passion among students and provide early-on/hands-on experience through lectures, field trips, case studies, and projects. Students will have a big picture view of the engineering profession and its practical requirements. Students will learn about the various aspects of the engineering profession and acquire both technical skills and non-technical skills, in areas such as communication, teamwork, and engineering ethics. The course also supports students entering the complex social system of the university in their efforts to succeed in engineering through personal and professional development, including understanding themselves as integrated physiological, social, and psychological entities who are able to formulate strategies and employ available university resources to support their academic and personal development.

Code	IE197
Name	Summer Training I
Hour per week	
Credit	
ECTS	0 (for 2nd year) / 4 (for 4th year)
Level/Year	Undergraduate / 2 and 4
Semester	Fall / Fall
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description	This is the first of three courses designed for internship programs that industrial engineering students are to attend during their education. The students who have attended a summer internship program for the first time register for the course. The students are assessed considering internship report, presentations, and the internship program coordinator's evaluation during the semester. The students get their credits for the course in the fourth year. To enroll in the course, a student must complete at least 6-week (30-workday) program. The students will have first-hand experience to learn the business environment, relationships in the business environment, the business culture, and business processes. For detailed procedures, refer to the department's web page.

Code	IE201
Name	Developing Entrepreneurial Skills
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate

Semester	Fall
Type	Compulsory
Prerequisites	
Coordinator(s)	Prof. Dr. İbrahim AKGÜN
Description:	This course aims at equipping the students with the tools and skills that they need to go from a business idea to an established business. The students will then take that knowledge and apply it to the development, implementation and evaluation of a self-directed project with a topic of their choice in groups. At the end of the course, a competition will be held for the projects. An 'Entrepreneurship Certificate' of KOSGEB will be delivered to successful students.

Code	IE212
Name	Deterministic Optimization
Hour per week	4 (4+0)
Credit	4
ECTS	7
Level/Year	Undergraduate / 2
Semester	Spring
Type	Compulsory
Prerequisites	IE213
Coordinator(s)	Prof. Dr. İbrahim AKGÜN
Description:	This course aims at equipping the students with the capability of developing and coding algorithms to solve different types of models. The types of models are linear, network, integer, and non-linear programming models. In this regard, the solution techniques and algorithms for different types of problems, e.g., simplex, dual simplex, network simplex, branch-and-bound algorithms and decomposition techniques, are introduced. Modeling and solving real-world problems is also emphasized in this course. Homework and project assignments will enhance students' modeling and problem solving abilities in practice.

Code	IE213
Name	Mathematical Modeling
Hour per week	5(3 + 2)
Credit	4
ECTS	7
Level/Year	Undergraduate / 2
Semester	Fall
Type	Compulsory
Prerequisites	MATH151, MATH152
Coordinator(s)	Prof. Dr. İbrahim AKGÜN
Description:	The course intends to teach the students the process of mathematical modeling. Specifically, the objective is to equip the students with the capability of abstracting a real-world system/problem conceptually, formulating and building mathematical models that are appropriate for the system/problem, coding and solving a mathematical model 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. The emphasis is placed on modeling and solving the problems rather than teaching the algorithms used to solve the models.
Code	IE 221
Name	Probability
Hour per week	3 + 0 (Theory + Practice)
Credit	3
ECTS	6
Level/Year	Undergraduate / 2

Semester	Fall
Type	Compulsory
Prerequisites	
Coordinator(s)	Asst. Prof. Selçuk Gören
Description:	This course introduces the fundamentals of probability theory. The course provides short history of probability and statistics; axiomatic definition of probability; probability spaces; random variables and vectors; probability distributions; continuous/discrete/joint distributions, distribution functions, density functions, standard distributions; mean value, variance and high-order moments; independence and conditional probability; common, marginal and conditional distributions.

Code	IE 222
Name	Statistics
Hour per week	4 + 0 (Theory + Practice)
Credit	4
ECTS	7
Level/Year	Undergraduate / 2
Semester	Spring
Type	Compulsory
Prerequisites	IE221
Coordinator(s)	Asst. Prof. Selçuk Gören
Description:	This course covers quantitative analysis of uncertainty on top of IE 221-Probability. The focus is on broad treatment of applications of statistics, concentrating on techniques used in industry and science. Topics include descriptive statistics, parameter estimation, confidence intervals, hypothesis testing, analysis of variance, and regression.

Code	IE 242
Name	Business Process Analysis and Design
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 2
Semester	Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	Asst. Prof. Muhammed Sütçü
Description:	This course provides an introduction to key concepts and approaches to business process management, design, analysis such as incremental improvement, process automation, and process redesign. The main focus of this course is both understanding and designing business processes. This course introduces fundamental concepts that can be used to systematically analyze any business process. The course covers how to identify, document, model, assess, and improve core business processes, process design principles by using sophisticated analytical techniques to design and manage efficient and effective operations and processes. The course will also include how to analyze and improve business processes in different contexts, and using different process improvement techniques and tools from simple process-mapping to computer-based process-modeling using Signavio and Microsoft Office Visio.
Code	IE297
Name	Summer Training II
Hour per week	
Credit	
ECTS	0 (for 3rd year) / 5 (for 4th year)
Level/Year	Undergraduate / 3 and 4

Semester	Fall and Spring
Type	Compulsory
Prerequisites	IE197
Coordinator(s)	
Description:	This is the second of three courses designed for internship programs that industrial engineering students are to attend during their education. The students who have attended a summer internship program for the second time register for the course. The students are assessed considering internship report, presentations, and the internship program coordinator's evaluation during the semester. The students get their credits for the course in the spring semester of the fourth year. To enroll in the course, a student must complete at least 8-week (40-workday) program. The students will have first-hand experience to learn the business environment, relationships in the business environment, the business culture, and business processes. For detailed procedures, refer to the department's web page.

Code	IE325
Name	System Simulation
Hour per week	5 (3 + 2)
Credit	4
ECTS	7
Level/Year	Undergraduate / 3
Semester	Fall
Type	Compulsory
Prerequisites	IE221, IE222
Coordinator(s)	Asst. Prof. Selçuk Gören
Description:	This is an introductory course in computer simulation, which covers the use of simulation as a decision-making, comparison, or estimation tool. The emphasis is on basic concepts and methods in developing discrete-event simulation models for stochastic and dynamic systems and on how to analyze and interpret the results of simulation experiments. The students will also learn how to use ARENA simulation software.

Code	IE326
Name	Business Analytics
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	IE221, IE222
Coordinator(s)	Asst. Prof. Selçuk Gören
Description:	This course intends to teach the students the scientific process of transforming data into insight for making better decisions. This course covers essential analytic methods in descriptive, predictive and prescriptive business analytics, and can be thought of as a confluence of statistics, operations research, data mining, and machine learning. The course will include fundamental classification, clustering algorithms and reinforcement learning.

Code	IE 335
Name	Stochastic Models
Hour per week	3 + 0 (Theory + Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall

Type	Compulsory
Prerequisites	IE 221
Coordinator(s)	Asst. Prof. Muhammed Sütçü
Description:	This course provides a comprehensive knowledge about stochastic processes and models. The course covers the following topics: Markov chains in discrete and continuous cases, the Poisson processes and exponential distribution, and queuing theory.

Code	IE345
Name	Financial and Managerial Accounting
Hour per week	3 (3+0)
Credit	3
ECTS	4
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	
Coordinator(s)	
Description:	This course provides fundamental knowledge and skills for accounting. The course covers the following topics: Financial reporting process, accounting information system and the use of accounting data for decision making and control. Understanding the financial statements of an organization, especially the Income Statement and the Balance Sheet and analyzing the financial performance of companies and making managerial decisions using accounting information are a crucial part of the course.

Code	IE 346
Name	Engineering Economics and Cost Analysis
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall
Type	Compulsory
Prerequisites	
Coordinator(s)	Asst. Prof. Muhammed Sütçü
Description:	This course aims at equipping students with the capability of understanding of the principles, basic concepts, and methodology of the study of economics and engineering economic analysis. These principles and techniques can be used in feasibility studies, decision making during design, and equipment selection and replacement analysis. This course will include how to apply standard time-value equivalence formulas to convert cash flows from different time points into comparable quantities and according to the risk that will arise in spite of the desired rate of return, the ability to set up a most appropriate portfolio of simple assets develops.

Code	IE 348
Name	Marketing Engineering
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222

Coordinator(s)	
Description:	This course intends to provide systematic processes of marketing information and experience to practical use through decision making tools. Customer value assessment, Segmentation and targeting, positioning, forecasting, new Product and service design, and Marketing mix are the models and methods which introduced throughout the semester.

Code	IE 351
Name	Project Management
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222
Coordinator(s)	
Description:	This course is an introduction to project management concepts and tools which include planning, scheduling, controlling, resource allocation, and performance measurement activities. The course provides risk analysis approach for identifying risks on budget, planning, scheduling and performance standards, and it covers risk mitigation strategies to avoid identified risks.

Code	IE 353
Name	Strategic Management
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222
Coordinator(s)	
Description:	This course offers a general overview of the planning process of business strategies. Topics include concepts of corporate strategy, the decision-making process, formulation of strategy, strategic thinking, and the formation, implementation and evaluation of strategy.

Code	IE 355
Name	Human Resources Management
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course provides students with the daily tools and skills they need to function as successful managers in both human resources and business in general. The course includes the following topics: role of a manager in strategic human resources management, job analysis, personnel planning and recruiting, performance management, ethics, justice, and fair treatment in HR Management.

Code	IE 356
Name	Organizational Behavior and Work Psychology
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course aims at giving insights to manage the behaviour of employees, teams, and groups in order to reach sustainable competitive advantage. The course includes the following topics: Attitudes and Job Satisfaction, Personality and Values, Perception and Individual decision making, foundations of group behaviour, leadership, power and politics, conflict and negotiation, stress management.

Code	IE 357
Name	International Business
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	The course provides management functions in international business. The course includes the following topics: global marketplaces, and business centres, international trade and investment, international monetary system and balance of payments, foreign exchange and international financial markets, formulation and national trade policies, international cooperation, strategic alliances, international marketing and operations management.

Code	IE 358
Name	Ergonomics
Hour per week	3 + 0
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	The course provides ergonomic theory and techniques used to maximize the design of tools, tasks and workplaces for greater comfort, safety and performance of the workforce. The techniques cover both the physical and psychosocial aspects of a workplace design, following relevant guidance and approaches to assess and mitigate risks.

Code	IE374

Name	Supply Chain Management
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall or Spring
Type	Elective
Prerequisites	IE221, IE222, IE212, IE213
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	This course introduces concepts and terminology of logistics and supply chain management. The course will include the following topics: Examination of components of logistics and supply chain systems, analysis of interactions and trade-offs among these components, logistics network configuration, risk pooling and multi-echelon inventory systems, value of information in supply chains, coordination of the supply chain using contracts and other mechanisms, distribution strategies for the supply chain and product design for supply chain efficiency.

Code	IE 375
Name	Production and Service Systems Management, I
Hour per week	4 + 0 (Theory + Practice)
Credit	4
ECTS	6
Level/Year	Undergraduate / 3
Semester	Fall
Type	Compulsory
Prerequisites	IE221, IE222, IE213, IE212
Coordinator(s)	Asst. Prof. Muhammed Sütçü
Description:	This course intends to strengthen the student's management skills by applying the technical and theoretical IE and OR materials provide throughout the curriculum to both production and service delivery systems. The course covers will include fundamental concepts of facility location and layout, quantitative methods used in production and service systems problems, demand-forecasting models using time series methods.

Code	IE 376
Name	Production and Service Systems Management II
Hour per week	4 + 0 (Theory + Practice)
Credit	4
ECTS	6
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	IE221, IE222, IE213, IE212, IE 375
Coordinator(s)	Asst. Prof. Muhammed Sütçü
Description:	This course, as a continuation of IE375, provides analytical skills and managerial insights necessary to analyze a firm's operations decisions and practices. The course covers will include fundamental concepts of scheduling and sequencing of the jobs, project management and supply chain management.

Code	IE 380
Name	Quality Control and Assurance
Hour per week	3 (3 + 0)
Credit	3
ECTS	4
Level/Year	Undergraduate / 3
Semester	Spring
Type	Compulsory
Prerequisites	IE 221, IE222
Coordinator(s)	Asst. Prof. Selçuk Gören
Description:	This course intends to teach the students the quality principles and related concepts that the student can use for quality evaluation and quality improvement in business environment. The course covers the following topics: what quality is and the methods to improve quality through design and control, principles and techniques used to evaluate both continuous and attribute data and enhances skills in computer software that are used in quality assurance activities and data analysis.

Code	IE391
Name	Industry Applications I
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall
Type	Elective
Prerequisites	IE221, IE213, IE212, IE222
Coordinator(s)	
Description:	This is the first course of a series of four courses designed to improve university-industry collaboration and to enable the students to gain experience in solving real problems of organizations. The students are expected to conduct research to solve a real-world problem in groups under the supervision of the instructor and in collaboration with the experts from the industry. In this context, the students survey papers related to the problem, visit the organization to analyze the problem and collect data, construct conceptual and analytical models to solve the problem, develop solution methodologies for the proposed models, and apply the models to the problem.

Code	IE392
Name	Industry Applications II
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Spring
Type	Elective
Prerequisites	IE221, IE213, IE212, IE222, IE325
Coordinator(s)	
Description:	This is the second course of a series of four courses designed to improve university-industry collaboration and to enable the students to gain experience in solving real problems of organizations. The students are expected to conduct research to solve a real-world problem in groups under the supervision of the instructor and in collaboration with the experts from the industry. In this context, the students survey papers related to the problem, visit the organization to analyze the problem and collect data, construct conceptual and analytical models

	to solve the problem, develop solution methodologies for the proposed models, and apply the models to the problem.

Code	IE393
Name	Industry Applications III
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall
Type	Elective
Prerequisites	IE221, IE213, IE212, IE222, IE325
Coordinator(s)	
Description:	This is the third course of a series of four courses designed to improve university-industry collaboration and to enable the students to gain experience in solving real problems of organizations. The students are expected to conduct research to solve a real-world problem in groups under the supervision of the instructor and in collaboration with the experts from the industry. In this context, the students review papers related to the problem, visit the organization to analyze the problem and collect data, construct conceptual and analytical models to solve the problem, develop solution methodologies for the proposed models, and apply the models to the problem.

Code	IE394
Name	Industry Applications IV
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Elective
Prerequisites	IE221, IE213, IE212, IE222, IE325
Coordinator(s)	
Description:	This is the fourth course of a series of four courses designed to improve university-industry collaboration and to enable the students to gain experience in solving real problems of organizations. The students are expected to conduct research to solve a real-world problem in groups under the supervision of the instructor and in collaboration with the experts from the industry. In this context, the students survey papers related to the problem, visit the organization to analyze the problem and collect data, construct conceptual and analytical models to solve the problem, develop solution methodologies for the proposed models, and apply the models to the problem.

Code	IE395
Name	Decision and Risk Analysis
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall
Type	Compulsory
Prerequisites	IE221, IE222, IE212, IE213
Coordinator(s)	Prof. Dr. İbrahim Akgün

Description:	This course provides students with fundamental knowledge and skills for decision and risk analysis. The course is mainly divided into three parts, general introduction to decision analysis, multi-criteria decision analysis, and multi-objective optimization. In the first part, the merits of a structured rational decision-making process are emphasized. In the second part, the structuring of decision elements (values, objectives, alternatives, measures, tradeoffs, and uncertainty), multi-attribute utility theory (MAUT), analytic hierarchy process (AHP), and decision tree under certainty/uncertainty are introduced. In the third part, multi-objective optimization and goal programming are discussed.

Code	IE396
Name	High-Tech Product Development I
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Fall
Type	Elective
Prerequisites	
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	This is the first course of a series of four courses designed to develop multidisciplinary and collaborative product developments skills that are essential for high technology involved in complex products. The students will learn and practice the following areas in the course: Computer Aided Design, Product Lifecycle Management, Bill of Material Management (eBOM, mBOM), Change Management, Requirements Management, Systems Engineering, Functional & Logical Systems Modeling, Electronic Control Systems & Drone Avionics, Virtual Reality with 3D Digital Twin, Product Flow and Process Planning, Factory and Manufacturing Line Layout, Workforce & Resource Planning, Optimizing Product Flow Routings, and Digital Continuity.

Code	IE397
Name	Summer Training III
Hour per week	
Credit	
ECTS	0 (for 4th year Fall Semester) / 6 (for 4th year Spring Semester)
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Compulsory
Prerequisites	IE297
Coordinator(s)	
Description:	This is the last of three courses designed for internship programs that industrial engineering students are to attend during their education. The students who have attended a summer internship program for the third time register for the course. The students are assessed considering internship report, presentations, and the internship program coordinator's evaluation during the semester. The students get their credits for the course in the spring semester of the fourth year. To enroll in the course, a student must complete at least 8-week (40-workday) program. The students will have first-hand experience to learn the business environment, relationships in the business environment, the business culture, and business processes. For detailed procedures, refer to the department's web page.

Code	IE398

Name	High-Tech Product Development II
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 3
Semester	Spring
Type	Elective
Prerequisites	IE396
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	This is the second course of a series of four courses designed to develop multidisciplinary and collaborative product developments skills that are essential for high technology involved in complex products. The students will learn and practice the following areas in the course: Computer Aided Design, Product Lifecycle Management, Bill of Material Management (eBOM, mBOM), Change Management, Requirements Management, Systems Engineering, Functional & Logical Systems Modeling, Electronic Control Systems & Drone Avionics, Virtual Reality with 3D Digital Twin, Product Flow and Process Planning, Factory and Manufacturing Line Layout, Workforce & Resource Planning, Optimizing Product Flow Routings, and Digital Continuity.

Code	IE 404
Name	Social Network Analysis
Hour per week	3 + 0
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	The course describes fundamental network concepts, provides an understanding of the role networks play in business and other aspects of our lives, and presents tools for analyzing networks. Both mathematical and social science perspectives are utilized with the general purpose of equipping the students with the necessary skill set to conduct successful network analysis projects. Although the main focus is on social networks, most notions discussed in the course are also relevant for other types of networks. Balanced emphases will be placed on theories behind network science and real-world applications. The real-world applications covered in this course mostly concern community detection, diffusion on networks, and machine learning on networks.
Code	IE412
Name	Network Optimization
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212
Coordinator(s)	
Description:	The course provides students with an integrated view of the theory, algorithms and the applications of key network optimization problems in telecommunication, logistics, social and computer networks. The course will include network optimization problems including the shortest path problem, the maximum flow problem, the minimum cost flow problem, assignment and

	travelling salesperson problems will be presented. The course also concentrates on solution methodologies such as network simplex algorithm, Lagrange relaxation, column generation and other decomposition methods.

Code	IE413
Name	Computational Methods for Industrial Engineering
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212
Coordinator(s)	
Description:	This course builds on the concepts and skills learned in courses, IE213 and IE212. Through a combination of instructor-led presentations and lab exercises, students learn the concepts, architecture, components, processes, and procedures necessary to build optimization algorithms. Students also learn how to test and debug models and integrate them into a larger application. Topics covered in this course include working with CPLEX API and Optimization Programming Language (OPL) to write mathematical programming and constraint programming models, linking to spreadsheets and databases, integration with other applications, flow control with IBM ILOG Script, and performance tuning.

Code	IE414
Name	Advanced Linear Programming
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, MATH203
Coordinator(s)	
Description:	This course intends to teach the students further concepts, theories, and algorithms than basic linear programming. The course begins by quickly refreshing the students' minds about the simplex method, duality theory and sensitivity analysis. Then, the course covers the following topics: advanced sensitivity analysis, variants of simplex method such as the dual simplex, revised simplex, simplex method with bounds, transportation simplex, network simplex algorithms, sparse matrix techniques, basis factorization and update, interior point methods such as Karmarkar's projective algorithms, or the ellipsoidal method, barrier methods, Dantzig-Wolfe decomposition, and delayed column generation.

Code	IE415
Name	Discrete Optimization
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4

Semester	Fall or Spring
Type	Elective
Prerequisites	IE 212, IE 213, or the consent of the instructor
Coordinator(s)	Asst. Prof. Selçuk Gören
Description:	This course provides fundamental knowledge and skills for concepts, theories, and algorithms of integer and combinatorial optimization. The course covers the following topics: modeling, comparison of alternative formulations, computational complexity, polyhedral theory, valid inequalities, cutting-plane algorithms, enumerative algorithms such as dynamic programming, branch-and-bound, branch-and-cut, heuristic algorithms and techniques to handle large problems such as Benders' decomposition and delayed column generation (and branch-and-price). Applications include graphs, networks, transportation, and scheduling.

Code	IE416
Name	Nonlinear Programming
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213
Coordinator(s)	
Description:	This course focuses on concepts algorithms and applications of constrained and unconstrained nonlinear programs. The course will include the fundamentals and the theoretical aspects such as convex sets and functions, necessary and sufficient optimality conditions, constraint qualifications, duality theory, Lagrange multipliers, and basic iterative methods such as Newton and Gauss-Newton methods, and gradient projections. The emphasis is on some selected applications from engineering, natural sciences, and statistics.

Code	IE417
Name	Heuristic Methods in Optimization
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 213, IE 212
Coordinator(s)	
Description:	This course focuses on heuristics methods that seek a fine, but not necessarily optimal solution in a reasonable amount of time. This course introduces a wide range of heuristic methods (greedy heuristics, improvement heuristics constructive heuristics, metaheuristics: simulated annealing, tabu search, genetic algorithms, ant colony optimization), emphasizing their generic characteristics and limitations, and the types of problems to which they are best adapted.

Code	IE418
Name	Discrete Mathematics
Hour per week	3 (3 + 0)
Credit	3

ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course aims at preparing students for a background in abstraction, notation, and critical thinking for the mathematics most directly related to optimization and computer science. The course covers the following topics: logic, relations, functions, basic set theory, countability and counting arguments, mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory, graph theory, and mathematical proof techniques.

Code	IE422
Name	Advanced Simulation
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE325
Coordinator(s)	
Description:	This course continues the material presented in IE 325 and focuses on the analysis of the statistical nature of simulation. The course will include modelling complex systems, verification, interpreting output and approaches for minimizing model run time. Probability distributions are examined for appropriateness and data fitting. Determining run length with appropriateness and confidence intervals are used to describe the output.

Code	IE425
Name	System Dynamics
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE325
Coordinator(s)	
Description:	This course introduces systems thinking and system dynamics modelling applied to strategy, organizational change, and policy design. Students study application cases including business cycles, the use and reliability of forecasts, the design of supply chains, service quality management, project management and product development, the dynamics of infectious diseases.

Code	IE426
Name	Data Mining
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4

Semester	Fall or Spring
Type	Elective
Prerequisites	IE221, IE222, IE213, IE212
Coordinator(s)	
Description:	The course introduces basic data and data mining concepts. This course is designed to teach data pre-processing; handling missing values, basic data transformations, rule induction; decision trees, naive Bayesian probability and neural networks, classification analysis; rule-based, nearest-neighbour and Bayesian classifiers, support vector machines, association analysis; rule generation, cluster analysis; center-based, hierarchical, density-based, and fuzzy clustering, cluster validation, anomaly detection.

Code	IE432
Name	Stochastic Programming
Hour per week	3 + 0 (Theory + Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 213, IE 221
Coordinator(s)	
Description:	This course is designed to teach optimization in the face of uncertainty. This course provides theory of stochastic programming, expected value of stochastic programming, applications of stochastic programming, two-stage stochastic linear programs, multi-stage stochastic linear programs, L-shaped algorithm, and stochastic decomposition.

Code	IE442
Name	Operations Analysis and Design
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE242, IE375, IE376
Coordinator(s)	
Description:	The course introduces traditional industrial engineering. This course is designed to teach concepts and functions in the design, improvement, and analysis of man - machine systems mainly in the context of a manufacturing environment, design and improvement of manufacturing systems such as cost reduction, process efficiency, time study, work measurement, material handling systems, and layout design.

Code	IE446
Name	Supply Chain Economics
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE374

Coordinator(s)	
Description:	This course brings an economics perspective to complex decision-making in the management of supply chains. The course introduces models that handle both competition and cooperation and provide the resulting product flows and prices in the chains. After an introduction of the theoretical foundations, the course extends relationships between electric power supply chains and transportation networks through theoretical results and the solution of practical examples. The course explores environmental supply chain and financial networks with intermediation, which are interpreted as supply chains and also solved as such.

Code	IE448
Name	International Marketing Tool: Turquality
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222
Coordinator(s)	
Description:	This course aims at providing the students with detailed information about Turquality, the first state-sponsored branding program of the world, designed to increase Turkey's exports by developing strong global brands. The course will include research and advertising, distribution and production activities, determining the aims and methods of the organizations, researches on the development of international marketing programs. Students will examine international similarities and differences in marketing functions in relation to the cultural, economic, political, social and physical dimensions of the environment.

Code	IE449
Name	Financial Engineering
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 335, IE 345, IE 346
Coordinator(s)	
Description:	This course focuses on the application of financial principles and derivatives in addressing financial problems. The course will include derivatives as risk-management and securities structuring instruments, investments, financial markets, structure of interest rates, fixed-income securities, risky and risk-free assets, asset pricing models, pricing and hedging derivative securities such as forwards, futures, swaps, and options, mean-variance analysis of portfolios, and value at risk.

Code	IE454
Name	Sustainable Energy Systems
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4

Semester	Fall or Spring
Type	Elective
Prerequisites	IE221, IE222, IE212, IE213
Coordinator(s)	Asst. Prof. Muhammed Sütçü
Description:	This course intends to teach the students current and potential future energy systems, covering resources, extraction, conversion, and end-use technologies, with emphasis on meeting regional and global energy needs in the 21st century in a sustainable manner. Various renewable and conventional energy production technologies, energy end-use practices and alternatives, and consumption practices in different countries will be examined. The course will include a quantitative framework to aid in evaluation and analysis of energy technology system proposals in the context of engineering, political, social, economic, and environmental goals.

Code	IE455
Name	Green Buildings
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course focuses on the ecological structures and understanding the environmental, economic and social benefits of ecological structures. This course provides identification, implementation and evaluation of ecological building metrics. Ecological building operations are analyzed by value chain. Moreover, the viability of ecological building possibilities are analyzed using quantitative models and techniques.

Code	IE456
Name	Operations Research in Sustainability
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222, IE325
Coordinator(s)	
Description:	This course intends to teach the students the application of operation research methods to address problems in planning and control of systems in forestry, mining, water resources or energy related industries such as large-scale networks of gas and electricity. Moreover, the course focuses on analysis of operations and design problems arising in renewable energy, 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	IE457
Name	Operations Research Applications in Energy Systems
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212
Coordinator(s)	
Description:	This course introduces review and critical assessment of the literature that involves application of operation research methods to address problems in sustainable energy. The course will include formulating, developing the computational implementation and finding the optimal solution of the sustainable energy problems by applying operations research methods.

Code	IE458
Name	Smart Transportation Systems
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course presents the fundamental concepts of Intelligent Transportation Systems (ITS) to students with interest in engineering, transportation systems, communication systems, vehicle technologies, transportation planning, transportation policy, and urban planning. ITS refers to information and communication technologies, as applied to transportation infrastructure and vehicles, that improve transportation safety, productivity, environment, and travel reliability.

Code	IE459
Name	Smart Cities
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221, IE222, IE325, IE326
Coordinator(s)	
Description:	This course intends to teach the students how industrial engineering and operations research techniques can be used in the development of smart systems in the context of smart cities which are places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems. The course covers some topics such as smart grid, smart transportation systems, smart buildings, cyber-physical systems, smart manufacturing systems, and smart logistics.

Code	IE 461
Name	Manufacturing Process
Hour per week	3 + 0 (Theory + Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course intends to teach the students the manufacturing processes. The course will include casting, metal forming and metal cutting with special machining operations (turning, milling, drilling, and grinding), product and process design, The course provides a comprehensive knowledge about manufacturing automation such as numerical control, CNC programming, PLC, FMS cells, industrial robots, and related software.

Code	IE462
Name	Lean Manufacturing
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE221, IE222, IE213, IE212
Coordinator(s)	
Description:	This course introduces lean manufacture principles and practice. The course will provide the student with an introduction to lean manufacture, describing the background behind its development and how evaluations and assessments of production systems are performed. Lean manufacture tools and techniques will be described and in some cases demonstrated in simulation exercises. Issues relating to employee involvement, improvement teams, training and culture will be presented. Planning for lean process implementation and the necessity of sustain improvements will be discussed. Examples of applications in manufacturing and business processes will be presented.

Code	IE463
Name	Disaster and Emergency Management
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 213, IE 212, IE 221, IE 222 and IE 325
Coordinator(s)	
Description:	This course aims at familiarizing the students with the basic principles and main problems of disaster/emergency management. Several issues with regard to four phases of disaster/emergency management, namely, mitigation, preparedness, response, and recovery, are discussed in depth. Disaster trends, hazards, risk, and

	vulnerability as well as management structures and advancements together with recent national and international initiatives around the world are addressed.

Code	IE464
Name	Operations Research Models in Disaster Management
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222, IE325
Coordinator(s)	
Description:	This course introduces basic concepts in disaster management, definitions and terminology used in disaster management, types and categories of disasters. The main objective of the course is to investigate operations research models used to solve several problems in disaster operations management. The models span issues in mitigation, preparedness, response, and recovery phases of disaster management.

Code	IE465
Name	Operations Research and Homeland Security
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221, IE222, IE325, IE326
Coordinator(s)	
Description:	This course intends to teach the students how operations research techniques can be applied to solve several problems in homeland security through several real-world cases. Homeland security deals with problems such as preventing terrorist attacks, planning and preparing for emergencies, and responding to and recovering from disasters. The course will include several OR models and methods, e.g., interdiction models, game-theoretic approaches, risk and decision analysis, data mining, and optimization, are studied.

Code	IE466
Name	Vulnerability and Resilience
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221, IE222, IE325
Coordinator(s)	
Description:	This course intends to teach the students how resilience can be introduced into a system to decrease its vulnerability considering several risk factors. Vulnerability is defined as the manifestation of the inherent states of a system that can be subjected to a natural hazard or be exploited to adversely affect that system,

	whereas resilience is defined as the ability of the system to withstand a major disruption within acceptable degradation parameters and to recover within an acceptable time, and composite costs, and risks. The course analyzes transportation systems, cyber-physical systems, computer systems, SCADA systems, and counter-terrorism systems.

Code	IE467
Name	Critical Infrastructure Planning
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221, IE222, IE325, IE326
Coordinator(s)	
Description:	This course focuses on sustainable and resilient critical infrastructure systems which are an emerging paradigm in an evolving era of depleting assets in the midst of natural and man-made threats. The course covers 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	IE 472
Name	Production Planning and Scheduling
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 375, IE 376
Coordinator(s)	
Description:	This course aims at developing both a theoretical understanding and a practical basis for working area. The course covers the following topics: Inventory control, production planning and scheduling, and demand forecasting. The course will include (i) analyze time series data, choose an appropriate forecasting model, and optimize the model; (ii) apply the concepts of sequencing and scheduling in the factory site and their personal lives.

Code	IE 474
Name	Humanitarian Logistics
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221
Coordinator(s)	
Description:	This course introduces humanitarian operations, basic concepts and terminologies used in disaster management. The main objective of the course is

	to investigate humanitarian logistics operations in disaster management cycle and location, routing, allocation and inventory problems in humanitarian logistics. Mathematical models are formulated and solution methodologies are developed for these problems.

Code	IE475
Name	Facility Layout and Location
Hour per week	3(3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE 212, IE 213, IE 221, IE375, IE376
Coordinator(s)	
Description:	This course provides fundamental knowledge and skills for facility location, facility layout, production line and material handling. The course covers the three main topics: Facility Location, Facility Layout and Production Line. Facility location focuses on location factors, location analysis with fixed costs and continuous facility location. Facility layout includes objectives, facility layout models, optimal and heuristic procedures and computerized layout planning. Production line concentrates on mass production management, single and mixed-model lines and buffer stocks design and operations. Lastly, definitions, objectives, principles, equipment selection of material handling are discussed.

Code	IE476
Name	Logistics Engineering
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate/4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221
Coordinator(s)	
Description:	This course focuses on logistics systems, reverse logistics and integrated logistics. The course also intends to teach the students facility selection, transportation decisions, vehicle routing problems, warehouse, stock policy decisions and storage systems. The course covers the following topics: Introduction to Business Logistics, Facility Location Decisions, Covering Problems, Center and Median Problems, Fixed Cost Facility Location Problems, Transportation Decisions, Vehicle Routing Problems, Inventory Policy Decisions, Storage and Handling Systems, Combined Models, Contemporary Issues (Carbon footprint, sustainability, information systems etc.).

Code	IE477
Name	Inventory Models
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/ 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213

Coordinator(s)	
Description:	This course aims to teach the students the role of the inventory management in an organization, the basic concepts of the inventory management and applying the inventory models to various areas. The course covers the following topics: the context of inventory management, basic economic order quantity model, quantity discounts, single item inventory models, time variant demand, models with perishable goods, coordinated replenishment, multi-echelon inventory systems.

Code	IE478
Name	Scheduling
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate/ 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE375
Coordinator(s)	
Description:	The course introduces the fundamentals of machine (resource) scheduling problems of manufacturing and service systems and techniques for solving these problems. The course covers the following topics: (i) machine scheduling: deterministic single machine, flow shop, and job shop scheduling, (ii) project scheduling: overview of CPM (critical path method) and PERT (project evaluation and review technique), workforce scheduling, crew scheduling.

Code	IE 482
Name	Economics of Healthcare
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course intends to teach the students investigating how different aspects of the health care system function and using mathematical models to assess the implications for different policies designed to improve that functioning. The course will include using tools and techniques to (i) master different economic techniques in the context of health care markets and (ii) learn about the specific institutional details and policies relevant to those markets.

Code	IE484
Name	Optimization Models in Health Care
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221, IE335
Coordinator(s)	

Description:	This course focuses on reviewing the literature on the applications of operations and design issues in planning, control, and analysis of problems arising in health and health care services. This course will include the utilization of different optimization techniques such as Markov decision processes, stochastic programming and dynamic programming on optimization applications in healthcare operations management including appointment and operating room scheduling, capacity planning, staff scheduling, healthcare facility location, organ allocation and transplantation, radiation therapy treatment planning, breast cancer screening, and vaccine design.

Code	IE486
Name	Healthcare Operations Management
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course aims at demonstrating the important relationship between operations research and the management of complex health care delivery organizations. The course will include the formulation of competitive strategy in operations management decision areas, including strategic planning, process design, quality control, and staff allocation. This course will be of interest to future health care delivery system managers, operations consultants, and decision-makers in organizations that support health care delivery.

Code	IE488
Name	Healthcare Policy Analysis
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	
Coordinator(s)	
Description:	This course intends to teach the students to define researchable policy questions, critically analyze policy issues and problems, and reveal relevant policy options to help decision-making process. This course aims to give the student the necessary research skills.

Code	IE489
Name	Optimization in Medicine and Biology
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212
Coordinator(s)	

Description:	The course is designed to cover a wide range of possible areas of biology and medicine. This course is designed to advance a student's ability to interpret experimental biological data and to construct primary mathematical descriptions of the phenomenon under investigation. It provides with wide comprehension of statistical nature underlying biological data together with competence to operate basic mathematical models in biology.

Code	IE490
Name	Decision Support Systems
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE213, IE212, IE221, IE222
Coordinator(s)	
Description:	The course provides essential tools and enhances skill levels of students on management information and knowledge extraction systems. The course integrates decision analysis tools such as operations research and risk analysis with the information systems, and promotes new ways to extract knowledge and management insights from this integration.

Code	IE494
Name	Industry 4.0
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall or Spring
Type	Elective
Prerequisites	IE212, IE213, IE221, IE222, IE325
Coordinator(s)	
Description:	Industry 4.0, also known as the fourth industrial revolution, is a name for the current trend of automation and data exchange in almost all sectors even though the focus is on manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing, modeling and simulation, and data analytics. The course addresses the concept and implementation of Industry 4.0 together with how industrial engineering and operations research can be useful in several areas of Industry 4.0.

Code	IE495
Name	High-Tech Product Development III
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Fall
Type	Elective
Prerequisites	IE396 and IE398
Coordinator(s)	Prof. Dr. İbrahim Akgün

Description:	This is the third course of a series of four courses designed to develop multidisciplinary and collaborative product developments skills that are essential for high technology involved in complex products. The students will learn and practice the following areas in the course: Computer Aided Design, Product Lifecycle Management, Bill of Material Management (eBOM, mBOM), Change Management, Requirements Management, Systems Engineering, Functional & Logical Systems Modeling, Electronic Control Systems & Drone Avionics, Virtual Reality with 3D Digital Twin, Product Flow and Process Planning, Factory and Manufacturing Line Layout, Workforce & Resource Planning, Optimizing Product Flow Routings, and Digital Continuity.

Code	IE496
Name	High-Tech Product Development IV
Hour per week	3 (3+0)
Credit	3
ECTS	5
Level/Year	Undergraduate / 4
Semester	Spring
Type	Elective
Prerequisites	IE396, IE39 ve IE495
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	This is the fourth course of a series of four courses designed to develop multidisciplinary and collaborative product developments skills that are essential for high technology involved in complex products. The students will learn and practice the following areas in the course: Computer Aided Design, Product Lifecycle Management, Bill of Material Management (eBOM, mBOM), Change Management, Requirements Management, Systems Engineering, Functional & Logical Systems Modeling, Electronic Control Systems & Drone Avionics, Virtual Reality with 3D Digital Twin, Product Flow and Process Planning, Factory and Manufacturing Line Layout, Workforce & Resource Planning, Optimizing Product Flow Routings, and Digital Continuity.

Code	IE497
Name	Systems Analysis and Design Project I
Hour per week	4 (4 + 0)
Credit	4
ECTS	10
Level/Year	Undergraduate / 4
Semester	Fall
Type	Compulsory
Prerequisites	IE221, IE213, IE212, IE222, IE375, IE376
Coordinator(s)	
Description:	This course is the first of two-quarter capstone sequence. The course is a good means for improving university-industry collaboration. The students will gain ability to design a complex system, process, device, or product to solve a real-world problem. In this context, the students will analyze the system, determine the problem(s) in the system, develop conceptual and mathematical models of the system, apply models to solve the problem(s), and prepare a project report. The project will be team-based and conducted to solve a real problem of an organization or a research problem under the supervision of academic and industry advisors. Students are expected to complete the problem analysis and model development phases in the first quarter.

Code	IE498

Name	Systems Analysis and Design Project II
Hour per week	4 (4 + 0)
Credit	4
ECTS	10
Level/Year	Undergraduate / 4
Semester	Spring
Type	Compulsory
Prerequisites	IE221, IE213, IE212, IE222, IE375, IE376, IE497
Coordinator(s)	
Description:	This course is the first of two-quarter capstone sequence. The course is a good means for improving university-industry collaboration. The students will gain ability to design a complex system, process, device, or product to solve a real-world problem. In this context, the students will analyze the system, determine the problem(s) in the system, develop conceptual and mathematical models of the system, apply models to solve the problem(s), and prepare a project report. The project will be team-based and conducted to solve a real problem of an organization or a research problem under the supervision of academic and industry advisors. Students are expected to apply the proposed solution methodology to solve the problem, to complete the report, and present the project to an audience in this quarter.

Code	IE 499
Name	Capstone Design Project
Hour per week	4 + 0
Credit	8
ECTS	20
Level/Year	Undergraduate / 4
Semester	Fall and Spring (one academic year)
Type	Compulsory
Prerequisites	IE221, IE213, IE212, IE222, IE375, IE376
Coordinator(s)	Prof. Dr. İbrahim Akgün
Description:	This course is a full-year course and starts in Fall semester and continues in Spring semester. The course is a good means for improving university-industry collaboration. The students will gain ability to design a complex system, process, device, or product to solve a real-world problem. In this context, the students will analyze the system, determine the problem(s) in the system, develop conceptual and mathematical models of the system, apply models to solve the problem(s), and prepare a project report. The project will be team-based and conducted to solve a real problem of an organization or a research problem under the supervision of academic and industry advisors. Students are expected to complete the problem analysis and model development phases in the first semester, and to apply the proposed solution methodology to solve the problem, to complete the report, and present the project to an audience in second semester