

Code	IE 102
Name	Exploring Profession
Hour per week	4 (3 Theory + 1 Practice)
Credit	4
ECTS	4
Level/Year	Undergraduate / 1 <sup>st</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	-
Description	IE 102 is designed 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 nontechnical 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. This course also provides a compressive knowledge about the philosophy of the ethics, different types of ethics (normative theories of ethics, anthropocentrism, relativism, monism, post modernism, etc.) and code of ethics.

### **COURSE RECORD**

Code	IE 201
Name	Probability
Hour per week	4 (4Theory + 0 Practice)
Credit	4
ECTS	6
Level/Year	Undergraduate/2 <sup>nd</sup> year
Semester	Fall
Туре	Compulsory
Prerequisites	MATH 101
Description	IE 201 is an introductory course to the concept of probability. Axioms of probability, fundamentals of probability, sample space, conditional probability, the most used discrete and continuous probability distributions, moment generating functions, and central limit theorem, joint probability distributions subjects will be delivered to the class.

Code	IE 202
Name	Statistics
Hour per week	4 (2 Theory + 2 Practice)
Credit	4
ECTS	6



Level/Year	Undergraduate/2 <sup>nd</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	IE 201
Description	This course introduces summarizing data and using data to make numerical conjectures to students. 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 linear regression. The course includes computer implementations using available up-to-date statistical software.

Code	IE 211
Name	Mathematical Modelling
Hour per week	5 (3 Theory + 2 Practice)
Credit	4
ECTS	7
Level/Year	Undergraduate / 2 <sup>nd</sup> year
Semester	Fall
Туре	Compulsory
Prerequisites	MATH 101
Description	Being able to solve the real-life problems and obtaining the right solution requires understanding and modeling the problem correctly and applying appropriate optimization tools and skills to solve the mathematical model. This course will focus on how to formulate, analyze, and solve mathematical models that represent real-world problems. In this course, how to use optimization software for solving optimization problems will be discussed. In particular, this course will cover linear programming, nonlinear programming, problem definition and formulation, sensitivity analysis, network optimization, integer linear programming, big-M method, and integrality property.

Code	IE 212
Name	Deterministic Optimization
Hour per week	4 (4Theory + 0 Practice)
Credit	4
ECTS	7
Level/Year	Undergraduate/2 <sup>nd</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	IE 211, MATH 203
Description	This course is a continuation of the course IE211 Mathematical Modeling in which the process of mathematical modeling, the development of models, and the coding and solution of the models by off-the-shelf software are emphasized. In this course, 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 are also emphasized in this course. Homework and project assignments will enhance students' modeling and problem-solving abilities in practice



Code	IE 242
Name	Business Process Analysis and Design
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/2 <sup>nd</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	-
Description	Business process management, design, analysis such as incremental improvement, process automation, and process redesign are the key concepts and approaches for all systems. 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.

### **COURSE RECORD**

Code	IE 298
Name	Summer Practice I
Hour per week	2 (0 Theory + 2 Practice)
Credit	1
ECTS	5
Level/Year	Undergraduate / 3 <sup>rd</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	A student who wants to enroll for the course must have studied at least six
	semesters in the Industrial Engineering (IE) undergraduate program, besides
	workplace of the internship must be approved by the IE department.
Description	This is the first of two 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. During the internship program, the students will have first-hand
	experience to learn the business environment, relationships in the business
	environment, the business culture, and business processes. The students are
	assessed considering internship report, presentations, and the internship
	program coordinator's evaluation during the semester. To enroll in the course
	and get ECTS credits, a student must complete at least 6-week (30-workday)
	program. For detailed procedures, refer to the IE department's web page.

Code	IE326
Name	Business Analytics
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	6
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall/Spring
Туре	Elective
Prerequisites	IE 202, IE 212



Description	INFORMS (The Institute for Operations Research and the Management
	Sciences) define business analytics as the scientific process of transforming
	data into insight for making better decisions. This course introduces 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. This course will emphasize
	machine learning Machine learning uses interdisciplinary techniques such as
	statistics linear algebra ontimization and computer science to create
	sutarities, mean algebra, optimization, and computer science to create
	make predictions or designs without human intervention. Machine learning
	nake predictions of decisions without numan intervention. Machine learning
	as a neiro is now increationy per vasive, with applications spanning noin business
	intelligence to nomeland security, from analyzing biochemical interactions to
	structural monitoring of aging bridges, and from emissions to astrophysics, etc.
	This class will familiarize students with a broad cross-section of models and
	algorithms for machine learning and prepare students for research or industry
	application of machine learning techniques. The course includes computer
	implementations using available up-to-date software and programming
	languages.

Code	IE 345
Name	Financial and Managerial Accounting
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall/Spring
Туре	Elective
Prerequisites	-
Description	Basic accounting knowledge is very crucial for the engineers which covers the financial reporting process, accounting information system, and the use of accounting data for decision making and control. Students will learn to understand the financial statements of an organization, especially the Income Statement and the Balance Sheet. Moreover, they will learn how to analyze and explain the financial performance of a company and to make managerial decisions using accounting information.

Code	IE 346
Name	Engineering Economics and Cost Analysis
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall
Туре	Compulsory
Prerequisites	-
Description	The fundamentals of engineering economy are very crucial for the engineers. The contents include basic concepts such as Cost Estimation Techniques, Price Changes and Exchange Rates, The Time Value of the Money, Project Evaluation and Selection among Alternatives, Evaluation Projects with the Benefit-Cost



Ratio Method, Probabilistic Risk Analysis, Replacement Analysis, Breakeven
and Sensitivity Analysis.

Code	IE 351
Name	Project Management
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall/Spring
Туре	Elective
Prerequisites	-
Description	This course provides students an overview of project management, focusing on project initiation and control. A discussion of the different types of projects, the project life cycle as well as the intricacies of defining and monitoring project resources, cost, scope and schedule through work breakdown structures, the precedence diagramming method and earned value analysis among other tools is included. Popular project management software will also be introduced. Concepts are reinforced by case studies covering a wide variety of project types and industries.

### **COURSE RECORD**

Code	IE 374
Name	Supply Chain Management
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall / Spring
Туре	Elective
Prerequisites	-
Description	This course introduces concepts and terminology of logistics and supply chain management, 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 (4 Theory + 0 Practice)
Credit	4
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall
Туре	Compulsory
Prerequisites	IE 211



Description	This course will focus on the design of production and service systems using
	mathematical, computational, and other modern analytical techniques. In
	particular, this course will cover forecasting, sales and operations planning,
	deterministic and stochastic inventory and lot-sizing models and supply chain
	management.
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Code	IE 376
Name	Production and Service Systems Management II
Hour per week	4 (4 Theory + 0 Practice)
Credit	4
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	IE 375
Description	This course will focus on the role of computers and data bases in production and service systems. In particular, this course will cover fundamental concepts in developing integrated production management systems including ERP, MPS, MRP, JIT and operations scheduling with emphasis on inventory, lead time, work-order management. Lastly, designing and locating new facilities is also emphasized in this course.

# **COURSE RECORD**

Code	IF 380
Name	Quality Control and Assurance
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall/Spring
Туре	Elective
Prerequisites	IE 202
Description	Provides students the opportunity to apply their theoretical background in optimization and statistics to quality management/improvement applications. Statistical process control, design of experiments, and acceptance sampling methodology are the three pillars of the course. To improve product and service quality, the course heavily focuses on these techniques and the applications of statistical control techniques in real-life.

Code	IE 395
Name	Decision and Risk Analysis
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/3 <sup>rd</sup> year
Semester	Fall/Spring
Туре	Elective
Prerequisites	IE 201, IE 212



Description	Provides students with fundamental knowledge and skills for decision and risk analysis. The course is divided into three parts: introduction to decision analysis, multi-criteria decision analysis, and multi-objective optimization. The structured rational decision-making process is emphasized in the first part. In the second part, multi-attribute utility theory, analytic hierarchy process, and decision tree are introduced. In the third part, multi-objective optimization and
	goal programming are discussed.

Code	IE 398
Name	Summer Practice II
Hour per week	2 (0 Theory + 2 Practice)
Credit	1
ECTS	5
Level/Year	Undergraduate /3 <sup>rd</sup> year
Semester	Spring
Туре	Compulsory
Prerequisites	A student who wants to enroll for the course must have studied at least five
	semesters in the Industrial Engineering (IE) undergraduate program, besides
	workplace of the internship must be approved by the IE department.
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. During the internship program, the students will have
	first-hand experience to learn the business environment, relationships in the
	business environment, the business culture, and business processes. The
	students are assessed considering internship report, presentations, and the
	internship program coordinator's evaluation during the semester. The
	students get their ECTS credits for the course in the fourth year. To enroll in
	the course and get ECTS credits, a student must complete at least 6-week (30-
	workday) program. For detailed procedures, refer to the IE department's web
	page.

Code	IE 400
Name	Workplace Experience
Hour per week	1 (0 Theory + 2 Practice)
Credit	1
ECTS	20
Level/Year	Undergraduate / 4 <sup>th</sup> year
Semester	Spring
Туре	Elective
Prerequisites	IE 497
Description	This course is designed for the experience program that industrial engineering students will attend during their final semester. During this extended workplace program, students will gain extensive hands-on experience in a professional environment. They will learn in-depth about business operations, workplace relationships, corporate culture, and advanced business processes. The course aims to bridge the gap between academic knowledge and real-



world application by immersing students in the industry for an extended period.

Throughout the semester, students will design and optimize complex systems, processes, or products within the company or institution, using advanced industrial engineering tools and techniques. They will continuously validate their designs and align them with the organization's needs and objectives. They are responsible for delivering the designed project to the organization as an application that addresses the relevant real-world problem at hand.

#### **COURSE RECORD**

Code	IE 402
Name	Discrete Mathematics
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Fall / Spring
Туре	Elective
Prerequisites	-
Description	This course introduces students to ideas and techniques from discrete mathematics that are widely used in science and engineering. The goal is to teach the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn logic and proof, sets, functions, as well as algorithms and mathematical reasoning. Key topics involving relations, counting, and graphs are covered in this course.

#### **COURSE RECORD**

Code	IE 415
Name	Discrete Optimization
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Fall / Spring
Туре	Elective
Prerequisites	IE 212
Description	This course introduces concepts, theories, and algorithms of integer and combinatorial optimization. Topics include 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	IE 416
Name	Non-Linear Programming
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5



Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Fall /Spring
Туре	Elective
Prerequisites	IE 212
Description	Nonlinear programming is used in a variety of applications, ranging from machine learning and data science to finance and engineering. This course introduces nonlinear programming and covers modelling techniques as well as solution algorithms. This course includes nonlinear optimization problems and their formulations, unconstrained optimization and limited optimization, gradient methods, projection methods, the characteristics of the optimal solutions, sufficient and necessary conditions for optimality, duality and semidefinite programming.

Code	IE 417
Name	Heuristic Methods in Optimization
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Fall / Spring
Туре	Elective
Prerequisites	IE 212
Description	Heuristics are methods that seek a fine, but not necessarily optimal solution in a reasonable amount of time. This course will survey 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	IE 478
Name	Machine Scheduling
Hour per week	3 (3 Theory + 0 Practice)
Credit	3
ECTS	5
Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Fall
Туре	Elective
Prerequisites	IE 212
Description	This course provides students with a comprehensive overview of machine scheduling in both deterministic and stochastic systems. Throughout the course, students will explore the fundamentals of scheduling theory, delve into various types of machine scheduling, and examine practical applications in real-world scenarios. By the end of the course, students will have gained a thorough understanding of the principles and practices of machine scheduling, equipping them with the skills necessary to apply these concepts effectively in their professional careers.



Code	IE 497
Name	Capstone Design Project I
Hour per week	1 (0 Theory + 2 Practice)
Credit	1
ECTS	10
Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Fall
Туре	Compulsory
Prerequisites	160 ECTS, all pre-capstone courses (IE 202, IE 212, IE 376) must be already
	taken and at least two of them must be successful
Description	The course is a one-semester course offered in the Fall semester. The course is a
	good tool for developing university-industry collaboration. In this context,
	students will analyze a system and identify 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 conducted through
	teamwork to solve a real problem of an organization or a research problem under
	the supervision of academic and industry mentors. Students are expected to
	complete the problem analysis and model development phases, apply the
	proposed solution methodology to solve the problem, complete the report and
	present the results of the project to stakeholders.

Code	IE 498
Name	Capstone Design Project II
Hour per week	1 (0 Theory + 2 Practice)
Credit	1
ECTS	10
Level/Year	Undergraduate/4 <sup>th</sup> year
Semester	Spring
Туре	Elective
Prerequisites	IE497
Description	The course is a one-semester course offered in the Spring semester. Students are expected to gain the ability to design a complex system, process, device or product to solve a real-world problem. During this course, students are expected to complete the projects developed within the scope of IE497 to solve a real-world problem as a viable system. The development process of this system is expected to be designed in line with the needs of the organization where the projects are carried out. It is the responsibility of the students to deliver the designed project to the organization where the project is carried out as an application that can be used in the focus of the relevant real-world problem. Throughout the process, students are expected to continuously follow and confirm the validation steps with the organizational authorities.