

**COURSE RECORD**

Code	<b>IE 102</b>
Name	<b>Exploring Profession</b>
Hour per week	3
Credit	4
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	-
Description	IE102 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	<b>IE 103</b>
Name	<b>Career Planning</b>
Hour per week	1 (1 + 0)
Credit	1
ECTS	1
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	-
Description	It is recommended that the Career Planning course be taught within the framework of the draft created by the Presidential Human Resources Office, with videos and activities prepared for each week, and guest trainers to be invited from university lecturers, industry professionals, non-governmental organizations and international organizations. The supporting activities to be included in the course are designed to inform students about the methods and tools used in professional applications and to enable them to use them in the most effective way and are supported by practical activities. Career centers will follow the course in practice with activities that provide experience opportunities that will support students to develop their skills. The proposed program regarding the structure and contents of the course is presented below. The program in question may differ according to the characteristics of the universities and the departments where the students who will take the course are registered.

**COURSE RECORD**

Code	<b>IE 211</b>
Name	<b>Mathematical Modelling</b>
Hour per week	5
Credit	4
ECTS	7
Level/Year	Undergraduate

Semester	Fall
Type	Compulsory
Prerequisites	Math 152
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.

#### **COURSE RECORD**

Code	<b>IE 212</b>
Name	<b>Deterministic Optimization</b>
Hour per week	4
Credit	4
ECTS	7
Level/Year	Undergraduate
Semester	Spring
Type	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.

#### **COURSE RECORD**

Code	<b>IE 242</b>
Name	<b>Business Process Analysis and Design</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	-
Description	Business process management, design, analysis such as incremental improvement, process automation, and process redesign are the key concepts and approaches for the 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	<b>IE325</b>
Name	<b>System Simulation</b>
Hour per week	5 (3 + 2)

Credit	4
ECTS	7
Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Prerequisites	IE222
Description	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.

#### **COURSE RECORD**

Code	<b>IE326</b>
Name	<b>Business Analytics</b>
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Prerequisites	"IE221 - Probability, IE222 - Statistics, IE213 - Mathematical Modeling, IE212 - Deterministic Optimization" or the consent of the Instructor
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, optimization, and computer science to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention. Machine learning as a field is now incredibly pervasive, with applications spanning from business intelligence to homeland 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.

#### **COURSE RECORD**

Code	<b>IE 345</b>
Name	<b>Financial and Managerial Accounting</b>
Hour per week	3
Credit	3
ECTS	4
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	-
Description	Basic accounting knowledge is very crucial for the engineers which covers the financial reporting process, accounting information system, and the use of

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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.

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#### **COURSE RECORD**

Code	<b>IE 346</b>
Name	<b>Engineering Economics and Cost Analysis</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Prerequisites	-
Description	The fundamentals of engineering economy is 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.

#### **COURSE RECORD**

Code	<b>IE 351</b>
Name	<b>Project Management</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall /Spring
Type	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	<b>IE 353</b>
Name	<b>Strategic Management</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall /Spring
Type	Elective
Prerequisites	-

Description	This course provides students a broad introduction to Strategic Management and provide them with the intellectual tools required to manage business and nonbusiness organizations. This course presents the key ideas, principles and instruments, strategy and competitive analysis. The course focuses on the data, analysis, procedures, and skills used by managers to position their organizations and set up strategy in order to influence the performance, success and survival of business and nonbusiness.
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#### **COURSE RECORD**

Code	<b>IE374</b>
Name	<b>Supply Chain Management</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall
Type	Elective
Prerequisites	IE212, IE222
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.

#### **COURSE RECORD**

Code	<b>IE375</b>
Name	<b>Production and Service Systems Management-I</b>
Hour per week	4
Credit	4
ECTS	6
Level/Year	Undergraduate
Semester	Fall
Type	Compulsory
Prerequisites	IE212, IE222
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.

#### **COURSE RECORD**

Code	<b>IE376</b>
Name	<b>Production and Service Systems Management-II</b>

Hour per week	4
Credit	4
ECTS	6
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	IE375
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	<b>IE380</b>
Name	<b>Quality Control and Assurance</b>
Hour per week	3 (3 + 0)
Credit	3
ECTS	4
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	IE222
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 those methods as well as process optimization.

#### **COURSE RECORD**

Code	<b>IE395</b>
Name	<b>Decision and Risk Analysis</b>
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Spring
Type	Compulsory
Prerequisites	IE212, IE221
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.

#### **COURSE RECORD**

Code	<b>IE415</b>
Name	<b>Discrete Optimization</b>

Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall
Type	Elective
Prerequisites	IE375
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.

#### **COURSE RECORD**

Code	<b>IE418</b>
Name	<b>Discrete Mathematics</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall, Spring
Type	Elective
Prerequisites	-
Description	A course designed to prepare students for a background in abstraction, notation, and critical thinking for the mathematics most directly related to optimization and computer science. Topics include 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.

#### **COURSE RECORD**

Code	<b>IE 425</b>
Name	<b>System Dynamics</b>
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall, Spring,
Type	Elective
Prerequisites	-
Description	Introduction to 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.

#### **COURSE RECORD**

Code	<b>IE 454</b>
Name	<b>Sustainable Energy Systems</b>
Hour per week	3
Credit	3
ECTS	5

Level/Year	Undergraduate
Semester	Fall/ Spring
Type	Elective
Prerequisites	
Description	Global warming and fossil fuel depletion increasingly place the development of sustainable energy systems at the top of political agendas around the world. Major investments in new energy technologies and systems to improve energy efficiency and reduce greenhouse gas emissions will continue to grow the coming decades. To meet this challenge this course provides an introduction to current and potential future energy systems, resources, extraction, conversion, and end-use technologies, with emphasis on meeting regional and global energy needs in the 21st century in a sustainable manner.

#### **COURSE RECORD**

Code	<b>IE 461</b>
Name	<b>Manufacturing Systems</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall or Spring
Type	Elective
Prerequisites	-
Description	Flow line production systems are present in different industrial environments and are utilized to manufacture a large variety of products. Usually, several versions of a standardized product differing from each other by optional components and equipment have to be assembled jointly on assembly lines. This type of decision problems have to be solved when such production systems are installed and operated. Within the scope of this course, different solution approaches for assembly lines will be discussed. Also, different types of manufacturing systems are discussed such as lean manufacturing, cellular manufacturing etc.

#### **COURSE RECORD**

Code	<b>IE 462</b>
Name	<b>Lean Manufacturing</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall or Spring
Type	Elective
Prerequisites	-
Description	Lean manufacturing techniques, which are today's most popular manufacturing system, are very important for any manufacturing systems. The course will provide the student with an introduction to lean manufacturing, describing the background behind its development and how evaluations and assessments of production systems are performed. Lean manufacture tools and techniques will be described. Issues relating to employee involvement, improvement teams, training and culture will be presented.

#### **COURSE RECORD**

Code	<b>IE464</b>
Name	<b>Operations Research Models in Disaster Management</b>



Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall
Type	Elective
Prerequisites	IE212, IE222, IE325
Description	The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery. The course mainly investigates 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.

#### **COURSE RECORD**

Code	<b>IE474</b>
Name	<b>Humanitarian Logistics</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall
Type	Elective
Prerequisites	IE212
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.

#### **COURSE RECORD**

Code	<b>IE 475</b>
Name	<b>Facility Layout and Location</b>
Hour per week	3 (3 + 0)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall, Spring,
Type	Elective
Prerequisites	-
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.

#### **COURSE RECORD**

Code	<b>IE494</b>
Name	<b>Industry 4.0</b>

Hour per week	3 (2 + 1)
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall/Spring
Type	Elective
Prerequisites	IE212
Description	Industry 4.0, also known as the fourth industrial revolution, is a name for the current trend of automation and data exchange. 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.

#### **COURSE RECORD**

Code	<b>IE499</b>
Name	<b>Capstone Design Project</b>
Hour per week	2 (0 + 2)
Credit	1
ECTS	20
Level/Year	Undergraduate
Semester	Yearly
Type	Compulsory
Prerequisites	IE212, IE222, IE376
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

#### **COURSE RECORD**

Code	<b>IE 416</b>
Name	<b>Non-Linear Programming</b>
Hour per week	3
Credit	3
ECTS	5
Level/Year	Undergraduate
Semester	Fall/Spring
Type	Elective
Prerequisites	-
Description	Nonlinear programming is used in a variety of applications, ranging from machine learning and data science to finance and engineering. This course provides an introduction to 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,

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sufficient and necessary conditions for optimality, duality and semidefinite programming.

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