

Course number and name	END 453 / Industry 4.0 and Digital Transformation
Credits, contact hours, categorization of credits	3 credits / 42 hours / Engineering topic
Instructor or course coordinator	Alp ÜSTÜNDAĞ
Text book and other supplemental materials	<ul style="list-style-type: none"> • <i>Industry 4.0: Managing the Digital Transformation</i>, Alp Ustundag, Emre Cevikcan, Springer, 2018.

Course information	
Content	Industry 4.0 and digital transformation design principles and conceptual framework, smart and connected product business models, maturity and readiness models, technology road mapping, project portfolio management and key technologies.
Prerequisites	None
Type	Selected elective

Course learning outcomes
<p>Students who pass the course will be able:</p> <ol style="list-style-type: none"> I. To be able to manage companies' industry 4.0 and digital transformation processes II. To have knowledge about Industry 4.0 and digital transformation conceptual framework and design principles III. To be able to develop smart and connected business models IV. To be able to perform the necessary evaluation and analysis for Industry 4.0 and digital transformation in companies V. To know the key Industry 4.0 technologies and understand the effects on the process/products VI. To identify the industry 4.0 roadmap and manage the project portfolio

Student outcomes	Level of contribution
SO1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	Partial
SO2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	High
SO3. An ability to communicate effectively with a range of audiences.	Partial
SO4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Partial
SO5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	Partial
SO6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	High

Week	Topics	Learning outcome(s)
1	Industry 4.0 and digital transformation design principles and conceptual framework	I, II
2	Business model innovation with smart and connected products	I, III
3	Industry 4.0 maturity and readiness models	I, IV
4	Technology roadmap for industry 4.0	I, IV, VI
5	Project portfolio management for Industry 4.0	I, IV, VI
6	Key technologies: Data analytics, artificial intelligence and machine learning	I, V
7	Key technologies: Augmented reality and virtualization	I, V
8	Key technologies: Automation and sensor technologies	I, V
9	Key technologies: Internet of Things and Industrial Communication Systems	I, V
10	Key technologies: Adaptive robotics and additive manufacturing	I, V
11	Key technologies: Virtual factory and simulation systems	I, V
12	Key technologies: Cloud Computing	I, V
13	Key technologies: Digital Traceability Systems in Production Systems	I, V
14	Key technologies: Cybersecurity	I, V