Course number and name	END 318 / System Dynamics
Credits, contact hours, categorization of credits	3 credits / 42 hours / Engineering topic
Instructor or course coordinator	Erhan BOZDAĞ
Text book and other supplemental materials	• *Business Dynamics: Systems Thinking and Modeling for a Complex World*, John D. Sterman, McGraw-Hill, 2000.Tabachnick, B.G., Fidell, L.S. (2013). *Using Multivariate Statistics*, 6th ed. USA: Pearson. • *Strategic Modelling and Business Dynamics*, John Morecroft, John-Wiley and Sons, England, 2007. • *System Enquiry: A System Dynamics Approach*, E. Wolstenholme, John-Wiley and Sons, Great Britain, 1990.

Course information	
Content	Understanding systems thinking approach, developing system dynamics models, understanding dynamic system behaviors.
Prerequisites	END 211 / END 215 System Thinking and Analysis
Type	Selected elective

Course learning outcomes

Students who pass the course will:
  I. draw causal diagrams of a system.
  II. determine dynamic behavior of a system with respect to feedback structure and delays.
  III. derive the dynamic equations for the system given in the cause and effect diagram
  IV. carry out experiments by using computer model and analyze model's outputs.

Student outcomes	Level of contribution
SO1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	High
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.	Partial
SO3. An ability to communicate effectively with a range of audiences.	Not applicable
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.	Little
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.	Not applicable
SO6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Partial
SO7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Little

Week	Topics	Learning outcome(s)
1	Introduction to the course. Introduction to system dynamics	I-IV
2	Causal loop diagrams	I
3	Causal loop diagrams	I
4	Stocks and flows, dynamics of stocks and flows	II
5	Flow diagrams (levels, rates, auxiliaries, constants)	II
6	Flow diagrams (levels, rates, auxiliaries, constants)	II
7	Dynamic equations: Formulating rate equations	III
8	Dynamic equations: Table functions	III
9	Dynamic equations: Information delays, material delays	III
10	Examples	I-IV
11	Examples	I-IV
12	Modes of dynamic behavior: Exponential growth, goal seeking behavior	I-IV
13	Modes of dynamic behavior: S-Shaped growth	I-IV
14	Validation and model testing	I-IV