Course number and name	END 448/ Introduction to Stochastic Modelling
Credits, contact hours, categorization of credits	3 credits / 42 hours / Engineering topic
Instructor or course coordinator	Emine YAYLALI
Text book and other supplemental materials	• Ross, S.M. (2006). *Introduction to Probability Models*, 9th edition, Academic Press, ISBN-13: 978-0125980623. • Winston, W.L. (2004). *Operations Research: Applications and Algorithms*, Thomson Learning, ISBN-13: 978-0534380588.

Course information	
Content	Introduction to mathematical modeling, analysis, and solution procedures applicable to uncertain (stochastic) systems. Methodologies covered include probability theory and stochastic processes. Applications relate to design and analysis of problems, inventory control, operations research, waiting lines, and system reliability and maintainability.
Prerequisites	None
Type	Selected elective

Course learning outcomes
Students who pass the course will be able: I. Develop models for decision making under uncertainty II. Analyze the concepts of random variables (single and multivariate), mean, variance and covariance III. Identify and apply the probability distributions accurately to applications IV. Develop and formulate decision problems using decision tress V. Measure the value of perfect and sample information VI. Identify and describe a stochastic process VII. Apply the stochastic process in the form of Markov chains and queuing models into real life problems

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.	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.	Not applicable
SO6. An ability to develop and conduct appropriate experimentation, analyse 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.	High

Week	Topics	Learning outcome(s)
1	Course Introduction and Probability Review I	I, II
2	Probability Review II	II, III
3	Decision Making using Decision Trees	I, IV,V
4	Introduction to Stochastic Processes and Markov Chains I	VI, VII
5	Markov Chains II: Limiting Probability	VI, VII
6	Markov Chains III: Absorbing Chains	VI, VII
7	Exponential Distribution and Poisson Process	III, VI
8	Continuous Time Markov Chains (CTMC) I	VI, VII
9	CTMC II: Birth and Death Processes	VI, VII
10	Queueing Theory I: M/M/1 Queueing Systems	VI, VII
11	Queueing Theory II: M/M/s Queueing Systems	VI, VII
12	Queueing Theory III: Limited Capacity Queueing Systems	VI, VII
13	Queueing Theory IV: Queueing Networks	VI, VII
14	Queueing Theory V: Queueing Networks	VI, VII