



**ÇANKAYA UNIVERSITY**  
**FACULTY OF ENGINEERING**  
**Department of Industrial Engineering**  
**IE 327**  
**System Simulation**  
**Spring 2018**



## **COURSE SYLLABUS**

Course Code : IE 327  
Course Title : System Simulation

Credit Hours : (3 2 4) 6  
Pre-requisites : IE 228

Students : IE  
Year : 3

Semester : Spring '18  
Section : 01, 02

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**Catalog Data:** Introduction, types of simulation, concepts and examples of discrete-event simulation, event-scheduling/time advanced algorithm, hand simulation, random-number generation, random-variate generation, input modelling, verification and validation of simulation models, output analysis for a single model, comparison and evaluation of alternative system designs, simulation model development and analysis using a simulation software package.

**Course Outline:** The following topics will be covered:

- Introduction to simulation
- Various simulation examples
- Discrete-event simulation concepts
- Event scheduling oriented hand simulation
- Input data analysis: Overview, identifying family of distributions using descriptive statistics and graphical tools
- Input data analysis: Parameter estimation, goodness-of-fit tests
- Input data analysis: Goodness-of-fit tests, selecting an input model in the absence of data
- Random-number generation
- Random-variate generation
- Verification and validation
- Output data analysis: Estimation of absolute performance for a terminating simulation
- Output data analysis: Estimation of absolute performance for nonterminating simulation
- Output data analysis: Estimation of relative performance for comparing multiple system alternatives
- Output data analysis: Selecting the best among multiple system alternatives

**Textbook:** The course is based around the following textbook:

- Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, Discrete-Event System Simulation, (5th Edition), Pearson, 2014, 978-1292024370.
- W. David Kelton, Randall Sadowski, Nancy B. Zupick, Simulation with ARENA, 6 edition, McGraw Hill, 2014, 978-0073401317.

**References:** The following useful reference books are available in the University Library:

- J.R. Evans, D.L. Olson, "Introduction to Simulation and Risk Analysis", 2nd ed., Prentice Hall, (2002), ISBN: 0-13-032928-2.
- L.M. Leemis, S.K. Park, "Discrete-Event Simulation", Prentice Hall, (2006), ISBN: 0-13-142917-5.
- A.M. Law, W.D. Kelton, "Simulation Modeling and Analysis", 3rd ed., McGraw-Hill International Editions, (2000), ISBN: 0-07-059292-6.
- W.D. Kelton, R.P. Sadowski, D.A. Sadowski, Simulation with ARENA, Second Edition, McGraw-Hill, (1998), ISBN: 0-07-561259-3.
- J. Banks, B. Burnette, H. Kollooski, J. Rose, Introduction to SIMAN/V and CINEMA/V, John Wiley and Sons Inc., (1994), ISBN: 0-47-130960-5.
- C. Harrell, B. Ghosh, R. Bowden, Simulation Using ProModel, McGraw-Hill, (2000), ISBN: 0-07-234144-0.

**Teaching Method:** Teaching will be based on enabling the students to understand the concepts and procedures in each topic section and to be able to apply them. To do this the course will be organized into two modules: Lectures and Tutorials/Laboratory sessions.

**Lectures:** In lectures the instructor will attempt to summarize and explain only selected important concepts and points as clearly as possible. To be familiar with the material presented in lectures and participate in class discussions, students are expected to read the material covered in the previous lectures prior to the class meeting. Students will then find the lectures more interesting, and will benefit from the discussion if they come well prepared.

**Tutorials:** In addition to the regular lectures, there will be tutorial sessions conducted in the classroom/laboratory by the assistant, according to the perceived need. In these hours the assistant will do extra example problems and give tutorials on computer applications and show videos related with the lecture materials.

**Lab Work:** Students should enter the announced laboratory sessions throughout the semester. There will be several evaluations based on the work done in the lab.

**Project Study:** Students should form groups of at most **4 students** in order to perform project work.

**Exams:** All examinations will be based on lectures, tutorials, labs, and project work. To pass these exams students will need to have studied the material well in advance in order to understand the concepts, procedures and techniques. To discourage last minute cramming, the instructor and the assistants will not answer any questions from students on the day of an examination. Descriptions of these examinations are as follows:

Midterm Exam: There will be one midterm examination that covers all the material up to the date of the examination.

Final Exam: The Final Examination will cover all the material studied throughout the semester and has the same structure as in the midterm examination.

**Note: The students need a calculator so they should bring their own calculators to all lecture/tutorial/lab/exam hours.**

**Make-up Exam:** Make-up examination will only be offered (at the end of the semester) to students who missed the **final examination or midterm exam** and provided adequate documentations for the reason of their absence.

**Attendance:** **With a minimum of 45% attendance** is necessary and it will be taken every lecture and tutorial/lab session. Without considering whether the students that satisfy or does not satisfy this minimum attendance requirement all students may enter the final exam.

**Academic Dishonesty:** Any act not suitable for a university student will not be tolerated and may lead to formal disciplinary action. Example of this are: getting someone else to take the examinations for you, misrepresentation of your own answer sheet as another's work, cheating, knowingly assisting other students to cheat, abusing the tolerance or breaking the discipline of the class.

**Grading Policy:** Although the student's overall grade will be based on the general assessment of the instructor, the following percentages may give an idea about the relative importance of various assessment tools.

Lab Work	20 %
Project Study	25 %
Midterm Exam	25 %
<u>Final Exam</u>	<u>30 %</u>
TOTAL	100 points

Note that the instructor reserves the right to modify these percentages in case he finds it necessary. Letter grade equivalents of numerical performances will be announced by the Registrar's Office after the last day for the submission of letter grades.

**NA Grading: Conditions that might lead to "NA" grade:**

1. Not attending **both Final Exam and Midterm Exam or their Make-up Exams without a valid excuse.**
2. **having an overall grading either "FF" or "FD" and the overall attendance to lectures/tutorials/labs/etc. less than 45%.**