**TED University**

**IE 341 Simulation**

**Fall 2016-2017**

Credit Hours: (2+2+0) 3 TEDU Credits, 7 ECTS Credits

| **Instructor:** | **Class Hours:** | | **Location:** |
|---|---|---|---|
| Çağrı Latifoğlu, Ph.D. | Wednesday | 10:00 – 11:50 (Section 1 Lab) | A316 |
| Industrial Engineering Department | Wednesday | 14:00 – 15:50 (Section 2 Lab) | A316 |
| Office: A427 | Friday | 10:00 – 11:50 (Section 1) | A326 |
| Phone: 205 | Friday | 13:00 – 14:50 (Section 2) | A229 |
| E-mail: cagri.latifoglu@tedu.edu.tr | **Office Hours:** by appointment | | |

**Teaching Assistant:**

Sırma Karakaya

Office: B343 Phone: 054

E-mail: sirma.karakaya@tedu.edu.tr **Office Hours:** by appointment

**Course Description:**

Simulation methodology and model building. Modeling with a simulation language. Random number and random variate generation. Basic issues in the design, verification and validation of simulation models. Analysis of simulation output.

**Course Objectives:**

The course aims to teach the basic principles and the methods in developing simulation models. The goal is to teach simulation modeling with a simulation package, ARENA including the design of the simulation experiments and statistical analysis of the input and output data for simulation models.

**Pre-requisites:**

Math 232

**Learning Outcomes:**

Upon succesful completion of this course, a student will be able to

1. Apply the basic concepts in discrete-event simulation modeling including model components, event list and flowchart. [e][B3]

2. Use simulation techniques and tools to model systems. [e, k][B3]

3. Construct simulation models using a simulation package and conduct simulation experiments. [b1, e] [B3]

4. Analyse the input and output data for simulation models. [b2][B4]

5. Perform verification and validation - for simulation models. [b2, e] [B3]

6. Identify engineering problems by using performance measures of simulation models. [e][B1]

7. Analyze solutions for industrial engineering problems and compare design alternatives by using simulation techniques. [e, b2][B4]

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 08:00 | | | | | |
| 09:00 | | | | | |
| 10:00 | | | IE 341_01 A316-Lab | | IE 341_01 A326 |
| 11:00 | | | | | |
| 12:00 | | | | | |
| 13:00 | | Office Hours | | | IE 341_02 A229 |
| 14:00 | | | IE 341_02 A316-Lab | | |
| 15:00 | | | | | |
| 16:00 | | | | | |
| 17:00 | | | | | |

**Required Text Book:**

W. David Kelton and Randall Sadowski and Nancy Zupick (2014), *Simulation with Arena (6th edition),* McGraw-Hill, New York

**Supplementary Text Books:**

Banks, J., Carson, J. S., Nelson, B. L., and Nicol, D. M. (2009), *Discrete Event System Simulation (5th edition),* Prentice Hall

Law, A. M. (2007), *Simulation Modeling and Analysis (4th edition),* McGraw-Hill, New York

Pegden, C.D., Shannon, R.E., and Sadowski, R.P., (1995), *Introduction to Simulation Using SIMAN (2nd edition),* McGraw-Hill, New York

**Software:** The simulation software package ARENA will be used.

**Important Dates:** Midterm I- November 16, 2016 Wednesday
Midterm II- December 21, 2016 Wednesday
Final Exam- To Be Announced

**Course Management System:**

Moodle (http://moodle.tedu.edu.tr/). All announcements and course related material such as homework assignments, lecture notes will be posted on Moodle course page. It is the students' responsibility to check the web page regularly and not miss any activity or information.

**Planned Learning Activities and Teaching Methods:**

Telling / Explaining, Discussion/Debate, Questioning, Problem Solving, Inquiry, Collaborative Learning, Hands-on Activities

**Grading:**

| | |
|---|---|
| Assignments: | 4 x 5% = 20% |
| Midterm Exams: | 2 x 15% = 30% |
| Final Exam: | 25% |
| Term Project: | 15% |
| Active Learning Exercises: | 10% |

**Term Project:**

In the term project, you will be asked to solve one or two realistic case-based problems which will require evaluation of the performance of a process, component or system and proposing preferred solution alternatives based on sensitivity and scenario analysis

**Active Learning Assignments:**

These will be in-class activities that will help to enhance the learning process. You will receive full credits if you are engaged in the activity in-class.

**Estimated Student Workload:**

| | |
|---|---|
| Lectures | 42 hrs |
| Readings | 30 hrs |
| Observation | 6 hrs |
| Quizzes / Homeworks | 40 hrs |
| Midterm Exams | 24 hrs |
| Final Exam | 18 hrs |
| Case Study | 10 hrs |

Total workload is 170 hours.

**Tentative Course Schedule:**

| Week | Topics | Chapters |
|---|---|---|
| 1 | Introduction to Simulation | Kelton, Chapter 1 |
| 2 | Fundamental Simulation Concepts | Kelton, Chapter 2 |
| 3 | Hand Simulation, Introduction to Arena | Kelton, Chapter 2, Chapter 3 |
| 4 | Introduction to ARENA (Create-Process Modules), ModelingBasic Operations (ConstructingModel 4.1) | Kelton, Chapter 3, Chapter 4 |
| 5 | Modeling Basic Operations (Record Modules, Schedules, Failures) | Kelton, Chapter 4 |
| 6 | Modeling Basic Operations(Set Concept, Frequency Type Statistics,Utilizations) | Kelton, Chapter 4 |
| 7 | Modeling Basic Operations (Stations, Routes) | Kelton, Chapter 4 |
| 8 | Intermediate Modeling (Sequence) | Kelton, Chapter 7 |
| 9 | Random Number Generation Random Variate Generation | Banks, Chapter 7, Chapter 8 |
| 10 | Input Modeling (Selecting Distribution, Parameter Estimation) | Banks, Chapter 9 |
| 11 | Input Modeling (Goodness of Fit Tests, Non-stationary Arrival Processes) | Kelton, Chapter 4 |
| 12 | Modeling Detailed Operations (Shared Queues; Batch-Match-Separate-Search-Remove Modules) | Kelton, Chapter 5, Chapter 9 |
| 13 | Output Analysis for Terminating Simulation | Kelton, Chapter 6 |
| 14 | Output Analysis for Steady-State Simulation | Banks, Chapter 11 |

**Attendance and Participation:**

Attendance is not mandatory in this course. However, the active learning assignments will be graded based on attendance and involvement. Please also note that this course can be learned best when the students participate in class-discussions.

**Academic Integrity:**

Please avoid all types of actions that can be considered as cheating or plagiarism. All of the following are considered plagiarism among others according to the web site www.plagiarism.org:

(i) turning in someone else's work as your own, (ii) copying words or ideas from someone else without giving credit, (iii) failing to put a quotation in quotation marks by referencing it, (iv) giving incorrect information about the source of a quotation, (v) changing words but copying the sentence structure of a source without giving credit, (vi) copying so many words or ideas from a source that it makes up the majority of your work, whether you give credit or not.

Plagiarism is a very serious offense and will be penalized accordingly by the university disciplinary committee. The best way to avoid accidentally plagiarizing is to work on your own before you ask for the help of other resources.

Cheating has a very broad description which can be summarized as "acting dishonestly". Some of the things that can be considered as cheating are the following:

(i) copying answers on exams and all types of assignments, (ii) using prohibited material on exams, (iii) lying to gain any type of advantage in class, (iv) providing false, modified or forged data in a report, (v) modifying graded material to be re-graded, (vi) causing harm to colleagues by distributing false information about an exam or an assignment.

TED University takes academic integrity seriously. We, the students and faculty of the TED University, dedicate ourselves to upholding the highest standards of academic integrity. Academic integrity means that one's work is the product of one's own effort, and one neither receives nor gives unauthorized assistance in any assignment. Because advanced academic work depends on the sharing of information and ideas, academic integrity at the college level includes rigorous adherence to the conventions for acknowledging one's use of the words and ideas of other people, and instruction in this fundamental skill of college life is available to all TED University students. (www.tedu.edu.tr)

**Syllabus Change:** The course schedule announced is tentative. It will be adapted to the pace of class in agreement with the students.

**Make up policy:** Make up exams will be given only for medical excuses documented by medical reports that are approved by the Student Health Center or other documented excuses approved by the university's executive branches. There will only be one comprehensive make up exam.

**Assignment submission policy:**

- Assignment solutions must be handed in at the beginning of class on the day that it is due.
- Late submissions are not accepted.
- Your solutions must be written neatly and in an understandable fashion.
- Under no circumstances it is allowed to copy another student's work. Otherwise, the student(s) involved will receive 0 for that assignment.