SYSTEMS SIMULATION

1	Course Title:	SYSTEMS SIMULATION
2	Course Code:	END3032
3	Type of Course:	Compulsory
4	Level of Course:	First Cycle
5	Year of Study:	3
6	Semester:	6
7	ECTS Credits Allocated:	5.00
8	Theoretical (hour/week):	3.00
9	Practice (hour/week):	0.00
10	Laboratory (hour/week):	1
11	Prerequisites:	Computer Programming II, Statistics II
12	Language:	English
13	Mode of Delivery:	Face to face
14	Course Coordinator:	Doç. Dr. Fatih ÇAVDUR
15	Course Lecturers:	
16	Contact information of the Course Coordinator:	e-posta: fatihcavdur@uludag.edu.tr, Telefon: + 90 (224) 294 20 77 Adres: Uludağ Üniversitesi, Mühendislik-Mimarlık Fakültesi, Endüstri Mühendisliği Bölümü, Görükle Kampüsü, 16059 Nilüfer, Bursa
17	Website:	
18	Objective of the Course:	Learning basic simulation concepts
19	Contribution of the Course to Professional Development:	
20	Learning Outcomes:	

	1	Being able understand simulation applications and limitations.
	2	Being able to understand and define state description, time advance and event scheduling mechanisms.
	3	Being able to modeling, verifying and validating a model using a simulation package.
	4	Being able to understand random number generation mechanisms.
	5	Begin able to analyze simulation results.
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21 Course Content:

Course Content:

Week	Theoretical	Practice
1	Introduction to Simulation -Basic concepts, areas of use	

2	Manual Simulation Examples -1-server queuing system -2-server queuing system -Newsboy problem -(m, M) inventory system -Monte Carlo simulation	Simple simulations by hand and using a table.
3	Simulation Concepts -Basic simulation concepts, definitions and computer models of basic simulation concepts, susch as entity, attribute, event, activity etc.	Manual simulation examples by hand.
4	Simulation Software -Simulation with different worldviews -Simulating a simple system using the time advance / event scheduling mechanism and a general purpose language	Coding a simple simulation program, information about simulation packages.
5	Probability Distributions -Basic discrete and continuous probability distributions, expectation and variance computations	Using statistical packages for probability computations
6	Queuing Models and Their Simulation -Basic queuing models, M/M/1, M/G/1, M/G/?	Simulation of queuing systems.
7	Queuing Models and Their Simulation -Basic queuing models, M/M/1, M/G/1, M/G/?	Simulation of queuing systems.
8	Random Number Generation -Random number generation mechanisms -Uniformity and independence tests for random numbers	Implementing random number generation algorithms, performing tests
9	Random Variable Generation -Inverse Transform techniques -Other techniques	Random variable generation applications.
10	Verification and Validation -Some approaches for verification and	Verification and validation for an example model.
11	Simulation Input Data Analysis parameter estimation and tests	Simulation input data analysis using simulation and
12	Simulation Output Data Analysis -Approaches for output data analysis, performance measures and their estimation.	Output data analysis for an example model, estimating performance measures.
13	Simulation Output Data Analysis -Long-run or steady-state simulation output data analysis	Long-run or steady-state output data anlysis for an example model.
14	Simulation Examples	Analyzing simulation examples from different areas.

Activites	Number	Duration (hour)	Total Work Load (hour)
Theoretical	14	3.00	42.00
Practicals/Labs	14	1.00	14.00
Self study and preperation	14	5.00	70.00
Homeworks	4	5.00	20.00
Projects	1	25.00	25.00
Field Studies	0	0.00	0.00
Midterm exams	1	4.00	4.00
Others	0	0.00	0.00
Final Exams	1	5.00	5.00
Total Work Load			180.00
Total work load/ 30 hr			6.00
ECTS Credit of the Course			5.00

22	Textbooks, References and/or Other Materials:	1.Discrete-Event System Simulation; 4th Edition; Jerry Banks, John S. Carson II, Barry L. Nelson, and David M. Nicol; Prentice Hall 2.Simulation Modeling and Analysis; Averill M. Law, W. David Kelton, 3rd Edition; McGraw 3.Simulation with Arena, 3rd Edition; W. David Kelton, Randall P. Sadowski and Deborah A. Sadowski; McGraw-Hill
23	Assesment	

TERM LEARNING ACTIVITIES	**NUMBER**	**WEIGHT**
Midterm Exam	1	20.00
Quiz	0	0.00
Home work-project	4	30.00
Final Exam	1	50.00
Total	6	100.00
Contribution of Term (Year) Learning Activities to Success Grade		50.00
Contribution of Final Exam to Success Grade		50.00
Total		100.00
Measurement and Evaluation Techniques Used in the Course		

24 ECTS / WORK LOAD TABLE

25 CONTRIBUTION OF LEARNING OUTCOMES TO PROGRAMME QUALIFICATIONS

	PQ1	**PQ2**	**PQ3**	**PQ4**	**PQ5**	**PQ6**	**PQ7**	**PQ8**	**PQ9**	**PQ10**	**PQ11**	**PQ12**	**PQ13**	**PQ14**	**PQ15**	**PQ16**
ÖK1	5	5	5	5	5	1	1	1	1	1	1	2	5	3	1	0
ÖK2	3	3	3	5	3	1	1	1	1	1	1	1	3	3	1	0
ÖK3	5	5	5	5	5	1	1	1	1	1	1	2	5	1	1	0
ÖK4	5	4	5	5	3	1	1	1	1	1	1	1	5	1	1	0
ÖK5	5	5	5	5	5	1	1	1	1	1	1	2	5	1	1	0

LO: Learning Objectives PQ: Program Qualifications

Contribution Level:	**1 very low**	**2 low**	**3 Medium**	**4 High**	**5 Very High**