Offered by:

Endüstri Mühendisliği

Course Title:	**Course Org. Title:**
MODELING AND ANALYSIS OF DISCRETE EVENT SYSTEMS	MODELING AND ANALYSIS OF DISCRETE EVENT SYSTEMS

Course Level:	**Course Code:**
Lisans	IND 4907

Language of Instruction:	**Form Submitting/Renewal Date**
İngilizce	23/08/2013

Weekly Course Hours:	**Course Coordinator:**
3	YRD.DOÇENT ŞENER AKPINAR

Theory	Application	Laboratory	National Credit: 3
3	0	0	ECTS Credit: 4

Offered to:	Course Status: Compulsory/Elective
Name of the Department:	
Industrial Engineering	**Elective Course**

Instructor/s:

Course Objective:

As the complexity of the systems grows, and the requirements for their correct behavior are strengthened, new theories have been developed to facilitate the generation of control structures for discrete event systems. Solving these problems is of critical importance to decrease the cost of automated manufacturing systems and to increase the system productivity. This course aims to give the student basic knowledge about important results from current research on discrete event systems and how these results can be applied to the problems in industrial systems.

This course covers elements of discrete mathematics and then focuses on Petri Net models and their basic properties: locality and concurrency. Condition/event systems; Place/transition nets; Colored Petri nets; Reachability graphs (Occurrence nets); and Invariant Analysis; Behavioral and Structural Properties. Temporal issues in Petri nets and Temporal Logic. Stochastic Petri nets. Relation to other discrete event models of dynamical systems. Applications of the theory to modeling, design and verification, and to systems engineering problems.

Learning Outcomes:

1	To define the basic elements of system theory, then focuses on discrete event dynamic systems
2	To explain the mathematical properties of discrete event systems through Graph Theory and Petri Net models
3	To adopt the Petri nets theory and applications in problems of system modelling, design, and verification
4	To apply the above to the analysis of performance and reliability properties
5	To discuss the extension of discrete time towards continuous time and stochastic techniques, leading to, e.g., Markov chains and stochastic Petri nets

Learning and Teaching Strategies:

Lectures, problem classes, worksheets, course notes, textbooks, web support.

Assessment Methods:

Name	Code	Calculation formula
Vize	VZ	
Ödev	OD	

Final	FN	
Bütünleme Notu	BUT	
BNS	BNS	VZ*035+D *015+FN * 050
Bütünleme Sonu Başarı Notu	BBN	VZ*035+D *015+BUT * 050

Further Notes about Assessment Methods:

Assessment Criteria:

MIDTERM(%35)+ASSIGNMENT(%15)+FINAL EXAM(%50)

Textbook(s)/References/Materials:

? B. Hrúz and M.C. Zhou (2007), Modeling and Control of Discrete-event Dynamic Systems with Petri Nets and Other Tool , Springer-Verlag, London.
? Proth, J.M. and Xie, X. (1996), ?Petri nets: A tool for design and management of manufacturing systems?. Chichester, UK: John Wiley & Sons Inc.
? Jerry Banks, John Carson, Barry L. Nelson, and David Nicol (1994). ?Discrete-Event System Simulation?, Fourth Edition by, Prentice Hall International Edition.
? Zhou, M.C. and DiCesare, F. (1993), ?Petri Net Synthesis for Discrete Event Control of Manufacturing Systems?, Norwell, Massachusetts: Kluwer Academic Publishers (1993).
? Desrochers, A.A. and Al-Jaar, R.Y. (1995). Applications of Petri nets in Manufacturing Systems. New York, NY: Institute of Electrical and Electronics Engineers Press.
? DiCesare, F., Harhalakis, G., Proth, J.M., Silva, M., and Vernadat, F.B. (1993). Practice of Petri Nets in Manufacturing. London: Chapman & Hall.

Course Policies and Rules:

Contact Details for the Instructor:

E-mail: gonca.tuncel@deu.edu.tr; Telf: 02323017617

Office Hours:

09:00 - 17:00

Course Outline:

Week	Topics:	Notes:
1	Brief review of basic notions from Systems Theory and its particularization for Discrete Event Systems.	
2	Brief review 2 ? Graph Theory	
3	Essential Features of Petri Nets: Petri Net models and Definitions, CPN Tools I	
4	Petri Net properties 1: Structural Methods and Invariants	
5	Petri Net properties 2 : Behavioral Properties	
6	State Space methods, Reachability Analysis	
7	State Space Analysis: Heuristic Methods	
8	Elementary Classes of Petri nets: Event (Marked) Graphs	
9	Midterm Exam	
10	Performance evaluation models: Timed PNs	
11	Stochastic PNs, Markov Chains	
12	Applications of Petri nets in Manufacturing Systems	
13	CPN modelling tools	
14	Presentation of Research Projects	

ECTS Table

Course Activities	Number	Duration (hour)	Total Work Load (hour)
In Class Activities			
Lectures	12	3	36

Exams			
Final exam	1	2	2
Mid-term exam	1	2	2

Out Class activities			
Preparation before/after weekly lectures	13	2	26
Preparation for Mid-term Exam	1	10	10
Preparation for Final Exam	1	14	14
Preparing Individual Assignments	2	4	8
Preparing Group Assignments	1	6	6
Preparing Presentations	1	4	4
Total Work Load (hour)			108
ECTS Credits of the Course= Total Work Load (hour) / 25			4