Fall 2023

ECE 453 - INTRO DISCRETE EVENT SYS

MengChu Zhou

Department of Electrical and Computer Engineering
New Jersey Institute of Technology

ECE 453: Introduction to Discrete Event Systems (3 credits, 3 contact hours, elective course)

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Text books: Hruz, B. and M. C. Zhou, *Modeling and Control of Discrete Event Dynamic Systems*, Springer, London, UK, 2007 (Advanced Textbooks in Control and Signal Processing). ISBN-13: 9781 8462 88722
Reference book: M. C. Zhou and K. Venkatesh, Modeling, Simulation and Control of Flexible Manufacturing Systems: A Petri Net Approach. World Scientific, 1998. ISBN 981-02-3029-X.

Catalog Course Description:
Introduces logical models, timed models, and stochastic timed models of discrete event systems. Applies petri net methodology to the modeling of computer systems, flexible manufacturing systems, communication networks, and robotics. Contrasts the approaches of simulation, elementary queueing theory, and Markov processes.

Course Description:
This course introduces fundamentals of discrete event systems: logical models, timed models, stochastic timed models, graphical representations, Markov chains, and discrete-event simulation. The primary mathematical and graphical model is Petri nets. It presents their applications in modeling, control, analysis, validation, simulation, and performance evaluation of various discrete event systems.

Prerequisite: ECE 251 or CIS251, MATH333 or ECE 321
Co-requisite: none

Course Learning Outcomes:
1. Able to build various models given system specifications, including logical models, timed models, stochastic timed models, and Markov chains.
2. Able to design sequential control systems by using logical models such as finite state machine and Petri nets
3. Able to perform modeling, control, analysis, validation, simulation, and performance evaluation of various discrete event systems.
4. Able to write and present research reports documenting the results of their term projects.

Relevant Student Outcomes:
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics; (CLO 1, 2, 3);
2. 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 (CLO 1, 2, 3);
3. An ability to communicate effectively with a range of audiences; (CLO 4)
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1-3)

Computer assisted design and course specific software:

MatLab
Petri Net Simulator

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks,

individual topics, and grading policy are subject to revision and changes by individual instructors.

Outline:

Topic	Week
Discrete event systems	1
State machines and math	2-3
Hardware implementation	4
Petri nets and properties	5-6
Midterm Exam	7
Petri net invariant analysis	8
Petri net reduction	9
Deterministic time Petri nets	10
Markov chains	11-12
Stochastic Petri nets	13
Project presentation	14

Grading policy: Midterm @ 40%; Final exam or term porject @ 30%; 4 homeworks and class participation @ 30% total. Homework will be posted to the class's email list at least one week prior to their due dates. No points will be given to your homework submission if it passes its submission deadline.

Updates and Assignments to be distributed via e-mail

Office hours, recitations and group studies: 5-6pm on the day this course offers or by appointment

Honor Code: The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

Office: ECE Bldg., Room 335

Prepared by: M. Zhou