The Hebrew University of Jerusalem

Syllabus

CYBER-PHYSICAL SYSTEMS - 67637

Last update 04-08-2019

<u>HU Credits:</u> *3*

<u>Degree/Cycle:</u> *1st degree (Bachelor)*

<u>Responsible Department:</u> *Computer Sciences*

<u>Academic year:</u> *0*

<u>Semester:</u> *2nd Semester*

<u>Teaching Languages:</u> *Hebrew*

<u>Campus:</u> *E. Safra*

<u>Course/Module Coordinator:</u> *Dr. Tal Pasternak*

Coordinator Email: paster@cs.huji.ac.il

<u>Coordinator Office Hours:</u> *Tuesdays 12:00pm*

<u>Teaching Staff:</u>

Dr. Tal Pasternak

Course/Module description:
Cyber-Physical Systems (CPS) are integrations of computation, networking, and physical processes. Embedded computers and networks monitor and control the physical processes, with feedback loops where physical processes affect computations and vice versa.
Cyber-Physical Systems provide the basis for the "Internet of Things".

The course will explore system design problems such reachability analysis and controller synthesis for safety using a state space basis.
Additionally the course will cover practical topics of particular interest in cyber-physical systems such as scheduling and performance analysis of computer networks.

Course/Module aims:
This course will provide concepts and tools needed for analysis, design, and implementation of cyber-physical systems.

Learning outcomes - On successful completion of this module, students should be able to:
To develop the skills to realize cyber-physical systems that are safe, reliable, and efficient in their use of resources.
To learn how to model and design the joint dynamics of software, networks, and physical processes.
To learn to think critically about technologies that are available for achieving such joint dynamics.

Attendance requirements(%):
0

Teaching arrangement and method of instruction: Lecture and tutorial

Course/Module Content:
Continuous Dynamics
Discrete Dynamics
UML State Diagrams
Hybrid Systems
Composition of state machines

FSM Model Matching
Control of state machines: safety
Invariants and Temporal Logic
Equivalence and refinement
Multi Tasking
Concurrent Models of compotation:
Petri Nets
Time(d) Petri Nets
Scheduling
Quantitative Analysis : queueing
Quantitative Analysis: network calculus

<u>*Required Reading:*</u>
 None

 <u>*Additional Reading Material:*</u>
  Books:
1. Introduction to Embedded Systems, a Cyber-Physical Systems Approach, Lee and Seshia
2. Principles of Cyber-Physical Systems, Rajeev Alur

MooC Course:
BerkeleyX: EECS149.1x Cyber-Physical Systems

 <u>*Course/Module evaluation:*</u>
 End of year written/oral examination 90 %
 Presentation 0 %
 Participation in Tutorials 0 %
 Project work 0 %
 Assignments 10 %
 Reports 0 %
 Research project 0 %
 Quizzes 0 %
 Other 0 %

<u>*Additional information:*</u>