EXPANDED COURSE DESCRIPTION
ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
Lassonde School of Engineering
Electrical Engineering Computer Science
LE / EECS 3342 3.0 SECTION Z
SYSTEM SPECIFICATION AND REFINEMENT
FALL 2019 / WINTER 2020

Last Modified Date: 07/18/2019

COURSE CALENDAR DESCRIPTION

Theory and tools for specifying computer systems (sequential, concurrent and embedded). Specification (via set theory and predicate logic), modelling, abstraction, refinement and formal reasoning are undertaken before code development so that systems are correct by construction under the stated assumptions.

Prerequisites: cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"); LE/EECS 2030 3.00 or LE/EECS 1030 3.00; LE/EECS 2011 3.00; SC/MATH 1090 3.00.

INSTRUCTOR(S)

<table>
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<tr>
<th>Name</th>
<th>Section / Format / Term</th>
<th>Contact Email</th>
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<tbody>
<tr>
<td>Ostroff, Jonathan</td>
<td>Sec. Z / LECT / W</td>
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ADDITIONAL INFORMATION

This course provides students with an understanding of how to use mathematics (set theory and predicate logic) to specify and design correct computer systems whether the systems are sequential, concurrent or embedded. The course stresses both the underlying theory as well as the ability to use industrial strength tools that can be applied in practice. User requirements are formalized via an abstract mathematical model that is amenable to formal reasoning long before any programming activity is undertaken (e.g. as done in Event-B, Z and VDM). Successive models are like blueprints in traditional engineering disciplines and their mathematical nature allows us to reason about and predict their safety properties.

After successful completion of the course, students are expected to be able to:

- Document requirements organizing them into appropriate categories such as environmental constraints versus functional properties (safety and progress).
- Construct high level, abstract mathematical models of a system (consisting of both the system and its environment) amenable to formal reasoning.
- Apply set theory and predicate logic to express functional and safety properties from the requirements as events, guards, system variants and invariants of a state-event model.
- Use models to reason about and predict their safety and progress properties.
- Plan and construct a sequence of refinements from abstract high-level specifications to implemented code.
- Prove that a concrete system refines an abstract model.
- Apply the method to a variety of systems such as sequential, concurrent and embedded systems.
- Use practical tools for constructing and reasoning about the models.
- Use Hoare Logic and Dijkstra weakest precondition calculus to derive correct designs

This course is 3 hours of instruction per week as well as 1 hour of supervised labs per week.

The lab time is used to give students detailed exercises and instruction in using a practical verification tool (such as Rodin for Event-B and TLA+) to accompany the material in the lectures. Tools are essential to using the theory and methods on larger examples and require expert knowledge of the use of automated theorem proving methods. Students will use such tools to prove the examples that are discussed in class as well as
larger examples.

**ACADEMIC INTEGRITY LINKS**
- Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
- Academic Integrity - http://lassonde.yorku.ca/academic-integrity

**STUDENT LINKS**
- Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
- Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
- Student Accessibility Services (SAS) - https://accessibility.students.yorku.ca/
- York University’s Policies on Gender/LGBTQ*/Positive Space - http://rights.info.yorku.ca/lgbtq/

**LAND ACKNOWLEDGEMENT**
- We acknowledge our presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders, the Mississaugas of the New Credit First Nation. This territory is subject of the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.
- The Indigenous Framework for York University: A Guide to Action can be found here: http://indigenous.info.yorku.ca/
- Meaning of a land acknowledgement: http://healthydebate.ca/opinions/indigenous-land-acknowledgements

Many courses utilize Moodle, York University’s course website system. If your course is using Moodle, click here to access it.

**Moodle @ York University**