Introduction to theory and techniques to shift digital circuit design validation to earlier stages of development. Topics include an introduction to pre-silicon validation, emulation, formal verification, system specification and verification. Familiarity with computer architecture and hardware description languages required. A design project is an integral part of this course.  

Prerequisites: ECE 351 and ECE 371 or permission of instructor.

Course Coordinator/Instructor: Tom Schubert  
FAB 20-10  
503.725.5395  
tom.schubert@pdx.edu

Course Objectives: Students will gain experience using several techniques used to validate modern digital designs. The course will cover theory and methodology followed by hands on experience with emulation and two different formal verification methods (protocol specification/verification and RTL design exercise). The course material complements the current ECE pre-silicon and post-silicon functional validation courses.

Outline of Course Content
- Design validation principles
  - Problem definition and solution strategies
  - Product lifecycle and risk management
- Emulation
  - Methods for design stimulus, checking, and coverage
  - Veloce system and tools
- Protocol and Architecture Specification
  - TLA+ language, TLC validation tool
- Formal Verification
  - Theory, representation of information, BDDs, BMC, SAT, assertions, assumptions
  - Formal verification tools

Course requirements
- midterm (20%), final (30%), project (30%), homework (20%)

Student Learning Outcomes
1. Knowledge of role of validation in modern digital design projects
2. Knowledge of formal verification theory and application to digital design
3. Knowledge of emulation techniques as a complement to simulation
4. Ability to test digital designs using emulation technology
5. Ability to use formal verification tools to model and validate evolving architecture ideas prior to RTL development
6. Ability to use formal verification tools during early RTL development.
7. Understanding of the central nature of validation and the need for a structured, measured validation approach.

Required Texts and/or Required Reading List (all materials online)
- Lamport. Specifying Systems
- Veloce tool documentation
- NuSMV documentation
- Papers