Course Outline ECE 5734 **Winter 2018**

ON LINE COURSE

Embedded System Verification and Validation

Instructor: Professor. Subra Ganesan
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Lecture: **On Line Course.** The course web site is at **moodle.oakland.edu**. Every week a set of reading material, power point slides or notes, home work assignment etc will be posted on the web. An email will be sent to your Oakland email account.

Meeting at OU: We meet at **OU twice** this semester, once on Saturday, February 10 2018 and second time on Saturday April 7, 2018

- On **February 10 2018**, I will make a quick review. This will be followed by a Exam 1.
- On **April 7 2018. After I make** a quick review, you will write Exam 3
- **Office Hours**: At any time by appointment. You can clarify your doubts by email/phone.

TEXT BOOK:

1. "Embedded systems and software validation", 2009 by Abhik Roychoudhury, Morgan Kaufman, ISBN: 13: 978-0-12-374230-8
2. "Requirement Engineering for Software and Systems" Phillip A. Laplante, CRC press, 2014, ISBN 978-1-4665-6081-9.
3. Jeffrey O. Grady, "System Validation and Verification" CRC press, Taylor & Francis Group, 1997, ISBN—0-8493-7838-9 -- Not available in book store.

Reference Texts:

4. Deborah Sater Carstens et al., "Project management tools and techniques- a practical guide", CRC press, 2013, ISBN 978-1-4665-1562-8
5. Edward Walker, "The design analysis – A practical Guide to design validation" revised edition, Newness publisher (Elsevier), ISBN-13: 978-0-7506-9088-1
6. Leszek A. Macisaszek, "Requirement Analysis and system design" Addison Wesly, 2001. ISBN 0 201 70944 9
7. Phillip A. Laplante, "Real time systems design and analysis", 3rd edition, Wiley Inder Science, ISBN 0-471-22855-9
8. Jane W. Liu "Real Time Systems" Prentice Hall, 2000, ISBN: 0-13-099651-3.
9. C.M. Krishna and R.G. Shin, "Real time system" McGraw Hill 1997.
10. Ronald Jurgen " Automotive Handbook", McGrawHill Handbook, Latest edition.

Catalog Description Topics covered include automotive embedded system requirements, verification during design, sneak circuit analysis, worst-case circuit analysis, design considering component tolerances and non-ideal behavior, thermal analysis, EMC analysis, FMEA analysis, grounding rules for circuits, six sigma, fault tolerance, risk analysis, reliability issues, trade-offs in design, delays in automotive networks, and software-in-the-loop and hardware-in-the-loop tests. Offered fall or winter.

PREREQUISITES: electrical, electronics, computer science or computer engineering.

Course Description

- Embedded System Characteristics
- Real Time Scheduling of Tasks- RM and EDF scheduling
- System Requirement
- Distributed vehicle system,
- Performance measure,
- Role of Software in Vehicle electronics
- Signal processing electronics in automotive
- Data communication using CAN, LIN, MOST and Communication issues,
- Non- ideal behavior of components
- Worst Case design of critical components
- Thermal Analysis
- EMC analysis.
- Failure analysis and Fault tolerance
- Reliability issues
- Economic issues
- Modeling embedded system hardware and software
    - model in the loop tests,
    - software in the loop test, hardware in the loop tests-
- Verification of concept, requirement, design, implantation, system integration, and behavior during operational and maintenance phases.
- Diagnosis- failure mode analysis-
- Embedded software and hardware verification process,
- NASA/IEEE Standards,
- use of NI Labview,
- Matlab, Real time analysis tool boxes and
- Simulation tools for validation.
- Research issues.

Graduate Program Outcomes:

The Program Outcomes are a set of skills that assure the achievement of the program educational objectives. Before graduating, SECS students will demonstrate their skills in the following key areas:

a. **Students will demonstrate an ability to design and analyze a product or process to satisfy a client's needs subject to constraints.**
b. **Students will demonstrate an ability to apply the skills and knowledge necessary for mathematical, scientific, and engineering practices.**
c. **Students will demonstrate an ability to interpret graphical, numerical, and textual data.**
d. **Students will demonstrate an ability to use modern engineering tools.**
e. **Students will demonstrate an ability to recognize when information is needed and to have the ability to locate, evaluate, and use effectively the needed information**.

ECE 5734 COURSE objective:

Upon successful completion of the course students will understand:
(The alphabet within the bracket refers to the graduate program outcome mentioned above)

- Explain Embedded System Requirement generation and Verification.

- Explain Modeling of Systems using Software in the loop and hardware in the loop techniques.
- Demonstrate the use of simulation tools like Matlab for verification
- Explain embedded system analysis such as Worst case design, non-ideal behavior of components, thermal/EMC analysis, failure analysis, fault tolerance.
- Explain design methods for Validation of final product.

At periodic intervals, we will check whether the course objectives have been met.

Presentation: A number of papers will be assigned for reading. Each student has to make one presentation on one of the topics (PPT + voice) and submit on the Moodle in February or March. .

Lab type Assignments: (Only a few of the following assignments will be given)

1. Mat lab tool: The students model a simple engine controller and learn how to analyze the design. They also download the code generated by Matlab autocode generator to a HCS12 micro board and do a hardware-in the loop testing. They use the (Real time) RT tool box.
2. Lab view: The students model a simple behavior and engine controller. This allows them to do a model-in the loop testing of their controller design.
3. PSpice: They use Pspice tool to simulate the effect of temperature on op-amp, look at the characteristics. In the model, they vary the resistance values with a given tolerance (to max and min values) and study the output behavior.
4. Simplorer: They use the Simplorer to study electronic circuit simulation.
5. Real time software development tools ASCET and INTECRIO from ETAS. The students use this software tool to schedule a few Real time tasks, run them in real time on a HCS12 board. Then check schedulability of various tasks within deadline using the software tool.

PROJECT

Each student must work on a term project during the second half of the course. The project must be completed before the due date mentioned below. **Dates may change**

Project title and brief abstract is due on:	March 11 2018
Project Progress report	March 18
Presentation in the lecture room	April 7, 2018
Final Project report is due on the moodle:	April ??

EXAMINATION AND GRADE POLICY. [Jan 16; ***Feb 19 to Feb 26 are OU Holidays***]
Dates may change

Exam 1 : (Open book, at OU in the class) **Feb 10, 2018**	15%
Exam 2 (Do at home, submit on Moodle) March 11, 2018	15%
Exam 3 on April 7, 2018	25%
Presentations Audio with ppt on a given topic in March	10%
Project -Report / Demonstration/presentation: (10% +5% +5%)	20%
Home work	15%

GRADING POLICY: **55% and 95% of the total score will be 1.0 and 4.0 respectively. The grading curve is linear between 1.0 and 4.0. Grading policy may be modified if the average of the exams/score is very low**.

Academic Conduct: Students are expected to practice and uphold standards of academic integrity and honesty. Examples of dishonesty: cheating in exams, labs, and home work; plagiarizing the work of others, unauthorized collaborations on computer assignments. Please refer the Graduate or Undergraduate catalog for details.