Design for Reliability of Complex Systems
ECE 8833
Course Syllabus

Summary:
As embedded systems become more complex and autonomous, their reliability and design assurance becomes more critical. Different failure modes shall be identified for electronic components, software, firmware, and mechanical systems. In addition, the interaction of various failure modes and their effects on the overall system performance and operation shall be emphasized. Emphasis shall be given for designing and evaluating system performance in terms of reliability.

Course Instructor: Dr. Thomas Martin

Office: Van Leer Room 378

Office Hours: Regularly scheduled office hours will be virtual and in-person office visits are encouraged and can be scheduled on an as needed basis.

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Credits: 3 lecture hours

Prerequisite: graduate standing

Course Texts: Reliability Physics and Engineering
                       J.W. McPherson, Published by Springer
                       ISBN-13: 978-3319936826
                       2019 Edition 3

Course Notes and Assignments: Posted on Canvas. All solutions as well as the power point presentation of each lecture is presented.

Grading:

Homework		5%
Attendance/Class Participation		5%
Exam 1		20%
Exam 2		20%
Project		25%
Final Exam		25%

Homework turned in after the deadline will not be accepted. Makeup Exams - may be rescheduled for students having 3 or more Exams in a 24 hour period. Extenuating circumstances will be handled on a case by case basis. Exams will cover reading assignments, homework, lecture presentations, and in class discussions.

Topical Outline

Probability density functions, failure rate modeling	2 weeks
Degradation, component failure rates, acceleration factor	2 weeks
Electrical failure mechanisms (hot carrier injection, NBTI, etc.)	2 weeks
Mechanical failure mechanisms (fatigue, corrosion, etc.)	2 weeks
System architecture considerations	1 week
Software/firmware reliability considerations	1 weeks
Digital architecture reliability considerations	2 weeks
Prognostics and health management	1 week
Ethical considerations	1 week
Project presentations	1 week

Course Objectives
As part of this course, students:

- Apply their knowledge of statistics to evaluate design decisions in terms of system reliability
- Demonstrate their knowledge of microelectronics to identify and characterize failure mechanisms
- Apply knowledge of electronic hardware, software, firmware, and mechanical systems to analyze their failure effects on overall system performance
- Utilize their acquired knowledge to complete a team based project on evaluating a specific system and associated design recommendations to improve reliability

Learning Outcomes
Upon successful completion of this course, students should be able to:

- Interpret accelerated life testing results to estimate device, module, and system time to failure under normal operating conditions
- Predict system reliability based on failure mechanisms and associated stresses
- Recommend design changes at device and/or system level to improve overall reliability
- Evaluate designs to control failure propagation and mitigate hazardous operation

Course Expectations and Guidelines

Absence and Late Policy
We will abide by the Institute policy on attendance, see http://catalog.gatech.edu/rules/4/. The following policies apply to this course: Students are required to complete all course assignments and in-class activities. Please discuss all absences with the course instructors, prior to the absence if it is planned. If not an excused absence, credit will be deducted from the work.

Academic Integrity
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.
Any student suspected of cheating or plagiarizing on a quiz or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities
If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, and http://disabilityservices.gatech.edu/content/welcome-accommodate as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Considerations for Hybrid Format

This course is being offered in a Hybrid format. Lectures will be delivered/recorded over Bluejeans and held during scheduled class times.

Several class sessions will be dedicated to meeting in person to discuss the class project. We will break the class into groups and rotate these meetings throughout the semester. Exceptions will be granted for special cases.

Attendance and class participation will be tracked for both in person and remote BlueJeans sessions. During virtual sessions it is expected that you will use the video and audio to interact during class time.

Assignments and exams (including final) will be assigned and submitted digitally. Exams will use the Honorlock digital proctoring system. This system requires the students to have access to a webcam, microphone, and reliable Internet connection.

Regularly scheduled office hours will be virtual and in-person office visits are encouraged and can be scheduled on an as needed basis.