

ESE 551 Electronics and Radiation Effects Syllabus
Spring 2024 created 1 2 2024

Prof. Thomas Robertazzi, Instructor, Prof. Emre Salman, Guest Instructor.
Email: Thomas.Robertazzi@stonybrook.edu or home 631 379 1449 (any time before 8 PM, any day).

Pre-req: ESE 272 or ESE 273 or equivalent electronics course.

This course is on Brightspace.

A study of the effects of radiation on electronic circuit operation. Radiation may come from space or man-made sources such as nuclear reactors or CAT scan machines. Coverage includes types of radiation, types of effects on circuits such as SEE (Single Event Effects), designing circuits to mitigate radiation effects and testing of circuits prior to deployment. Applications include electronics for space and for use in nuclear reactors and certain medical imaging machines. Spring, 3 credits, grading ABCF.

Learning Objective: To give students a broad introduction into designing and testing electronics for use in radiation environments.

Reference Text: Radiation Handbook for Electronics, by Robert Baumann and Kirby Kruckmeyer, Texas Instruments, 2019, available for free download. Also, a seminar on Single Effect Events (SEE) was held by Stony Brook in Fall 2022. Videos and powerpoint (some of which will be used in the course) are available at <https://nanohub.org/courses/SUS>

This is a course with slides available on Blackboard (slides from a NASA sponsored course given at Brookhaven National Laboratory).

Week 1, Monday Jan 22: p2.1 Radiation Testing in Context (15 slides).

Week 2, Jan 29: p2.2a Natural Space Radiation Environments (50 slides).

Week 3, Feb. 5: Designing Electronics for Space I (Prof. Emre Salman). **Outline 1 due Feb 11.** Chapters 1 and 2 Texas Instrument Handbook and/or other sources (please cite, any citation style).

Topic for outline: Describe types of radiation. Mention sources, composition and strengths.

Week 4, Feb. 12: Designing Electronics for Space II (Prof. Emre Salman). **Portfolio 1 due Feb. 19.**

Week 5, Feb. 19: p2.2b Selecting a Test Facility (24 slides) and p2.3a SEE Basics (68 slides). **Outline 2 due Feb 25.** Chapters 3 and 4 TI Handbook and/or other sources (please cite, any citation style).

Topic for outline: Single events effects (SEE).

Week 6, Feb. 26: p2.3a SEE (Single Event Effects) Basics continued (68 slides). Online **Midterm on March 4th**.

Week 7, March 4: p2.3b Test Execution Definitions (39 slides).

Spring Break: March 11-17 – No Class.

Week 8, March 18: p2.4 How to Set Requirements and Goals (34 slides) and 2.5a SEE Test Planning (55 slides). **Outline 3 due March 24.** Chapter 5 and 6 TI Handbook and/or other sources (please cite, any citation style).

Topic for outline: Radiation hardening.

Week 9, March 25: 2.5a SEE Test Planning continued (55 slides) and 2.5b SEE Test Preparation (44 slides).

Week 10, April 1: p2.6 NSRL Overview (51 slides). **Portfolio 2 due April 9th**.

Week 11, April 8: p2.7a SEE Test Execution (55 slides)

Week 12, April 15: p2.7b Weird Data (15 slides) and 2.8a Data Analysis and Interpretation (30 slides). **Outline 4 due April 21.** Chapter 7 and 8 TI Handbook and/or other sources (please cite, any citation style).

Topic for outline: Discuss radiation testing.

Week 13, April 22: p2.8b SEE Data Fitting (35 slides).

Week 14, April 29: **Online Final.**

Last Day of Classes: May 6th

Grading: Outlines on topics to be posed by Professor (4 at 10 points each): 40 points, Portfolios (2 at 15 points each), Midterm 15% and Final 15%: Total is 100%. A is 90 and above.

Essays: Create a 2-3 page outline posed by the professor for each assignment. Organize it with sections and bullets. Additional sources besides the Texas Instruments handbook including course power points and videos can be used. Please cite source(s) in small print (any citation style is fine). A good place to find articles is the library website under Databases and then maybe under ieeexplore or Science Direct. Another good place to look for papers is Google Scholar. See syllabus for due dates.

Portfolios: Students create 4 qualitative problems and answers for each portfolio. Answers should be a few sentences, but no more than 3-4 sentences. Answers are

expected to be mostly qualitative (word answers). Multiple choice questions are not acceptable. Questions should make one think a bit. Portfolios are graded for choice of questions, broad coverage, neat presentation (should be typed) and correctness of answers.

Midterm and Final: Midterm and final are standard (online) exams of material of a qualitative nature.

Note: If you have a physical, psychological, medical or learning disability that may impact on your ability to carry out assigned course work, I would urge you to contact the staff in the Student Accessibility Support Center (SASC) at 631-632-6748. SASC will review your concerns and determine with you what accommodations are necessary and appropriate. All information and documentation of disability are confidential.