

ESE 551 Electronics and Radiation Effects Syllabus
Spring 2023 updated 12 29 2022 version 5

Prof. Thomas Robertazzi, Instructor, Prof. Emre Salman, Guest Instructor.
Email: Thomas.Robertazzi@stonybrook.edu or home 631 281 9331 (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 23: p2.1 Radiation Testing in Context (15 slides).

Week 2, Jan 30: p2.2a Natural Space Radiation Environments (50 slides).

Week 3, Feb. 6: Designing Electronics for Space I (Prof. Emre Salman). **Essay 1 due Feb 12.** Chapters 1 and 2 Texas Instrument Handbook and/or other sources (please cite, any citation style).

Discussion topic for essay: How does radiation affect matter. Describe types of radiation.

Week 4, Feb. 13: Designing Electronics for Space II (Prof. Emre Salman). **Portfolio 1 due Feb. 19.**

Week 5, Feb. 20: p2.2b Selecting a Test Facility (24 slides) and p2.3a SEE Basics (68 slides). **Essay 2 due Feb 26.** Chapters 3 and 4 TI Handbook and/or other sources (please cite, any citation style).

Discussion topic for essay: Describe various single event effects (SEE).

Week 6, Feb. 27: p2.3a SEE (Single Event Effects) Basics continued (68 slides). Online **Midterm on March 6th**.

Week 7, March 6: p2.3b Test Execution Definitions (39 slides).

Spring Break: March 13-19 – No Class.

Week 8, March 20: p2.4 How to Set Requirements and Goals (34 slides) and 2.5a SEE Test Planning (55 slides). **Essay 3 due March 26.** Chapter 5 and 6 TI Handbook and/or other sources (please cite, any citation style).

Discussion topic for essay: Discuss radiation hardening.

Week 9, March 27: 2.5a SEE Test Planning continued (55 slides) and 2.5b SEE Test Preparation (44 slides).

Week 10, April 3: p2.6 NSRL Overview (51 slides). **Portfolio 2 due April 9th**.

Week 11, April 10: p2.7a SEE Test Execution (55 slides)

Week 12, April 17: p2.7b Weird Data (15 slides) and 2.8a Data Analysis and Interpretation (30 slides). **Essay 4 due April 23.** Chapter 7 and 8 TI Handbook and/or other sources (please cite, any citation style).

Discussion topic for essay: Discuss radiation testing.

Week 13, April 24: p2.8b SEE Data Fitting (35 slides).

Week 14, May 1: **Online Final.**

Last Day of Classes: May 6th

Grading: Essays on questions 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%

Essays: Write 750 word essay answering the question posed by the professor for each assignment. Additional sources besides the Texas Instruments handbook such as course power points and videos can be used but are not necessary. Please cite source(s) (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.

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.