

ESE 512 Syllabus  
Fall 2023

Prof. Thomas Robertazzi, Instructor

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Learning Objective: To give students a broad introduction to quantum computing and information system including the underlying math and quantum circuits.

This is a course that is completely online with synchronous lectures on late Monday afternoons. Work will be assigned in place of Wednesday classes. Videos are available for all of the lectures if you can't make a class.

Texts:

- (A) **Required:** Quantum Computing for Everyone by Chris Bernhardt, MIT Press, 2019. A very accessible book for the subject. Pretty inexpensive too.
- (B) **Optional:** Chapter 1 of Quantum Computation and Quantum Information by Michael Nielsen and Isaac Chuang, Cambridge University Press, 2000. At a higher level than the Bernhardt book but chapter 1 has similar coverage.

Week 1 (Week of Aug, 28<sup>th</sup>): Introduction (see Chuang videos Overview I, II and III).

Week 2 (Sept.4): LABOR DAY NO CLASS Chapter 2: Linear Algebra (use Bernhardt book and videos from this point)

Week 3 (Sept.11<sup>th</sup>): Chapter 2: Linear Algebra (continued). **Homework 1 due Sept. 18<sup>th</sup> (see homework sheet for instructions).**

Week 4 (Sept. 18<sup>th</sup>): Chapter 4: Entanglement.

Week 5 (Sept. 25<sup>th</sup>): Chapter 4: Entanglement (continued). **Homework 2 due Oct. 2<sup>nd</sup> (see homework sheet for instructions).**

Week 6 (Oct. 2<sup>nd</sup>): Classical Gates and Circuits

Week 7 (Oct. 9<sup>th</sup>): Quantum Gates and Circuits (continued).

Week 8 (Oct. 16<sup>th</sup>): FALL BREAK-NO CLASS. Quantum Gates and Circuits (continued)

Week 9 (Oct. 23<sup>rd</sup>): Quantum Gates and Circuits (continued). **Portfolio due Oct. 30<sup>th</sup>.**

Week 10 (Oct. 30<sup>th</sup>): Quantum Algorithms.

Week 11 (Nov. 6<sup>th</sup>): **EXAM 1 DURING CLASS TIME.** Quantum Algorithms (continued).

Week 12 (Nov. 13<sup>th</sup>): Quantum Sensing (6x5 slide lectures in one class). **Homework 3 due Nov. 13<sup>th</sup> (see homework sheet for instructions).**

Week 13: (Nov. 20<sup>th</sup>): Quantum communication.

Week 14: (Nov. 27<sup>th</sup>): **EXAM 2 DURING CLASS TIME.** Hardware and Special Topics (IBM Architecture).

Week 15 (Dec. 4<sup>th</sup>): Quantum Encryption and Ion Traps.

Grading:

Portfolio: 20%, Exam 1: 20%, Homeworks (three assignments at 10% each): 30%, Exam 2: 30% Total is 100 points.

Homework:

Generally consist of 3 or 4 questions. Answer each question in no more than 3 or 4 sentences or 75 words. Be clear and to the point. Answers should be your own work.

Portfolio:

Students create four problems and answers involving quantum calculations covered in the first half of the course. See sample midterm for representative questions. Grading is based on choice of questions and correctness of answers. See syllabus for due date.

Exam 1 and 2:

Regular on line exams given during class time. You must have your camera on to have the exam graded. Must be done on your own. Three to four questions.

*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.*