PURDUE UNIVERSITY

QUANTUM DETECTORS AND SENSORS

QUANTUM TECHNOLOGY: DETECTORS AND NETWORKING MICROMASTERS®

Course Run

ECE 69502: Quantum Detectors and Sensors (1T2021a)

Instructor

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Audience

This course is ideally suited for both industry practitioners and university students with a curiosity to understand quantum technology. It assumes a very basic undergraduate level of knowledge of differential equations and teaches foundational concepts underlying modern quantum technology. Those pursuing a career in various industries related to emerging computing platforms (quantum/neuromorphic), defense/reconnaissance/surveillance systems, next generation hyperspectral imaging, information/communication systems, AI/machine perception will benefit from understanding fundamental advantages offered by quantum detectors and sensors.

Course Description

Learners will experience an overview of foundational ideas on which future quantum technology will be built. This course introduces the knowledge that will empower students to understand the difference between the quantum and classical realms. Specifically, this course teaches the concept of quantum detectors, which are central to a wide variety of quantum technologies from computing to networking. Students will also learn about quantum sensors and how they push the frontiers of existing classical sensor technology. Students can expect to learn skills for designing next generation information/communication/imaging systems that exploit unique functionality of quantum detectors and sensors.

Prerequisites

- Basic knowledge of differential equations
- Basic knowledge of electromagnetic fields

Course Learning Outcomes

After completing this course, you will be able to:

- Identify the fundamental differences between classical noise and quantum fluctuations in physical quantities (Quantum noise)
- Define the concept of coherence in space and time through the example of light (Quantum coherence)
- Describe the next generation of ultra-precision measurement tools (Quantum metrology)
- Design new systems for imaging, communications and a host of other applications exploiting superior detector technology (Quantum detectors)
- Recognize the fundamental limits of classical sensors and how to overcome them using quantum phenomena (Quantum sensing)

Required Text and Materials

Textbook

There is no required textbook for this course. Students will find the material covered in the course and provided references to be self-contained. The slides contain references to specific books and research papers.

Grading

This course will be graded based on the following criteria:

Assessment Type	Description	% of Final Grade
Homework Assignments	There will be three (3) homework assignments. Homework assignments will involve problem-solving based on material covered in the lectures.	30%
Midterm Exam	There will be one (1) midterm exam. The midterm exam will be open book/open notes, and it will consist of all multiple choice questions.	30%
Final Exam	There will be one (1) final exam. The final exam will be open book/open notes.	40%

Grading Scale

Your course grade will be based on the following grading scale: 95-100% A+; 85-95% A; 75-85% A-; 75-85% B+; 70-75% B; 65-70% B-; 60-65% C+; 55-60% C; 50-55% C-; 48-50% D+; 46-48% D; 45-46% D-; <45% F.

Estimated Effort

- 6-9 hours/week
- 16 weeks total

Languages

Content: English | Videos: English | Transcripts: English

Course Difficulty

- Advanced

Course Help

To get help with course content, comment in the discussion forums located in each unit. By commenting in the unit discussion forums, the course team will be able to respond to your question more quickly.

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"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

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