QUANTUM SCIENCE AND ENGINEERING MINOR

The Department of Electrical and Computer Engineering oversees the Quantum Science and Engineering minor. Students with questions about the minor can email eceadvise@umd.edu. For more information about the minor: https://ece.umd.edu/undergraduate/degrees/minor-quantum-science-and-engineering (https://ece.umd.edu/undergraduate/degrees/minor-quantum-science-and-engineering/)

The minor in Quantum Science and Engineering (QSE) is an interdisciplinary program offered by the Departments of Electrical and Computer Engineering, Physics, Computer Science, Mechanical Engineering, and Materials Science and Engineering. Students in the minor will develop fundamentals in math and physics needed for studying quantum systems. They will also be introduced to different aspects of quantum, such as quantum computing technologies, algorithms for quantum computers, characteristics of quantum materials, and sensing and noise in quantum systems. Besides theory courses, students will in addition be given hands-on laboratory experience, either in building quantum hardware or in programming quantum computers. This curriculum, offered through the QSE minor, will provide students with a solid foundation in quantum, preparing them for the coming quantum revolution.

Program Learning Outcomes

1. An ability to identify, formulate, and solve complex problems in quantum by applying principles of engineering, science, and mathematics
2. An ability to communicate effectively with a range of audiences
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use scientific and engineering judgment to draw conclusions
4. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

REQUIREMENTS

The Quantum Science and Engineering minor will consist of 5 courses, totaling 15-16 credits depending on which courses students select. As per university requirements, at least 3 courses (9 credits) must be unique to the minor, permitting 2 courses (6-7 credits) to double count with the students' majors. For each course, students will be able to choose among a list of courses from a course category.

Course	Title	Credits
Mathematics Course (choose one of the following):		**3-4**
MATH240	Introduction to Linear Algebra	
MATH461	Linear Algebra for Scientists and Engineers	
ENEE290	Introduction to Differential Equations and Linear Algebra for Engineers	
PHYS274	Mathematical Methods for Physics I	
MATH243	Introduction to Linear Algebra and Differential Equations	
MATH341	Multivariable Calculus, Linear Algebra, Differential Equations II (Honors)	
Introduction to Quantum Course (choose one of the following):		**3-4**
ENEE491	Quantum Phenomena in Electrical Engineering	
PHYS401	Quantum Physics I	
ENMA434	Quantum Mechanics for Engineers (Quantum Mechanics for Engineers)	
PHYS360	(Introduction to Quantum Mechanics: A Linear Algebra Approach)	
Core Course (choose one of the following):		**3**
PHYS467/ ENEE492	Introduction to Quantum Technology	
ENMA436	Introduction to Quantum Materials and Devices	
ENME434	Engineering Quantum Systems and Sensors	
PHYS/ CMSC457	Introduction to Quantum Computing	
Laboratory Course (choose one of the following):		**3**
ENEE493	Quantum Hardware Laboratory (Quantum Hardware Laboratory)	
CMSC437	Introduction to Quantum Software Laboratory (Introduction to Quantum Software Laboratory)	
Elective Course (choose one of the following): [1]		**3**
ENEE489	Topics in Electrophysics (ENEE489C Quantum Information Processing)	
ENEE489	Topics in Electrophysics (ENEE489W Incubating Quantum Leaps)	
ENMA481	Introduction to Electronic and Optical Materials	

[1] In lieu of these Elective options, students can also choose a second course from the Core or Laboratory categories.