Course Change Request

New Course Proposal

Date Submitted: 08/13/25 12:25 am

Viewing: QSE 500 : Ideas in Quantum Science and Technology

Last edit: 08/19/25 2:50 pm

Changes proposed by: kgaj

In Workflow

1. **SC Curriculum Committee**
2. SC Assistant Dean
3. Assoc Provost-Graduate
4. Registrar-Courses
5. Banner

Programs referencing this course	: Quantum Science and Engineering, MS

Are you completing this form on someone else's behalf?

No

Effective Term: Spring 2026

Subject Code: QSE - Quantum Science and Engineering **Course Number:** 500

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Ideas in Quantum Science and Technology

Banner Title: Ideas in Quantum Sci and Tech

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit (NR)
GRADUATE ONLY

Default Grade Mode: Graduate Regular

Recommended Prerequisite(s):

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

This course is designed to equip students with the essential skills necessary for navigating the dynamic landscape of the quantum industry while exposing them to modern quantum technology. By introducing students to the industry's technology and concepts essential for business interactions, they will be equipped to enter an expanding industry. Over the semester, students will develop skills to communicate across diverse disciplines, with a focus on articulating quantum information technical concepts in a clear and concise manner. The practice of communicating these technical concepts will serve as an introduction to quantum information systems and their application.

Justification:

What: Creating a new course.

Why: The field of quantum information science and technology (QIST) is experiencing rapid growth, creating more job openings. To meet this demand, students must be equipped with foundational knowledge of quantum science and engineering that will allow them to build their preparation for further study in this area.

This course addresses this need by offering a background in the foundational concepts that underlie the teaching of this subject and will be a pre-requisite for many of the courses being developed in this area. Students will learn key concepts including quantum states, superposition, measurement, and entanglement. They will be exposed to notation that they will develop more fully in future courses. They will also learn about the hardware that powers quantum technologies and to develop the ability to separate what they are able to do from the hype.

Students will examine applications of quantum technologies to better understand how they work. Through talks and papers, they will hone their communication skills. By combining conceptual foundations with the soft-skills required by the industry, this course prepares students to contribute meaningfully to research and development efforts in the rapidly evolving QIST landscape.

The proposed new course does not overlap with any existing courses.

Does this course cover material which crosses into another department?

No

Learning Outcomes:

Will this course be scheduled as a cross-level cross listed section?	No
Attach Syllabus	QSE_500_syllabus.pdf
Additional Attachments	

Have you reached out to the Libraries to determine whether there are adequate resources to support your course? If not, please email Meg Meiman, Associate University Librarian for Learning, Research, and Engagement at mmeiman2@gmu.edu.

Yes

Additional Comments:	This is a core course for the new MS in Quantum Science and Engineering.
Reviewer Comments	

Key: 19072

QSE 500: Ideas in Quantum Science and Technology

Instructor: Dr. Jessica Rosenberg
Department of Physics & Astronomy, College of Science
Email: jrosenb4@gmu.edu

Course Description:

This course is designed to equip students with the essential skills necessary for navigating the dynamic landscape of the quantum industry while exposing them to modern quantum technology. By introducing students to the industry's technology and concepts essential for business interactions, they will be equipped to enter an expanding industry. Over the semester, students will develop skills to communicate across diverse disciplines, with a focus on articulating quantum information technical concepts in a clear and concise manner. The practice of communicating these technical concepts will serve as an introduction to quantum information systems and their application.

Recommended Prerequisite: None

Course Learning Outcomes:

- Students will explain how experiments provide evidence for quantum behaviors.
- Students will describe how quantum properties are used in several key technologies.
- Students will explore at least one quantum technology in depth and will produce a final project that connects the technology to their professional interests

Course topics:

- What is quantum and how does it differ from classical physics
- How do we see quantum at macro scales?
    - Polarization of light
    - Double slit experiment
    - Emission line spectra
- Key principles of quantum
    - Quantum states
    - Quantum measurement and how it differs from classical measurement
    - Superposition
    - Entanglement
- Quantum sensing
- Quantum computing
- Quantum communications

Tentative Course Schedule:

Week	Topic	Activity/Assignment
1-2	Introduction to quantum science	5-minute introduction lightening talk; polarization as a quantum phenomenon
3-4	What is a qubit/types of qubits	Short paper on viability of one type of qubit
5	Braket notation and the representation of quantum states	Braket notation exercises
6-7	Quantum communications and cryptography	Short presentation
8-9	Quantum sensing	Short paper: evaluation of quantum sensing options for
10-11	Quantum computing basics	Researching case studies of quantum technologies (final project part 1); Presentation on technology
12-13	Quantum algorithms	Final project draft paper; presentation on application of technology and limitations
14-15	Ethics, implementation, and the state of quantum technologies	Final project paper and presentation

Grading:

Homework/short papers	40%
Quizzes	10%
Presentations	15%
Final Project	30%
Participation	5%

Grading Schema:

A	95-100	C	70-77.9
A-	90-94.9	D	65-69.9
B+	86-89.9	F	0-64.9
B	82-85.9		
B-	78-81.9		

Grading Policies:

- There are no make-ups except in a situation of extended illness or long-term personal circumstances that extend beyond the one drop you get.
- Work submitted after grading is complete will not be accepted.

Course policies that are common across Mason are available here.

AI (Artificial Intelligence) Tools Policy:

The use of AI-based tools is permitted for purposes of learning, exploring ideas, and identifying credible references. Students may use such tools to clarify concepts, brainstorm topics, or locate scholarly sources. However, AI tools must not be used to generate complete solutions to assignments, assessments, or projects, nor may students present AI-generated text, code, or other output as their own original work. Copying, paraphrasing, or otherwise incorporating AI-generated materials without attribution constitutes academic dishonesty and will be treated as plagiarism under the University's Academic Standards. Students are responsible for critically evaluating and verifying any information obtained through AI tools, ensuring that their submissions reflect their own understanding, analysis, and synthesis of course material.

QSE 500: Ideas in Quantum Science and Technology

Instructor: Dr. Jessica Rosenberg
Department of Physics & Astronomy, College of Science
Email: jrosenb4@gmu.edu

Semester and Year: TBA

Class Meeting Day(s) and Time(s): TBA
Modality: Face-to-Face
Class Location: TBA
Office Hours: TBA
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Common Policies Affecting All Courses at George Mason University:

Common policies affecting all courses at George Mason University, including

- Academic Standards
- Accommodations for Students with Disabilities
- FERPA and Use of GMU Email Addresses for Course Communication
- Title IX Resources and Required Reporting,

are available at

https://stearnscenter.gmu.edu/home/gmu-common-course-policies

You are strongly encouraged to get familiar with this additional information.