Program Change Request

EP.26.088_FINAL
Approved by EP 02/02/2026

New Proposal

Date Submitted: 08/18/25 7:32 am

Viewing: : Quantum Information Science Minor, UG

Last edit: 02/05/26 8:34 am

Changes proposed by: Eric Chitambar

In Workflow

1. U Program Review
2. Gen Ed Review
3. 1227-ENG Head
4. KP Committee Chair
5. KP Dean
6. University Librarian
7. COTE Programs
8. Provost
9. Senate EPC
10. Senate
11. U Senate Conf
12. Board of Trustees
13. IBHE
14. HLC
15. Catalog Editor
16. DMI

Approval Path

1. 08/18/25 4:38 pm Brianna Vargas-Gonzalez (bv4): Approved for U Program Review
2. 08/19/25 3:23 pm Melissa Steinkoenig (menewell): Approved for Gen Ed Review
3. 09/05/25 2:48 pm Katherine Freeman (katefree): Approved for 1227-ENG Head
4. 12/02/25 1:34 pm

Katherine Freeman (katefree): Approved for KP Committee Chair
5. 12/02/25 2:02 pm Brittany Brunson (bhitchi2): Approved for KP Dean
6. 12/02/25 2:11 pm Tom Teper (tteper): Approved for University Librarian
7. 12/02/25 2:39 pm Suzanne Lee (suzannel): Approved for COTE Programs
8. 12/04/25 9:17 am Brooke Newell (bsnewell): Approved for Provost
9. 02/05/26 9:13 am Barbara Lehman (bjlehman): Approved for Senate EPC

Proposal Type

Proposal Type:	Minor (ex. European Union Studies)

Administration Details

Official Program Name	Quantum Information Science Minor, UG
Diploma Title	-

Sponsor College	Grainger College of Engineering
Sponsor Department	Engineering Administration
Sponsor Name	Eric Chitambar
Sponsor Email	echitamb@illinois.edu
College Contact	Jonathan Makela
College Contact Email	jmakela@illinois.edu
College Budget Officer	Tessa Hile
College Budget Officer Email	tmhile@illinois.edu

If additional stakeholders other than the Sponsor and College Contacts listed above should be contacted if questions during the review process arise, please list them here.

Kate Freeman, katefree@illinois.edu
Elizabeth Goldschmidt, goldschm@illinois.edu

Does this program have inter-departmental administration?

No

Effective Catalog Term

Effective Catalog Term	Fall 2026
Effective Catalog	2026-2027

Proposal Title

Proposal Title (either Establish/Revise/Eliminate the Degree Name in Program Name in the College of XXXX, i.e., Establish the Bachelor of Science in Entomology in the College of Liberal Arts and Sciences, include the Graduate College for Grad Programs)

Establish the Undergraduate Minor in Quantum Information Science in the Grainger College of Engineering

Does this proposal have any related proposals that will also be revised at this time and the programs depend on each other? Consider Majors, Minors, Concentrations & Joint Programs in your department. Please know that this information is used administratively to move related proposals through workflow efficiently and together as needed. Format your response like the following "This BS proposal (key 567) is related to the Concentration A proposal (key 145)"

Program Justification

Provide a brief justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

This minor is designed to provide students with a multidisciplinary understanding of quantum information science (QIS) from core principles to cutting-edge applications. QIS is a rapidly developing field driven by expertise within ECE, Physics, MatSE, CS, and Math. By realizing and controlling the basic features of quantum systems, new technologies can be built that provide enhanced computational performance, increased security of data, and/or improved sensing capabilities. Establishing a pathway toward this new technology is a high priority for both the US government [1] and the state of Illinois [2]. UIUC has responded by making QIS a key area of research and investment, especially through the launching of the Illinois Quantum Information Science and Technology center (IQUIST) and the strategic hiring of multiple QIS faculty across campus. This activity has motivated an effort to enhance and emphasize QIS educational opportunities at UIUC, drawing from the significant strengths in The Grainger College of Engineering. The proposed QIS minor aims to provide a comprehensive and modern educational experience for students interested in quantum computing and information technologies, leading to a variety of professional opportunities in science, engineering and mathematics.

Enthusiasm in QIS has also translated into an increased demand for a “quantum-literate” workforce. Indeed, multiple studies have recently been conducted to assess the current QIS education landscape and job market [3, 4, 5]. While most quantum-invested companies do not require their quantum employees to have a deep understanding of QIS, surveys indicate their general desire for employees who have a QIS awareness beyond what is typical of an undergraduate STEM student. In particular, three areas of knowledge stand out as being crucial for most quantum R&D programs:

- Quantum science, photonics, and materials (in physics, EE, MatSE, etc.),
- Quantum algorithms and software development (in CS, CE, Math).

The proposed QIS minor will strike an ideal balance of providing a foundation in these areas while allowing the student to take more specialized courses on topics of interest. Its primary objective is to delineate a clear trajectory for students to acquire the competencies needed to emerge as future leaders in academia and industry, and after completing the minor, the student should have the proper training to immediately join a QIS graduate program or the QIS workforce.

While engineering administration will provide governance and general academic advising for students pursuing this minor, the Education Committee within IQUIST will offer technical advising. This means specifically that the Committee members will offer guidance to students on which QIS courses best match their interests and career aspirations. For example, a student interested in quantum algorithms will likely want to take a different sequence of QIS courses

within the minor compared to a student interested in hardware design. The subject matter experts serving on the IQUIST Education Committee will be able to advise students on not only questions of course selections but also on research, internship, and career opportunities that are available in QIS. Additionally, the IQUIST Education Committee will evaluate new QIS courses that are developed on campus and decide whether they are suitable for inclusion in the QIS minor. The IQUIST Education Committee consists of faculty members from Physics, ECE, Math, CS, and MatSE that work to coordinate and plan quantum education efforts across campus. We anticipate that most of the students interested in the Minor will already be interacting with IQUIST faculty through courses in physics, ECE, etc. and other IQUIST events. In addition, to help with advising, IQUIST and the supporting departments plan to hold a yearly informational and Q&A session on the QIS minor that is open to everyone.

[1] https://www.quantum.gov/
[2] https://www.illinois.gov/news/press-release.23784.html
[3] C. Hughes et al., "Assessing the Needs of the Quantum Industry," in IEEE Transactions on Education, vol. 65, no. 4, pp. 592-601, (2022).
[4] C. D. Aiello et al., “Achieving a Quantum Smart Workforce,” in Quantum Sci Technology vol. 6, pp. 030501, (2021).
[5] M. F. J. Fox et al., “Preparing for the Quantum Revolution: What Is the Role of Higher Education?,” in Phys Rev Phys Educ Res vol. 16, pp 020131, (2020).

Please include how the proposed minor requires some depth in the subject, but not as extensive as the major.

The proposed QIS minor will provide a learning opportunity for students interested in gaining a more holistic view of the QIS landscape while still pursuing one of the existing engineering or science degree programs at UIUC. The study and development of quantum information technologies relies on scientists and engineers having a broad swath of knowledge that spans multiple departments. The minor in QIS brings together courses across different academic departments to provide students with additional breadth and depth in the field that they would not be able to obtain through completion of their respective majors alone.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a resul of this new program/proposed change?

No

Does this new program/proposed change result in the replacement of another program?

No

Does the program include other courses/subjects outside of the sponsoring department impacted by the creation/revision of this program? If Yes is selected, indicate the appropriate courses and attach the letter of support/acknowledgement.

Yes

Courses outside of the sponsoring department/interdisciplinary departments:

ECE 305 - Quantum Systems I
CS 478 - Quantum Algorithms & Complex
ECE 404 - Quantum Information Theory
ECE 405 - Quantum Systems II
ECE 406 - Quantum Optics and Devices
PHYS 370 - Intro to Quant Info and Comp
CS 374 - Intro to Algs & Models of Comp
MATH 416 - Abstract Linear Algebra
MSE 404 - Materials Laboratories
PHYS 403 - Modern Experimental Physics
PHYS 446 - Modern Computational Physics
PHYS 485 - Atomic Phys & Quantum Theory
PHYS 486 - Quantum Physics I
PHYS 487 - Quantum Physics II
PHYS 495 - Where the Arts Meets Physics

Please attach any letters of support/ acknowledgement for any Instructional Resources. Consider faculty, students, and/or other impacted units as appropriate.	Letter of Support_CS.pdf Letter of Support_ECE.pdf Letter of Support_MSE.pdf Letter of support -Math-QIS.pdf QIS_Letter of support_Physics.pdf

Program Features

Academic Level	Undergraduate

Is this minor?

An interdisciplinary study focusing on a single theme

Is this program part of an ISBE approved licensure program?

No

Will specialized accreditation be sought for this program?

No

Other than certification via the students' degree audits, is there any additional planned mechanism to award/honor successful completion of the minor?

No

Does this program prepare graduates for entry into a career or profession that is regulated by the State of Illinois?

No

Program of Study

An undergraduate minor should consist of at least 16 - and no more than 21 hours - of course work, with at leas 6 hours of 300- or 400- level courses. Except for clearly remedial offerings, prerequisite courses within the sponsoring unit count towards the total; prerequisite courses outside the sponsoring unit do not count toward this total. The unit sponsoring the minor and that unit's college may set educationally necessary prerequisites fc eligibility for the minor within these constraints. Does this proposal meet these criteria?

Yes

Attach Program of Study related information here.

Catalog Page Text - Overview Tab

Catalog Page Overview Text

The undergraduate minor in Quantum Information Science (QIS) offers students an interdisciplinary introduction to quantum information processing in terms of fundamental principles and hardware designs. The subjects of quantum computing and communication are taught within a broad curriculum that spans quantum mechanics, quantum algorithms, quantum information theory, quantum photonics and materials, and quantum devices. The minor requires students to take at least 16 hours of quantum information courses offered across Electrical and Computer Engineering, Physics, Computer Science, Mathematics, and Materials Science and Engineering. These courses focus on material that is strongly connected to cutting-edge research areas and current interests within the QIS industry. Completing this minor will provide students with a strong foundation for advancing their careers in Quantum Information Science (QIS), whether they choose to pursue a graduate degree or join the rapidly growing QIS workforce after graduation.

Statement for
Programs of Study
Catalog

Core Courses - At least two courses must be selected from the list below.	
CS 478	Quantum Algorithms and Complexity
ECE 305	Quantum Systems I
ECE 404	Quantum Information Theory
ECE 405	Quantum Systems II
ECE 406	Quantum Optics and Devices
PHYS 370	Introduction to Quantum Information and Computing
Elective Courses - Additional courses can be selected from the list below or in consultation with an advisor.	
CS 374	Introduction to Algorithms & Models of Computation
MATH 416	Abstract Linear Algebra
MSE 404	Laboratory Studies in Materials Science and Engineering (Sections QS & QM)
PHYS 403	Modern Experimental Physics
PHYS 446	Modern Computational Physics
PHYS 485	Atomic Phys & Quantum Theory

PHYS 486	Quantum Physics I	
PHYS 487	Quantum Physics II	
PHYS 495	Where the Arts Meets Physics	
Total Hours		**16**

Program Regulation and Assessment

Plan to Assess and Improve Student Learning

Illinois Administrative Code: 1050.30(b)(1)(D) Provision is made for guidance and counseling of students, evaluations of student performance, continuous monitoring of progress of students toward their degree objectives and appropriate academic record keeping.

Student Learning Outcomes

Quantum Information Science (QIS) is an interdisciplinary field cutting across many areas of science and technology. This minor aims to support a wide range of undergraduate students by providing them with a common QIS foundation and fostering their interests in diverse quantum areas such as computing, algorithms, communication, and devices. The curriculum is designed to help meet the growing demands and expectations from the QIS research and industry sectors.

Students earning a minor in Quantum Information Science will be able to:
• Identify and explain how the use of quantum bits, called “qubits”, can enable new computing and information applications such enhanced computation, secure communication, and faster simulation;
• Solve theoretical and experimental problems in QIS based on a rigorous foundation and broad competency obtained in quantum mechanics, information theory, and quantum hardware;
• Communicate effectively with students and researchers across different areas of QIS through the development a common “language” that reflects the standards and conceptual foundation shared among theoreticians and experimentalists in the field;
• Prepare competitive application material for QIS research programs or industry positions using their broad understanding of the QIS landscape and their technical depth acquired on specific topics of interest.

Describe how, when, and where these learning outcomes will be assessed.

Describe here:

Each course selected as a part of the QIS minor has a unique set of learning objectives and desired educational outcomes. In general, students will define and explain key concepts in QIS through course homework and examinations, including multiple-choice questions and problems that require mathematical calculations. The homework and exam scores will provide one primary tool for assessing how well the learning objective are being met. Beyond homework and exams, courses like CS 478, ECE 305, PHYS 370, and PHYS 446 will require students to apply basic QIS knowledge through the development of quantum computing simulations using computational tools like Qiskit and Python.

Special attention will be given to student performance on the six "core" QIS courses of the minor. After completing the required number of core courses for the QIS minors, students will be able to define and apply the principles that form the foundation for advanced study and research in QIS.

To assess that students are developing effective QIS communication skills, courses like ECE 404, ECE 405, MSE 404, PHYS 403, and PHYS 495 have some team project or capstone written report. Student performance on these elements will demonstrate how well students can communicate QIS concepts in their own words to classmates and instructors.

Another measure of success for the QIS minor will be the number of students who enroll in graduate programs or attain employment in the QIS industry after graduation. This information will be obtained using standard campus resources (e.g., the Illini Success first destinations survey).

Identify faculty expectations for students' achievement of each of the stated student learning outcomes. What score, rating, or level of expertise will signify that students have met each outcome? Provide rating rubrics as necessary.

The faculty expect that students will achieve the stated learning outcomes by successfully completing the individual courses constituting the minor. The assessment strategies to effectively assess student achievement of learning outcomes in each course are described in the previous question. How well students meet each of these outcomes will be represented by their final course grades. Students are expected to obtain a 70% or higher in each course, which represents proficiency is the objectives of the course. Based on previous experience with student placement, it is expected that at least 66% or all students who complete the QIS minor will enter a QIS-related graduate program or profession after graduation. The IQUIST Education Committee will meet monthly to evaluate how well students are meeting these expectations. The committee will also process explicit course feedback given by the instructors in order to identify strategies that support student learning and success in the program.

Explain the process that will be implemented to ensure that assessment results are used to improve student learning.

The engineering and math departments (except Physics) providing coursework for this minor are all ABET accredited. For that accreditation, the departments each have a continuous improvement process developed which will be leveraged to ensure that the individual courses and overall learning objectives for the minor are being assessed and that those assessments are used to improve student learning. This process includes a regular evaluation of average test scores, the performance of students on subsequent courses, and their acceptance rate into graduate programs and the workforce.

This current framework will be augmented by the IQUIST Education Committee. The committee will meet monthly to assess course feedback and analyze performance data of the minor. Revisions to the program will be discussed and implemented in response to the assessments conducted. This committee has rotating members every two years, and it consists of faculty that teach the courses of the QIS minor.

Program Description and Requirements

Attach Documents

QIS Program Description Requirements.pdf

Delivery Method

This program is available:

On Campus - Students are required to be on campus, they may take some online courses.

Enrollment

Will the department limit enrollment to the minor?

No

Describe how the department will monitor the admission to/enrollment in the minor.

The process to declare a minor in The Grainger College of Engineering is described at https://advising.grainger.illinois.edu/degree-programs/minors. As a college-level minor, interested students will meet with a college advisor to discuss the program ahead of declaring the minor.

Are there any prerequisites for the proposed minor?

Yes

List the prerequisites including course titles and number of credit hours for each prerequisite course, and whether or not these prerequisites count in the total hours required for the minor.

Students taking advanced STEM courses in their respective programs will already have taken the pre-reqs for the courses in the QIS minor. Some of the QIS courses in the minor build on each other. For example, ECE 405 has a pre-req of either ECE 305 or PHYS 486; but ECE 305 and PHYS 486 have no other pre-reqs beyond what students in STEM majors already need to fulfill in their respective programs.

Number of Students in Program (estimate)

Year One Estimate	20	5th Year Estimate (or when fully implemented)
100		

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

No

Additional Budget Information

Attach File(s)

Financial Resources

How does the unit intend to financially support this proposal?

The minor is comprised of courses already regularly offered by the participating departments. There is no additional cost with course delivery.

Will the unit need to seek campus or other external resources?

No

Attach letters of support

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

We have consulted with Sarah Park, the Mathematics and Computational Science Librarian and Head of Mathematics Library. She has provided the following statement of support.

Quantum Information Science is a highly interdisciplinary field that draws on physics, materials science, computer science, electrical engineering, mathematics, and many other areas of science and engineering. Supporting this field requires the engagement of libraries and subject librarians from the Grainger Engineering Library Information Center (GELIC), the Physics & Astronomy Library, the Chemistry Library, and the Mathematics Library.

All the libraries mentioned above, along with the University Library as a whole, are recognized as leaders among the nation's top academic libraries and effectively support the programs and courses at the University of Illinois Urbana-Champaign. As such, the library's collections and resources are well-positioned to support the proposed Quantum Information Science minor.

Moreover, the IQUIST Education Committee will collaborate with the University Library to identify and secure any additional commercial or subscription-based resources that may be needed to support the QIS minor curriculum.

EP Documentation

EP Control Number	EP.26.088
Attach Rollback/ Approval Notices	

Non-EP Documentation

U Program Review Comments	Re_ Question regarding Quantum Information Science Minor, UG.pdf
Rollback Documentation and Attachment	

DMI Documentation

Attach Final	

Approval Notices

Banner/Codebook Name

Program Code:

Minor Code	Conc Code	Degree Code	Major Code

Senate Approval Date

Senate Conference Approval Date

BOT Approval Date

IBHE Approval Date

HLC Approval Date

DOE Approval Date

Effective Date:

Program Reviewer Comments

Brianna Vargas-Gonzalez (bv4) (08/18/25 4:37 pm): At this time CS 478 is a new course proposal in workflow. The red box will disappear once the course has been fully approved.

Key: 1342