SOUTH DAKOTA BOARD OF REGENTS

Academic and Student Affairs
Consent

AGENDA ITEM: 5 – B (2)
DATE: December 11-12, 2024

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SUBJECT

New Program Request – DSU – Minor in Quantum Computing for Cybersecurity

CONTROLLING STATUTE, RULE, OR POLICY

BOR Policy 2.3.2 – New Programs, Program Modifications, and Inactivation/Termination

BACKGROUND / DISCUSSION

Dakota State University (DSU) requests authorization to offer a minor in Quantum Computing for Cybersecurity. The proposed minor is one of two quantum computing minors being proposed collaboratively by DSU and South Dakota School of Mines & Technology (SDMST). These programs leverage the complementary strengths of both universities, DSU's expertise in cybersecurity and cryptography and SDMST's focus on material sciences.

The proposed minor will focus on how quantum computing leverages the unique properties of quantum mechanics—such as superposition and entanglement—to solve complex problems far beyond the capability of classical computers, enabling advancements in encryption, data security, and cryptography critical for the evolving cyber landscape.

IMPACT AND RECOMMENDATION

DSU plans to offer the minor in Quantum Computing for Cybersecurity on campus, online and at SDSMT. DSU does not request new state resources. Three new courses will be required. DSU estimates 20 students enrolled and 10 graduates by the fourth year of the program.

Board office staff recommends approval.

ATTACHMENTS

Attachment I – New Program Request Summary: DSU – Minor in Quantum Computing for Cybersecurity

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DRAFT MOTION 20241211_5-B(2):

I move to authorize DSU to offer a minor in Quantum Computing for Cybersecurity, as presented.

SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Baccalaureate Degree Minor

Use this form to propose a new baccalaureate degree minor (the minor may include existing and/or new courses. An academic minor within a degree program enables a student to make an inquiry into a discipline or field of study beyond the major or to investigate a particular content theme. Minors provide a broad introduction to a subject and therefore develop only limited competency. Minors consist of a specific set of objectives achieved through a series of courses. Course offerings occur in a specific department or may draw from several departments (as in the case of a topical or thematic focus). In some cases, all coursework within a minor proscribed; in others cases, a few courses may form the basis for a wide range of choices. Regental undergraduate minors typically consist of 18 credit hours. Proposals to establish new minors as well as proposals to modify existing minors must recognize and address this limit. The Board of Regents, Executive Director, and/or their designees may request additional information about the proposal. After the university President approves the proposal, submit a signed copy to the Executive Director through the system Chief Academic Officer. Only post the New Baccalaureate Degree Minor Form to the university website for review by other universities after approval by the Executive Director and Chief Academic Officer.

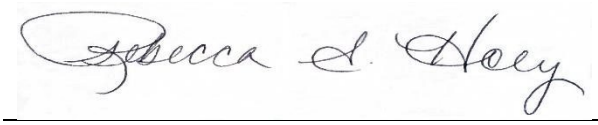
UNIVERSITY:	DSU
TITLE OF PROPOSED MINOR:	Quantum Computing for Cybersecurity
DEGREE(S) IN WHICH MINOR MAY BE EARNED:	Artificial Intelligence, Computer Science, Cyber Ops, Mathematics
EXISTING RELATED MAJORS OR MINORS:	None
INTENDED DATE OF IMPLEMENTATION:	Fall 2025
PROPOSED CIP CODE:	11.0701
UNIVERSITY DEPARTMENT:	Beacom College of Computer and Cyber Sciences
BANNER DEPARTMENT CODE:	DCOC
UNIVERSITY DIVISION:	Computer Science
BANNER DIVISION CODE:	DSCI

☒ **Please check this box to confirm that:**

- The individual preparing this request has read AAC Guideline 2.3.2.2.D, which pertains to new baccalaureate degree minor requests, and that this request meets the requirements outlined in the guidelines.
- This request will not be posted to the university website for review of the Academic Affairs Committee until it is approved by the Executive Director and Chief Academic Officer.

University Approval

To the Board of Regents and the Executive Director: I certify that I have read this proposal, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.



President of the University — Date: 10/31/2024

Note: In the responses below, references to external sources, including data sources, should be documented with a footnote (including web addresses where applicable).

1. **Do you have a major in this field (*place an "X" in the appropriate box*)?** ☐ *Yes* ☒ *No*

2. **If you do not have a major in this field, explain how the proposed minor relates to your university mission and strategic plan, and to the current Board of Regents Strategic Plan 2014-2020.**

   Links to the applicable State statute, Board Policy, and the Board of Regents Strategic Plan are listed below for each campus.

BHSU:	*SDCL § 13-59*	*BOR Policy 1.2.1*
DSU:	*SDCL § 13-59*	*BOR Policy 1.2.2*
NSU:	*SDCL § 13-59*	*BOR Policy 1.2.3*
SDSMT:	*SDCL § 13-60*	*BOR Policy 1.2.4*
SDSU:	*SDCL § 13-58*	*BOR Policy 1.2.5*
USD:	*SDCL § 13-57*	*BOR Policy 1.2.6*

Board of Regents Strategic Plan

The collaborative minors in *Quantum Computing for Cybersecurity* at Dakota State University (DSU) and *Quantum Information Science* at South Dakota Mines (SDM) exemplify a strategic partnership that drives innovation and supports both the South Dakota Board of Regents' (SDBOR) Strategic Plan and DSU's *ADVANCE* plan. These programs leverage the complementary strengths of both universities, DSU's expertise in cybersecurity and cryptography and SDM's focus on material sciences—addressing critical needs for workforce development, economic growth, and academic excellence in the state. This interdisciplinary collaboration ensures that students receive specialized, high-impact education aligned with the emerging quantum computing industry, which Governor Noem has identified as "the next big industry" for South Dakota.

The partnership directly aligns with the SDBOR Strategic Plan Goal 4, by creating academic programs that respond to the future demands of the workforce, ensuring South Dakota remains competitive in the knowledge economy. As quantum computing reshapes fields like cybersecurity and artificial intelligence, these minors prepare students to address complex technological challenges, contributing to regional workforce development and positioning the state at the forefront of technological innovation. The efficient use of faculty expertise and shared resources between the two institutions aligns with Goal 1, promoting responsible governance and minimizing program duplication across the university system.

These programs advance DSU's ADVANCE strategic plan by driving success in key focus areas. First, the minors support Pillar 1: Increase Student Success, providing students with cutting-edge education in quantum technologies, which enhances employability and aligns with DSU's goal of 100% job placement within six months of graduation. Additionally, the minors contribute to Pillar 3: Grow Scholarship, Research, Intellectual Property, & Economic Development by promoting student and faculty participation in research, increasing research funding, and creating new economic opportunities. This collaboration also supports Pillar 5: Increase Sustainability & Resilience, ensuring that DSU can increase enrollment and double the number of graduates in high-demand fields like cybersecurity, computer science, and AI.

Ultimately, the partnership between DSU and SDM ensures responsible stewardship of state resources while fostering academic innovation, aligning both with the SDBOR's objectives and DSU's mission to be a leader in cyber and quantum education. Together, these minors not only prepare students to thrive in the rapidly evolving quantum industry but also position South Dakota as a national hub for technological research and workforce development.

3. What is the nature/purpose of the proposed minor? Please include a brief (1-2 sentence) description of the academic field in this program.

As the science behind quantum computing advances, DSU must include this field to achieve its mission to prepare cyber-savvy graduates. Quantum computing is the advancement of the special focus of DSU as a technologically focused university. Quantum computing leverages the unique properties of quantum mechanics—such as superposition and entanglement—to solve complex problems far beyond the capability of classical computers, enabling advancements in encryption, data security, and cryptography critical for the evolving cyber landscape.

4. How will the proposed minor benefit students?

The minor in Quantum Computing for Cybersecurity will provide Bachelor of Science level students in AI, Computer Science, Cyber Operations, and Math with basic knowledge of quantum computing, leveraging their degrees to prepare them for careers in a burgeoning quantum industry.

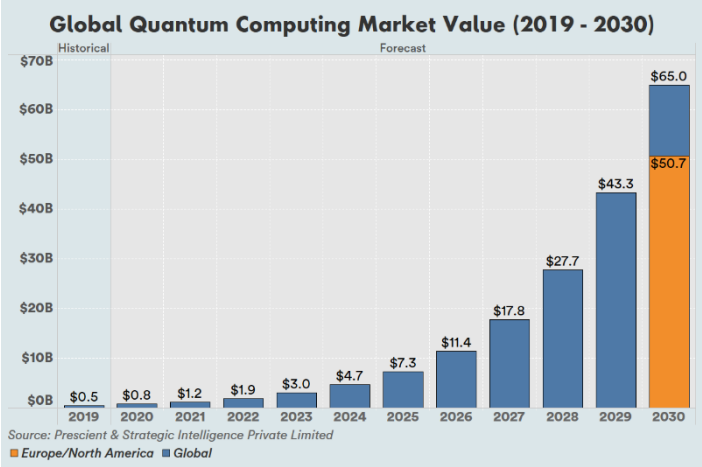
Desired student outcomes for the Minor in Quantum Computing for Cybersecurity:

1. Explain Quantum Computing Fundamentals: Students will be able to explain core concepts such as superposition, entanglement, and quantum gates, and how they differ from classical computing models.
2. Apply Quantum Algorithms to Cybersecurity Problems: Students will apply quantum algorithms to solve cybersecurity problems, such as encryption and secure communication, demonstrating the ability to evaluate and implement quantum-based solutions to current and future security challenges.
3. Implement Post-Quantum Cryptography Techniques: Students will evaluate post-quantum cryptography methods then implement them in practical settings to secure systems against quantum computing threats, understanding their role in future cybersecurity solutions.
4. Create Solutions for Cybersecurity Challenges Using Quantum Computing: Students will create interdisciplinary solutions to complex cybersecurity problems by integrating knowledge from AI, computer science, mathematics, and quantum computing.

5. **Describe the workforce demand for graduates in related fields, including national demand and demand within South Dakota.** *Provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc. Please cite any sources in a footnote.*

The workforce demand for graduates with expertise in quantum computing and cybersecurity is rapidly growing both nationally and within South Dakota. This demand is driven by the increasing need for secure computing solutions in light of the significant impact of quantum computing on encryption methods, and the overall rise in cyber threats.

The market for quantum computing is predicted to grow 20-fold by 2030. DSU will provide qualified students to work in this burgeoning industry. These activities present new opportunities for DSU students to enter an NSF defined "Industry of the Future."



Thousands of universities, research organizations, and enterprises are already learning and experimenting with quantum computing. Given the amount of quantum computing investment, advancements, and activity, the industry is set for a dynamic change, similar to that caused by AI – increased performance, functionality, and intelligence. Quantum computing is where AI was in 2015, fascinating but not widely utilized. Fast forward just five years and AI is being integrated into almost every platform and application. In just five years, quantum computing could take computing and humanity to a new level of knowledge and understanding.

At the national level, the U.S. Bureau of Labor Statistics (BLS) projects that employment of information security analysts—a field closely related to cybersecurity—will grow 35% from 2021 to 2031, much faster than the average for all occupations. This growth is attributed to the rising frequency of cyberattacks and the increasing need to implement strong security protocols across industries. While the BLS does not yet have specific data for quantum computing roles, the field is expected to grow alongside broader trends in cybersecurity and advanced computing. Industries such as defense, finance, healthcare, and technology are seeking experts in quantum computing to develop next-generation encryption methods and protect sensitive data against future quantum threats.

Companies like IBM, Google, and Rigetti Computing are investing heavily in quantum computing research, creating new jobs in quantum software development, quantum algorithm design, and post-quantum cryptography. According to a report by Burning Glass Technologies, job postings for quantum computing roles in the U.S. have increased by over 100% in recent years, highlighting the emerging need for a skilled workforce in this area.

In South Dakota, demand for cybersecurity professionals is also on the rise. The South Dakota Department of Labor and Regulation projects a 31.7% increase in cybersecurity-related jobs

between 2020 and 2030, with roles like information security analysts, computer scientists, and systems engineers being in high demand. Companies and institutions across the state, including East River Electric, Avera Health, and Daktronics, have recognized the need to strengthen their cybersecurity measures to protect sensitive data from evolving threats.

Overall, both nationally and within South Dakota, there is a strong and growing demand for graduates with expertise in quantum computing and cybersecurity. As industries recognize the critical need for post-quantum cryptography and other quantum-based technologies, graduates with this specialized knowledge will be well-positioned to meet workforce needs and lead in protecting critical systems from emerging threats.

6. **Provide estimated enrollments and completions in the table below and explain the methodology used in developing the estimates (*replace "XX" in the table with the appropriate year*).**

	Fiscal Years*			
	1st	2nd	3rd	4th
Estimates	FY 26	FY 27	FY 28	FY 29
Students enrolled in the minor (fall)	**5**	**10**	**15**	**20**
Completions by graduates	**0**	**0**	**5**	**10**

*Do not include current fiscal year.

7. **What is the rationale for the curriculum? Demonstrate/provide evidence that the curriculum is consistent with current national standards.**

The rationale for the curriculum of the Minor in Quantum Computing for Cybersecurity is in the growing importance of quantum computing in cybersecurity, as well as the need for professionals who can apply quantum technologies to secure information systems. The curriculum is designed to provide students with a foundational understanding of quantum computing principles, practical applications in cybersecurity, and critical skills in post-quantum cryptography, aligning with current national standards and industry demands.

The curriculum takes an interdisciplinary approach by combining core elements of quantum computing, mathematics, and cybersecurity, reflecting the interdisciplinary nature recommended by national organizations such as the National Security Agency's (NSA) Center of Academic Excellence (CAE) guidelines. The CAE standards emphasize the integration of emerging technologies, like quantum computing, into cybersecurity education to address future threats, which is achieved by offering courses like "Quantum Computing Applications" and "Post-Quantum Cryptography."

The inclusion of a course specifically focused on Post-Quantum Cryptography ensures that students are prepared for the shift in encryption methods required by advancements in quantum computing, which aligns with the National Institute of Standards and Technology (NIST) roadmap for post-quantum cryptographic algorithms. NIST has prioritized the development of quantum-resistant cryptography standards to secure digital communications in the era of quantum computing. The curriculum directly supports this by educating students on the latest cryptographic protocols.

Practical, Hands-On Experience: Courses such as "Quantum Computing Applications" are in line with DSU's approach and will emphasize real-world applications of quantum algorithms and their impact on cybersecurity. This practical focus is consistent with the Computing Curricula 2020 (CC2020) standards developed by the Association for Computing Machinery (ACM) and IEEE Computer Society, which stress the importance of hands-on learning experiences that connect theory with practice, particularly in emerging fields like quantum computing.

The required courses, including "Introduction to Quantum Computing" and "Discrete Mathematics," align with foundational knowledge areas outlined by the Cybersecurity Education Framework from the National Initiative for Cybersecurity Education (NICE). These courses ensure that students gain a strong theoretical understanding that is necessary for advanced studies and practical application in cybersecurity roles.

8. Complete the tables below. Explain any exceptions to Board policy requested.
Minors by design are limited in the number of credit hours required for completion. Minors typically consist of eighteen (18) credit hours, including prerequisite courses. In addition, minors typically involve existing courses. If the curriculum consists of more than eighteen (18) credit hours (including prerequisites) or new courses, please provide explanation and justification below.

This minor is designed for students who have prerequisites to these courses in their major. The required courses for this minor overlap with fewer than 6 credits required for any major, including prerequisites.

A. Distribution of Credit Hours

[Insert title of proposed minor]	Credit Hours	Percent
Requirements in minor	15	83%
Electives in minor	3	17%
Total	18	

B. Required Courses in the Minor

Prefix	Number	Course Title *2 of 3 required*	Prerequisites for Course	Credit Hours	New (yes, no)
CSC	250*	Computer Science II	CSC 150	3	No
CSC	275	Introduction to Quantum Computing	CSC 250	3	Yes
MATH	201	Introduction to Discrete Mathematics	MATH 114 or MATH 115	3	No
MATH	437	Post-Quantum Cryptography	CSC 250 and MATH 201	3	No
CSC	483	Quantum Computing Applications	CSC 275 and MATH 201	3	Yes
			Subtotal	15	

*CSC 250 is a required course for students majoring in AI, Computer Science, and Cyber Operations. These students will select one more course from the elective options.

9. Elective Courses in the Minor: List courses available as electives in the program. Indicate any proposed new courses added specifically for the minor.

Prefix	**Number**	**Course Title** *(add or delete rows as needed)*	**Prerequisites for Course** *Include credits for prerequisites in subtotal below.*	**Credit Hours** *Choose 11 -12 Cr. Hr.*	**New (yes, no)**	**Prereqs Covered in Core**
CSC	247	Introduction to Artificial Intelligence	CSC 150 and MATH 201	3	No	Yes, all
MATH	321	Differential Equations	MATH 125	3	No	Only Math
PHYS	331	Introduction to Modern Physics	PHYS 113 or PHYS 213	3	No	None
CSC	386	Applications of Deep Learning	CSC 250	3	No	Yes, all
NANO	404	Nanophotonics		3	No	N/A
NANO	405	Quantum Photonics and Communications	NANO 404	4	No	None
MATH	436	Number Theory and Cryptography	MATH 201 and CSC 250	3	No	Yes, all
PHYS	471	Quantum Mechanics	MATH 225 or MATH 321 and PHYS 331	3	No	None
PHYS	492	ST: Advanced Quantum Simulations in Physical Sciences and Chemistry	CSC 275, MATH 201, PHYS 331, and PHYS 471	3	Yes	None for PHYS 331 and 471
				3		

A. What are the learning outcomes expected for all students who complete the minor? How will students achieve these outcomes? *Complete the table below to list specific learning outcomes—knowledge and competencies—for courses in the proposed program in each row. Label each column heading with a course prefix and number. Indicate required courses with an asterisk (*). Indicate with an X in the corresponding table cell for any student outcomes that will be met by the courses included. All students should acquire the program knowledge and competencies regardless of the electives selected. Modify the table as necessary to provide the requested information for the proposed program.*

Individual Student Outcome (Same as in the text of the proposal)	CSC 275	MATH 201	MATH 437	CSC 483
Explain Quantum Computing Fundamentals	X	X		
Apply Quantum Algorithms to Cybersecurity Problems		X		X
Implement Post-Quantum Cryptography Techniques			X	X

Create Solutions for Cybersecurity Challenges Using Quantum Computing			X	X

Modify the table as necessary to include all student outcomes. Outcomes in this table are to be the same ones identified in the text.

10. What instructional approaches and technologies will instructors use to teach courses in the minor? *This refers to the instructional technologies and approaches used to teach courses and NOT the technology applications and approaches expected of students.*

The courses are primarily a combination of face—to-face and online lectures.

11. Delivery Location

Note: The accreditation requirements of the Higher Learning Commission (HLC) require Board approval for a university to offer programs off-campus and through distance delivery.

Dakota State University

A. Complete the following charts to indicate if the university seeks authorization to deliver the entire program on campus, at any off campus location (e.g., USD Community Center for Sioux Falls, Black Hills State University-Rapid City, Capital City Campus, etc.) or deliver the entire program through distance technology (e.g., as an online program)?

	Yes/No	***Intended Start Date***
On campus	Yes	**Fall 2025**

	Yes/No	***If Yes, list location(s)***	***Intended Start Date***
Off campus	Yes	SDM	**Fall 2025**

	Yes/No	***If Yes, identify delivery methods*** *Delivery methods are defined in AAC Guideline 2.4.3.B.*	***Intended Start Date***
Distance Delivery (online/other distance delivery methods)	Yes	X15 – Online Asynchronous	**Fall 2025**
Does another BOR institution already have authorization to offer the program online?	No	**If yes, identify institutions:**	

B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the minor through distance learning (e.g., as an online program)? *This question responds to HLC definitions for distance delivery.*

	Yes/No	***If Yes, identify delivery methods***	***Intended Start Date***

Distance Delivery (online/other distance delivery methods)	Yes	X15 – Online Asynchronous	**Fall 2025**

12. **Does the University request any exceptions to any Board policy for this minor? Explain any requests for exceptions to Board Policy.** *If not requesting any exceptions, enter "None."*

    None.

13. **Cost, Budget, and Resources: Explain the amount and source(s) of any one-time and continuing investments in personnel, professional development, release time, time redirected from other assignments, instructional technology & software, other operations and maintenance, facilities, etc., needed to implement the proposed minor.** *Address off-campus or distance delivery separately.*

    The proposed *Quantum Computing for Cybersecurity* minor will require the development of two new courses, representing a one-time investment of approximately 40 hours for course creation. DSU already has the necessary faculty expertise to design and deliver these courses, ensuring no additional staffing costs.

Students can use local or cloud-based simulators for most of their practice and exercises. However, running actual jobs on quantum computing platforms like AWS Braket or IBM Cloud can be costly, depending on the platform. For instance, IBM charges approximately $50 to $100 per minute for running quantum jobs. On AWS Braket, the cost is around $0.01 to $0.03 per shot, and a single job usually requires at least a few hundred to a thousand shots to achieve reasonable accuracy, leading to higher overall costs. This expense may be offset for selected students at DSU and SDSMT by the $3 million Senate Bill 45 (2024) appropriation for a Center for Quantum Information Sciences & Technology through 2029.

14. **New Course Approval: New courses required to implement the new minor may receive approval in conjunction with program approval or receive approval separately. Please check the appropriate statement (*place an "X" in the appropriate box*).**

    ☒ YES,
    the university is seeking approval of new courses related to the proposed program in conjunction with program approval. All New Course Request forms are included as Appendix C and match those described in section 7.

    ☐ NO,
    the university is not seeking approval of all new courses related to the proposed program in conjunction with program approval; the institution will submit new course approval requests separately or at a later date in accordance with Academic Affairs Guidelines.

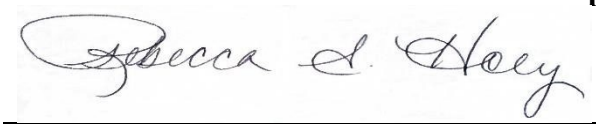
15. **Additional Information:** *Additional information is optional. Use this space to provide pertinent information not requested above. Limit the number and length of additional attachments. Identify all attachments with capital letters. Letters of support are not necessary and are rarely included with Board materials. The University may include responses to questions from the Board or the Executive Director as appendices to the original proposal where applicable. Delete this item if not used.*

SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Course Request

Use this form to request a new common or unique course. Consult the system course database through for information about existing courses before submitting this form.

DSU	**Beacom College of Computer and Cyber Sciences**
Institution	**Division/Department**



	10/28/2024
Institutional Approval Signature	**Date**

Section 1. Course Title and Description

If the course contains a lecture and laboratory component, identify both the lecture and laboratory numbers (xxx and xxxL) and credit hours associated with each. Provide the complete description as you wish it to appear in the system course database, including pre-requisites, co-requisites, and registration restrictions.

Prefix & No.	Course Title	Credits
CSC 275	Introduction to Quantum Computing	3

NOTE: The Enrollment Services Center assigns the short, abbreviated course title that appears on transcripts. The short title is limited to 30 characters (including spaces); meaningful but concise titles are encouraged due to space limitations in the student information system.

Course Description

This course provides students with a fundamental understanding of key concepts, principles, and techniques in quantum computing. It is available to high school students through the dual enrollment program.

NOTE: Course descriptions are short, concise summaries that typically do not exceed 75 words. DO: Address the content of the course and write descriptions using active verbs (e.g., explore, learn, develop, etc.). DO NOT: Repeat the title of the course, layout the syllabus, use pronouns such as "we" and "you," or rely on specialized jargon, vague phrases, or clichés.

Pre-requisites or Co-requisites (add lines as needed)

Prefix & No.	Course Title	Pre-Req/Co-Req?
CSC 250	Computer Science II	Pre-Req

Registration Restrictions

Section 2. Review of Course

2.1. **Will this be a unique or common course (*place an "X" in the appropriate box*)?**

☒ **Unique Course**
If the request is for a unique course, institutions must review the common course catalog in the system course database to determine if a comparable common course already exists. List the two closest course matches in the common course catalog and provide a brief narrative explaining why the proposed course differs from those listed. If a search of the common course catalog determines an existing common course exists, complete the Authority to Offer an Existing Course Form. Courses requested without an attempt to find comparable courses will not be reviewed.

Prefix & No.	Course Title	Credits
NANO 571	Quantum Mechanics (SDM)	4
PHYS 471	Quantum Mechanics (USD and SDSU)	4
CHEM 345	Quantum Mechanics of Chemical Systems (SDSU)	2

Provide explanation of differences between proposed course and existing system catalog courses below:

The proposed course is a lower-level undergraduate course specifically designed to appeal to a broader range of students. Quantum mechanics is different than quantum computing. Quantum mechanics is a branch of physics that describes the behavior of particles at the atomic and subatomic levels, introducing concepts like wave-particle duality, superposition, and entanglement. It serves as the theoretical foundation for technologies such as semiconductors and lasers. Quantum computing, on the other hand, applies these principles to computation, using qubits—quantum bits that can represent 0, 1, or both simultaneously through superposition. By leveraging phenomena like entanglement and quantum interference, quantum computers can solve certain complex problems, such as large-number factorization and optimization, more efficiently than classical computers. In essence, quantum mechanics explains the science behind quantum behavior, while quantum computing harnesses that behavior to revolutionize computing.

☐ **Common Course** *Indicate universities that are proposing this common course:*

☐ BHSU ☐ DSU ☐ NSU ☐ SDSMT ☐ SDSU ☐ USD

Section 3. Other Course Information

3.1. Are there instructional staffing impacts?

☐ **No**. Replacement of _____
(course prefix, course number, name of course, credits)
*Attach course deletion form

Effective date of deletion: Click here to enter a date.

☒ **No**. Schedule Management, explain below:
The course will be added to the rotation schedule with existing faculty members.

☐ **Yes**. Specify below:

3.2. Existing program(s) in which course will be offered (i.e., any current or pending majors, minors, certificates, etc.):

This is designed to support the addition of Quantum Computing for Cybersecurity Minor. Elective in other majors.

3.3. Proposed instructional method by university *(as defined by AAC Guideline 2.4.3.A)*:
Please provide a brief description of how the course is appropriate for the instructional method, as defined in AAC Guidelines.

R – Lecture. Because this is an introductory course, the learning environment will be highly structured with course content largely rooted in facts, principles, ideas, and theory.

3.4. Proposed delivery method by university *(as defined by AAC Guideline 2.4.3.B and 2.4.3.B(A-1))*:

X01 (F2F) and X15 (Online Asynchronous)

3.5. Term change will be effective: Fall 2025

3.6. Can students repeat the course for additional credit?
☐ Yes, total credit limit: _____ ☒ No

3.7. Will grade for this course be limited to S/U (pass/fail)?
☐ Yes ☒ No

3.8. Will section enrollment be capped?
☒ Yes, max per section: 20 ☐ No

3.9. Will this course equate (i.e., be considered the same course for degree completion) with any other unique or common courses in the common course system database?

☐ Yes ☒ No
If yes, indicate the course(s) to which the course will equate (add lines as needed):

Prefix & No.	Course Title

3.10. Is this prefix approved for your university?
☒ Yes ☐ No
If no, provide a brief justification below:

Section 4. Department and Course Codes (Completed by University Academic Affairs)

4.1. University Department: Computer Science

4.2. Banner Department Code: DCSC

4.3. Proposed CIP Code: 11.0101

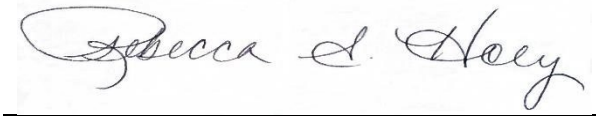
Is this a new CIP code for the university? ☐ Yes ☒ No

SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Course Request

Use this form to request a new common or unique course. Consult the system course database through for information about existing courses before submitting this form.

DSU	**Beacom College of Computer and Cyber Sciences**
Institution	**Division/Department**



	10/28/2024
Institutional Approval Signature	**Date**

Section 1. Course Title and Description

If the course contains a lecture and laboratory component, identify both the lecture and laboratory numbers (xxx and xxxL) and credit hours associated with each. Provide the complete description as you wish it to appear in the system course database, including pre-requisites, co-requisites, and registration restrictions.

Prefix & No.	Course Title	Credits
CSC 483	Quantum Computing Applications	3

NOTE: The Enrollment Services Center assigns the short, abbreviated course title that appears on transcripts. The short title is limited to 30 characters (including spaces); meaningful but concise titles are encouraged due to space limitations in the student information system.

Course Description

This course provides students with an application-based foundation in cybersecurity focused applications. Some topics and applications in quantum chemistry, physics and mathematics will be covered as well as a broad area of quantum computing and quantum information science applications.

NOTE: Course descriptions are short, concise summaries that typically do not exceed 75 words. DO: Address the content of the course and write descriptions using active verbs (e.g., explore, learn, develop, etc.). DO NOT: Repeat the title of the course, layout the syllabus, use pronouns such as "we" and "you," or rely on specialized jargon, vague phrases, or clichés.

Pre-requisites or Co-requisites (add lines as needed)

Prefix & No.	Course Title	Pre-Req/Co-Req?
CSC 275	Introduction to Quantum Computing	Pre-Req
MATH 201	Introduction to Discrete Mathematics	Pre-Req

Registration Restrictions

Section 2. Review of Course

2.2. **Will this be a unique or common course (*place an "X" in the appropriate box*)?**

☒ **Unique Course**
If the request is for a unique course, institutions must review the common course catalog in the system course database to determine if a comparable common course already exists. List the two closest course matches in the common course catalog and provide a brief narrative explaining why the proposed course differs from those listed. If a search of the common course catalog determines an existing common course exists, complete the Authority to Offer an Existing Course Form. Courses requested without an attempt to find comparable courses will not be reviewed.

Prefix & No.	Course Title	Credits
NANO 571	Quantum Mechanics (SDM)	4
PHYS 471	Quantum Mechanics (USD and SDSU)	4
CHEM 345	Quantum Mechanics of Chemical Systems (SDSU)	2

Provide explanation of differences between proposed course and existing system catalog courses below:

CSC 483 Quantum Computing Applications bridges quantum theory with computational practices, with a focus on real-world applications in cybersecurity and computing, whereas the other courses emphasize the theoretical underpinnings of quantum mechanics within specific scientific contexts.

The proposed course primarily focuses on application-based quantum computing, particularly for cybersecurity, quantum information science, and computational problem-solving. It covers how quantum principles are applied to practical computing tasks, such as encryption and optimization. It also includes applications beyond just physics or chemistry, integrating content from mathematics, quantum information science, and cybersecurity. It also introduces how quantum computing can solve real-world challenges in various industries.

☐ **Common Course** *Indicate universities that are proposing this common course:*

☐ BHSU ☐ DSU ☐ NSU ☐ SDSMT ☐ SDSU ☐ USD

Section 3. Other Course Information

3.11. Are there instructional staffing impacts?

☐ **No**. Replacement of _____
(course prefix, course number, name of course, credits)
*Attach course deletion form

Effective date of deletion: Click here to enter a date.

☒ **No**. Schedule Management, explain below:
The course will be added to the rotation schedule with existing faculty members.

☐ **Yes**. Specify below:

3.12. Existing program(s) in which course will be offered (i.e., any current or pending majors, minors, certificates, etc.):

This is designed to support the addition of Quantum Computing for Cybersecurity Minor.

3.13. Proposed instructional method by university *(as defined by AAC Guideline 2.4.3.A)*:
Please provide a brief description of how the course is appropriate for the instructional method, as defined in AAC Guidelines.

R – Lecture. The learning environment will be highly structured with course content largely rooted in facts, principles, ideas, and theory.

3.14. Proposed delivery method by university *(as defined by AAC Guideline 2.4.3.B and 2.4.3.B(A-1))*:
X01 (F2F) and X15 (Online Asynchronous)

3.15. Term change will be effective: Fall 2025

3.16. Can students repeat the course for additional credit?
☐ Yes, total credit limit: _____ ☒ No

3.17. Will grade for this course be limited to S/U (pass/fail)?
☐ Yes ☒ No

3.18. Will section enrollment be capped?
☒ Yes, max per section: 20 ☐ No

3.19. Will this course equate (i.e., be considered the same course for degree completion) with any other unique or common courses in the common course system database?

☐ Yes ☒ No
If yes, indicate the course(s) to which the course will equate (add lines as needed):

Prefix & No.	Course Title

3.20. Is this prefix approved for your university?
☒ Yes ☐ No
If no, provide a brief justification below:

Section 4. Department and Course Codes (Completed by University Academic Affairs)

4.4. University Department: Computer Sciences

4.5. Banner Department Code: DCSC

4.6. Proposed CIP Code: 11.0101

Is this a new CIP code for the university? ☐ Yes ☒ No