Intent to Plan for a New Program
South Dakota Board of Regents
Academic Affairs Forms

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Use this form to request authorization to plan a new baccalaureate major, associate degree program, or graduate program; formal approval or waiver of an Intent to Plan is required before a university may submit a related full proposal request for a new program. The Executive Director and/or their designees may request additional information. After the university President approves the Intent to Plan, submit a signed copy to the Executive Director through the System Academic Officer through the proper process. Only post the Intent to Plan to the university website for review by other universities after approval by the Executive Director, System Academic Officer or designee. This form is meant to capture critical elements for stakeholders to review prior to a full proposal.

University	SDSU - South Dakota State University
Degree	BS : Bachelor of Science
Name of Major	X999 : New Major Requested **Healthcare Systems Engineering**
Specialization Required?	No *Note: If the new proposed program includes specific specializations within it, complete and submit a New Specialization Form for each proposed specialization and attach it to this form. Since specializations appear on transcripts, they require Board approval.*
College/Department	3E : SDSU JeromeJ Lohr College Engr/SMEC : Mechanical Engineering
Intended Date of Full Proposal	Fall 2024
Planned CIP Code	14.2701

Program Description

1. Provide the working program description that may appear in the university catalog.

Healthcare Systems Engineering is a multidisciplinary field that encompasses a wide range of technologies to enhance human health and well-being. As healthcare is becoming increasingly complex under technological, economic, social, and regulatory impacts, there is a pressing need for a holistic approach in addressing these challenges through convergent research and education and train future professionals who are ready to serve the healthcare industry. Healthcare Systems Engineering integrates engineering, computer science, data science, and health sciences. The B.S. in Healthcare Systems Engineering program will prepare students for rapidly emerging technologies in artificial intelligence (AI) and machine learning (ML), big data and cybersecurity, biomedical informatics, pharmaceutical 3D (Design, Development, and Delivery) and testing, genetic and tissue engineering, computational physiological modeling, imaging science, as well as healthcare infrastructure, environmental health and safety, rural health, e-health and telemedicine. This program will provide students with a mastery of incorporating engineering principles and mathematical methods and using cutting-edge tools and techniques to bridge knowledge gaps between healthcare professionals and engineers.

Additional information about the proposed program:
Healthcare systems engineering is a field that focuses on optimizing and improving healthcare delivery systems. Professionals in this field use engineering principles and methodologies to enhance the efficiency, quality, and safety of healthcare processes and systems. Healthcare systems engineers analyze and design workflows, implement quality improvement initiatives, and work towards optimizing the overall performance of healthcare organizations. Through a systems approach healthcare systems engineering focuses on the use of data, interoperability of systems, and improvement in patient safety and healthcare outcomes.

It is important to distinguish the proposed program from the traditional Biomedical Engineering (BME) programs. Unlike these traditional BME programs, which combine engineering sub-disciplines (typically electrical engineering, mechanical engineering, and material sciences) to develop prosthetics, medical devices, and instrumentation for the medical industry, the proposed program will prepare engineers who will adopt a systems approach – combining engineering and health sciences.

Strategic Impact

2. Describe how the program fits in with the institutional mission, strategic plan, existing institutional program array, and academic priorities.

SDSU is statutorily authorized through SDCL § 13-58.1, to offer academic programs in the liberal arts and sciences and professional education in agriculture, education, engineering, home economics, business economics, nursing, and pharmacy. The engineering and healthcare focus of this major fits within the statutory mission of South Dakota State University.

The mission of South Dakota State University includes providing a rich academic experience through innovation, creative activities, and research that enhances the quality of life in South Dakota, the region, the nation, and the world. The proposed program aligns well with SDSU's mission and strategic plan; Pathway to Premier 2030. More specifically, it is a perfect fit for the strategic goal "Achieve Excellence Through Transformative Education" which calls for (a) investments in innovative undergraduate and graduate academic programs, and (b) adapting pedagogical approaches by engaging learners in new and innovative ways to enhance student success and inspire current and future students. Technological breakthroughs like generative AI and computational modeling in high-resolution anatomic domains will revolutionize the healthcare industry. This is the most opportune time to invest in developing and offering this program to equip students with the skills to address future challenges using innovative science, engineering, and computational methods. Such a program does not exist in the institution's current program array or in the region. As South Dakota's land-grant university, SDSU is uniquely situated to pioneer this innovative Healthcare Systems Engineering program. SDSU has thriving programs in all areas to make it an innovative, unique, and successful program. The Jerome J. Lohr College of Engineering offers programs in statistics, data science, computer science, mechanical engineering, and electrical engineering that can be easily leveraged to offer the proposed engineering program. In addition, SDSU offers health-related programs from the College of Nursing, College of Natural Sciences, College of Pharmacy and Allied Health Professions, College of Education and Human Sciences, and College of Agriculture, Food & Environmental Sciences. Many of SDSU's professors are already engaged in healthcare-related research and projects. This existing strength aligns seamlessly with the proposed program, making it a logical and strategic addition to our offerings.

If the program does not align to the strategic plan, provide a compelling rationale for the institution to offer the program.

N/A

3. How does the program connect to the Board of Regent's Strategic Plan?

The proposed B.S. in Healthcare Systems Engineering aligns with the SDBOR Strategic Plan Goal 4: Workforce and Economic Development which expects South Dakota public universities to create academic programming that responds to the changing educational and workforce skills needed to meet the demands through 2030 and ensure engagement designed to enhance the state's long-term economy. South Dakota and the US are the leaders and will continue to lead the advancements in human and animal healthcare. As healthcare is becoming increasingly complex under technological, economic, social, and regulatory impacts[1], there is a pressing need for a holistic approach in addressing these challenges through convergent research and education and train future professionals who are ready to serve the healthcare industry. Healthcare systems engineering is a future focused program to equip students with the skills that will not only be needed to ensure the quality of healthcare to the public but will be critical for the continued growth of the healthcare industry in South Dakota and the US.

[1] Chyu, M-C, et. al (2015). "Healthcare Engineering Defined: A White Paper," Journal of Healthcare Engineering, Vol. 6, No. 4

Program Summary

4. If a new degree is proposed, what is the rationale?

This question refers to the type of degree, not the program. For example, if your university has authorization to offer the Bachelor of Science and the program requested is a Bachelor of Science, then the request is not for a new degree.

This is not a new degree.

5. What modality/modalities will be used to offer the new program?

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.

	Yes/No	Intended Start Date
On Campus	Yes	Fall 2024

	Yes/No	Location(s)	Intended Start Date
Off Campus Location	No		

	Yes/No	Delivery Method(s)	Intended Start Date
Distance Delivery	No		

	Yes/No	Identify Institutions
Does another BOR institution already have authorization to offer the program online?	No	

6. If the program will be offered through distance delivery, identify the planned instructional modality:

Not Applicable : Program will not be offered through distance delivery.

Academic Quality

7. What peer institutions and current national standards will be referenced to develop the curriculum for this program? Include links to at least 3 comparable programs at peer institutions and links to national or accreditation standards, if any.

The proposed program is an innovative and transformative engineering program, that is not currently being offered at any of the Regental universities or peer institutions. Healthcare systems engineers must complete an undergraduate, graduate, or certification program to be eligible for work in this field. Degree and certificate programs provide knowledge and the skills necessary to achieve such vital results in healthcare.

SDSU will complete a review of other related systems engineering programs and the standards and requirements outlined by Accreditation Board for Engineering and Technology (ABET) to develop the curriculum.
• Accreditation Board for Engineering and Technology (ABET) -https://www.abet.org/accreditation/
• Healthcare Engineering Technology Management (B.S.), Indiana University - Purdue University Indianapolis (IUPUI) - https://et.iupui.edu/departments/ent/programs/hetm/
• Healthcare Systems Engineering (M.S.), Johns Hopkins University- https://ep.jhu.edu/programs/healthcare-systems-engineering/
• Healthcare Systems Engineering (M.S), Lehigh University - https://engineering.lehigh.edu/hse
• Medical Sciences and Engineering (B.S.), Indian Institute of Technology, Madras (one of the premier engineering institutions of India) - https://mst.iitm.ac.in/bs-in-medical-sciences-engineering/

To ensure the success of the proposed program, the foundation has been laid for collaboration across a broad spectrum of institutions and industry partners. Within SDSU, the university anticipates robust collaborations involving the Jerome J. Lohr College of Engineering, College of Nursing, College of Natural Sciences, College of Pharmacy and Allied Health Professions, College of Education and Human Sciences, and College of Agriculture, Food & Environmental Sciences. Beyond SDSU, the university has initiated dialogues with Dakota State University and several potential industry partners about this program. Once approval for this initiative has been secured, the university will actively engage with all BOR system institutions and private partners. Significant stakeholders like Sanford and Avera, who are already in collaboration with SDSU on a project focusing on data and AI-driven decision support tools for healthcare, will be pivotal in shaping the final curriculum. SDSU's overarching goal is to harness the strengths and expertise across the Regental institutions, ensuring the development and delivery of a truly groundbreaking program.

8. What program accreditation is available, if any?

Accreditation through ABET (Accreditation Board for Engineering and Technology).

9. Will the proposed program pursue accreditation or certifications?

Yes

If no, why has the department elected not to pursue accreditation for the program?

N/A

Duplication and Competition

10. Do any related programs exist at other public universities in South Dakota?

A list of existing programs is available through the university websites and the RIS Reporting: Academic Reports Database. If there are no related programs within the Regental system, indicate ***none.***

The proposed Healthcare Systems Engineering program is an innovative and transformative engineering program, that is not currently being offered at any of the six Regental universities. It is important to distinguish the proposed program from the traditional Biomedical Engineering (BME) programs. The University of South Dakota (USD) and South Dakota School of Mines and Technology (SDSMT) offer a B.S. in Biomedical Engineering and SDSU offers a minor in Biomedical Engineering. Unlike these traditional BME programs, which combine engineering sub-disciplines (typically electrical engineering, mechanical engineering, and material sciences) to develop prosthetics, medical devices, and instrumentation for the medical industry, the proposed program will prepare engineers who will adopt a systems approach – combining engineering and health sciences. Healthcare systems engineering is a field that focuses on optimizing and improving healthcare delivery systems. Through a systems approach healthcare systems engineering focuses on the use of data, interoperability of systems, and improvement in patient safety and healthcare outcomes.

A. If yes, defend the need for an additional program within the state, Include IPEDS enrollment data and additional data as needed.

N/A

B. If yes, would this program be a candidate for Regental system collaboration?

As mentioned above in question 7 to ensure the success of the proposed program, the foundation has been laid for collaboration across a broad spectrum of institutions and industry partners. The university has initiated dialogues with Dakota State University and several potential industry partners about this program. Once the intent to plan has been approved, the university will actively engage with significant stakeholders to shape the final curriculum. SDSU's overarching goal is to harness the strengths and expertise within the Regental system and in South Dakota's healthcare systems, ensuring the development and delivery of a truly groundbreaking program.

11. Do any related programs exist at any non-Regental college or university within 150 miles of the university?

List those programs here:

No

A. If yes, use IPEDS to identify the enrollment in those programs.

N/A

B. What evidence suggests there is unmet student demand for the proposed program, or that the proposed program would attract students away from the existing program?

No programs exist at any non-Regental college or university within 150 miles of SDSU. The proposed program, Healthcare Systems Engineering, would serve an emerging industry and is not currently available in the region. SDSU's major would be one of a few in the nation. The Jerome J. Lohr College of Engineering conducted a student interest survey. Of the 63 participants that completed the survey, 18 students (28.5%) indicated if they were starting their education today, based on the program description, they would be interested in majoring in Healthcare Systems Engineering.

Market Demand

This section establishes the market demand for the proposed program (eg Regental system need, institutional need, workforce need). Use the following sources for your data:

- South Dakota Department of Labor & Regulation
- O-Net
- US Department of Labor Projections Central
- SDBOR Workforce and Degree Gap Analysis Report

12. What is the expected growth of the industry or occupation in South Dakota and nationally?

Include the number of openings, as well as the percentage of growth when possible.

Many career fields fall under the umbrella of healthcare systems engineers.[1] After completion of a program, jobs a candidate could apply for include the following positions below:
• Applied biomedical engineer
• Continuous improvement specialist
• Healthcare analyst
• Healthcare management engineer
• Healthcare manager
• Health systems engineer
• Hospital process engineer
• Industrial healthcare engineer
• Public health engineer
• Healthcare engineering faculty
• Systems engineer

The healthcare industry is the fastest growing industry in the world. The B.S. in Healthcare Systems Engineering program will prepare students for rapidly emerging technologies in artificial intelligence (AI) and machine learning (ML), big data and cybersecurity, biomedical informatics, pharmaceutical 3D (Design, Development, and Delivery) and testing, genetic and tissue engineering, computational physiological modeling, imaging science, as well as healthcare infrastructure, environmental health and safety, rural health, e-health and telemedicine. This program will provide students with a mastery of incorporating engineering principles and mathematical methods and using cutting-edge tools and techniques to bridge knowledge gaps between healthcare professionals and engineers. Just the AI segment of the healthcare industry alone is projected to grow to nearly $200B by 2030.[2] The Fourth Industrial Revolution is poised to unlock new business opportunities, shape innovations, and boost economic productivity.

An estimate of employment opportunities for graduates within the state of South Dakota was calculated using the CIP code for systems engineering 14.2701 and its translation to SOC (Standard Occupational Classification) codes: 11-9041 Architects and Engineering Managers, 15-1243 Database Architects, 17-2112 Industrial Engineers, and 17-2199 Engineering, all others. The South Dakota present employment numbers and projected growth for these occupations is (in order) 145 (9.7%), 194 (9.8%), 605 (19.0%), and 143 (8.0%). The weighted projected increase in these occupations is 14.6% or a change from 1087 current jobs to 1246 projected jobs in 2030. [3][4]

[1] Healthcare Degree, Healthcare Systems Engineer, https://www.healthcaredegree.com/administration/healthcare-systems-engineer (visited December 7, 2023)
[2] Artificial intelligence (AI) in healthcare market size worldwide from 2021 to 2030, https://www.statista.com/
[3] CIP SOC Crosswalk from National Center for Education Statistics https://nces.ed.gov/ipeds/cipcode/post3.aspx?y=56
[4] SD Dept of Labor & Regulations Occupational Employment Projections – Long Term, 2020-2030 data download https://www.southdakotaworks.org/vosnet/Default.aspx (visited December 14, 2023)

13. What evidence, if any, suggests there are unfilled openings in South Dakota or nationally?

Healthcare systems engineering is an emerging field that does not have a specific occupation code. The broad field of systems engineering is in high demand within the state of South Dakota. As described in question 12, the annual openings in the occupations related to systems engineering are 12 (11-9041 Architects and Engineering Managers), 17 (15-1243 Database Architects), 52 (17-2112 Industrial Engineers), 10 (17-2199 Engineering) for a total of 91 annual openings. Each of these areas is also listed as rapidly growing in demand.[1]

Healthcare engineers at the U.S. Department of Veterans Affairs are involved with project planning, design, and documentation, and provide oversight and project management for construction and maintenance efforts. Supervisory healthcare engineers manage engineering groups, oversee budgeting, provide expert advice on complex projects, and oversee facility maintenance and operations ensuring accreditation standards are met. Their healthcare engineers frequently collaborate with biomedical engineers to integrate technology and plan site layouts, ensuring that their medical centers and clinics have the right infrastructure and equipment to best meet the needs of the Veterans they serve. The VA currently has 52 jobs posted for healthcare engineering.[2]

Throughout history, science and engineering have continually evolved, branching out to address the ever-changing demands of society. The swift pace of modern technological progress is reshaping the future of healthcare. This creates a significant gap in preparing a workforce tailored for the imminent needs of engineers in the healthcare industry. This gap is particularly pronounced in South Dakota, where the potential to make

transformative strides in the healthcare market is immense.

The proposed Healthcare Systems Engineering program not only addresses this gap but also aligns perfectly with SDSU's emphasis on "rural wellness." This program will meet the multifaceted need of the workforce by modern healthcare systems in South Dakota. In addition, this program is poised to significantly benefit the state by harnessing the power of telemedicine and remote patient monitoring, potentially reducing healthcare costs, and promoting the well-being of South Dakotans. While its primary focus is on human health, the program will also play a pivotal role in advancing animal healthcare.

[1] SD Dept of Labor & Regulations Occupational Employment Projections – Long Term, 2020-2030 data download https://www.southdakotaworks.org/vosnet/Default.aspx (visited December 14, 2023)
[2] U.S. Department of Veterans Affairs, Create and innovate as a healthcare engineer at VA, https://vacareers.va.gov/job-news-advice/create-and-innovate-as-va-healthcare-engineer/ (visited January 11, 2024)

14. What salaries can program graduates expect to earn in South Dakota and nationally?

Healthcare systems engineering is an emerging field that does not have a specific occupation code. The B.S. in Healthcare Systems Engineering program will prepare students for rapidly emerging technologies in artificial intelligence (AI) and machine learning (ML), big data and cybersecurity, biomedical informatics, pharmaceutical 3D (Design, Development, and Delivery) and testing, genetic and tissue engineering, computational physiological modeling, imaging science, as well as healthcare infrastructure, environmental health and safety, rural health, e-health and telemedicine. GlassDoor.com estimates the average salary for a Healthcare Systems Engineer is $120,711 per year in the United States.[1] As a systems engineer, Industrial Engineers average salary in South Dakota is $83,180 and nationally $96,350.[2]

[1]GlassDoor.com
[2] O*NET OnLine, National Center for O*NET Development, www.onetonline.org/. Accessed 24 January 2024. South Dakota source: Projections Central 2020-2030 long-term projections external site. https://projectionscentral.org/Projections/LongTerm; United States source: Bureau of Labor Statistics 2022-2032 employment projections https://www.bls.gov/emp/

15. Optional: Provide any additional evidence of regional demand for the program.

e.g. prospective student interest survey data, letters of support from employers, community needs...

Student Demand

16. Provide evidence of student completers/graduates at that degree level at peer institutions that offer the same/similar program using data obtained from IPEDS.

Choose programs not already listed in question 11. Use the most recent year available.

University Name	State	Program Name	Number of Degrees Conferred in Program	Total Number of Conferrals at Level (Undergrad or Grad)
Indiana University - Purdue University Indianapolis (IUPUI)	IN : Indiana	Healthcare Engineering Technology Management (B.S.)	6	4521
University of Wisconsin - Madison	WI : Wisconsin	Industrial Engineering (B.S.) - Healthcare Systems Engineering	105	9926
Northern Illinois University	IL : Illinois	Industrial and Systems Engineering (B.S.) - Health Systems Engineering Emphasis	46	3080

17. What evidence suggests there is interest from prospective students for this program at the university?

The proposed Healthcare Systems Engineering program is an innovative and transformative engineering program. The program would serve an emerging industry and is not currently available in the region. SDSU's major would be one of a few in the nation. Healthcare Systems Engineering integrates engineering, computer science, data science, and health sciences. In fall 2023, over 980 students were enrolled in the related undergraduate engineering programs at SDSU. The College of Engineering Joint Engineering Council was told about the proposed program during initial planning, and they expressed support and interest in the proposed program. The college also conducted a student interest survey. Of the 63 participants that completed the survey, 18 students (28.5%) indicated if they were starting their education today, based on the program description, they would be interested in majoring in Healthcare Systems Engineering.

Enrollment

18. Are students enrolling in this program expected to be new to the university or redirected from existing programs at the university?

Include the number of openings, as well as the percentage of growth when possible.

SDSU anticipates that the program will include both students who will have been redirected from existing programs, as well as new students.

19. Narrative Description of the preliminary estimates on annual enrollment in this program by year six

Include all students within the program, not just those new to the program.

As mentioned above in question 17, over 980 students were enrolled in related undergraduate engineering programs at SDSU. Based on the survey results the college estimates year 1 enrollment at 5 students and growing the program to 24 students by year 6.