|  |  |
| --- | --- |
|  |  |
|  | **SOUTH DAKOTA BOARD OF REGENTS**  ACADEMIC AFFAIRS FORMS |
| New Baccalaureate Degree Minor |
|  |  |

|  |  |
| --- | --- |
| **UNIVERSITY:** | DSU |
| **TITLE OF PROPOSED MINOR:** | **Bioinformatics** |
| **DEGREE(S) IN WHICH MINOR MAY BE EARNED:** | **All** |
| **EXISTING RELATED MAJORS OR MINORS:** | **Biology, Artificial Intelligence, Computer Science** |
| **INTENDED DATE OF IMPLEMENTATION:** | **Fall 2025** |
| **PROPOSED CIP CODE:** | **26.1103** |
| **UNIVERSITY DEPARTMENT:** | **Science** |
| **BANNER DEPARTMENT CODE:** | **DSCI** |
| **UNIVERSITY DIVISION:** | **College of Arts and Sciences** |
| **BANNER DIVISION CODE:** | **DAS 8A** |

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

* The individual preparing this request has read [AAC Guideline 2.3.2.2.D](https://public.powerdms.com/SDRegents/documents/1677065), 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.*

|  |  |  |
| --- | --- | --- |
| A picture containing text  Description automatically generated |  | 4/15/2025 |
| President of the University |  | Date |

|  |
| --- |
|  |

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

|  |  |  |
| --- | --- | --- |
|  |  |  |
| *Yes* |  | *No* |

1. **Do you have a major in this field (*place an “X” in the appropriate box*)?**
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*](https://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=13-59)[*BOR Policy 1.2.1*](https://public.powerdms.com/SDRegents/documents/1729445)

*DSU:* [*SDCL § 13-59*](https://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=13-59)[*BOR Policy 1.2.2*](https://public.powerdms.com/SDRegents/documents/1729444)

*NSU:* [*SDCL § 13-59*](https://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=13-59)[*BOR Policy 1.2.3*](https://public.powerdms.com/SDRegents/documents/1729443)

*SDSMT:* [*SDCL § 13-60*](https://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=13-60)[*BOR Policy 1.2.4*](https://public.powerdms.com/SDRegents/documents/1729442)

*SDSU:* [*SDCL § 13-58*](https://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=13-58)[*BOR Policy 1.2.5*](https://public.powerdms.com/SDRegents/documents/1729439)

*USD:* [*SDCL § 13-57*](https://sdlegislature.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=13-57)[*BOR Policy 1.2.6*](https://public.powerdms.com/SDRegents/documents/1729438)

[*Board of Regents Strategic Plan*](http://sdbor.edu/wp-content/uploads/2023/09/StrategicPlan_22_27.pdf)

A bioinformatics minor is a valuable addition to DSU’s mission and strategic plan as it merges biology, computer science, statistics, and mathematics to address complex biological questions. The rapid advancement in genomics, personalized medicine, and biotechnology has created a high demand for professionals skilled in analyzing large biological datasets. There is expected to be well above market average growth in this sector of the job market in the next decade. DSU is well placed with its technology focused curriculum to provide students with the training to take advantage of a hot and very competitive landscape.

Given the interdisciplinary nature of bioinformatics, this minor program will perfectly complement DSU’s Biology, Computer Science, and Artificial Intelligence degrees.

A bioinformatics minor aligns with the goals of the South Dakota Board of Regents (SDBoR) as outlined in the 2022-2027 strategic plan. A bioinformatics minor strengthens the state's academic and economic landscape, preparing graduates to lead in a rapidly evolving field.

1. Workforce Development & Economic Growth (Goal 4): Bioinformatics addresses the rising demand for data science and computational biology expertise, equipping students with skills crucial for healthcare, biotechnology, and agricultural industries. This aligns with the SDBoR's commitment to creating academic programs that respond to the evolving workforce and economic needs of South Dakota, driving long-term growth.
2. Academic Excellence & Student Outcomes (Goal 3): The interdisciplinary nature of bioinformatics fosters academic excellence by integrating life sciences with computational skills, preparing students for cutting-edge research and innovation. This supports the SDBoR's goal of enhancing student success and educational attainment​.
3. Access & Affordability (Goal 5): Bioinformatics offers pathways to high-demand careers without requiring out-of-state migration, promoting affordable education options within South Dakota. Leveraging DSU’s strengths and existing curriculum in Biology, Computer Science, and Artificial Intelligence, this bioinformatics minor will be both accessible and affordable. This aligns with SDBoR's goal to offer high-quality, affordable education for South Dakotans.
4. **What is the nature/purpose of the proposed minor? Please include a brief (1-2 sentence) description of the academic field in this program.**

A bioinformatics minor merges biology, data science, and computational techniques to address complex problems in research as well as healthcare, pharmaceuticals, and biotechnology industries. The growing demand for professionals skilled in analyzing large biological datasets reflects rapid advancements in healthcare and biotechnology.

1. **How will the proposed minor benefit students?**

A bioinformatics minor equips students (and graduates) with critical interdisciplinary skills in programming, statistical analysis, and biological knowledge, preparing them for a large range of careers in research, healthcare, pharmaceuticals, and biotechnology industries. With a strong foundation in both life sciences and computational methods, graduates can contribute to solving challenges. Additionally, bioinformatics is a field of continuous innovation, making it an attractive choice for students interested in cutting-edge technology and research.

1. **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.*

While a bioinformatician is not listed as a separate occupation with the South Dakota Department of Labor and Regulations (SDDLR), the skills developed during this minor will permit across several other listed occupations. Based on the projected employment growth till 2032 from SDDLR there are several high growth categories which our students could explore directly after completing this minor if they chose not to pursue further graduate work in the field. These include: Data Scientist (47 openings, 40.5% projected growth), Medical Scientist, except epidemiologists (20 openings, 15.4% growth), Postsecondary Biology Science Teacher (15 openings, 10.3% growth) as well as several lower growth paths such as Biological Technician (12 openings,5.4% growth), Environmental Scientist (10 opening, 5.6% growth), Biologist (5 opening, 3.1% growth) amongst others.

Nationally Bioinformatics is expected to be a growth industry in the near and long term. According to information linked to the Department of Labor they expect a 6% growth and ~71,000 job openings by 2033 (<https://www.careeronestop.org/Toolkit/Careers/Occupations/occupation-profile.aspx?keyword=Bioinformatics%20Scientists&location=UNITED%20STATES&onetcode=19102901>). Many of these jobs are very high paying, with a median pay of $91,100, with a plurality of these only requiring a bachelor’s degree. This does not include the employment opportunities in related occupations like Data Scientist, Biostatistician, Molecular Biologist or Geneticist, who also will be seeking individuals with the training and background a Bioinformatics minor can provide.

1. **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 25-26** | **FY 26-27** | **FY 27-28** | **FY 28-29** |
| **Students enrolled in the minor (fall)** | **4** | **8** | **10** | **20** |
| **Completions by graduates** | **0** | **2** | **4** | **7** |

\*Do not include current fiscal year.

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

We modeled our Bioinformatics curriculum after the BS programs at Minot State University, Augustana University, and the University of Central Missouri.

<https://catalog.minotstateu.edu/undergraduate/collegeofartsandsciences/departmentofbiology/#bsinbioinformaticstext>

<https://augie.smartcatalogiq.com/en/2024-2025/2024-2025-undergraduate-catalog/academic-program/bioinformatics/bioinformatics-major/>

<https://catalog.ucmo.edu/preview_program.php?catoid=23&poid=7572>

Also, the International Society for Computational Biology (ISCB) does offer curriculum guidelines, which we have followed.

<https://www.iscb.org/curriculum-guidelines-colleges-universities>

1. **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.*

1. **Distribution of Credit Hours**

|  |  |  |
| --- | --- | --- |
| **Bioinformatics Minor** | **Credit Hours** | **Percent** |
| Requirements in minor | 15.0 | 83.3 % |
| Electives in minor | 3.0 | 16.7 % |
|  |  |  |
| Total | 18.0 |  |

1. **Required Courses in the Minor**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Prefix** | **Number** | **Course Title**  *(add or delete rows as needed)* | **Prerequisites for Course**  *Include credits for prerequisites in subtotal below.* | **Credit Hours** | **New**  **(yes, no)** |
| BIOL | 151 and 151L | General Biology I with Lab | None | 4.0 | No |
| BIOL | 335 | Introduction to Bioinformatics | BIOL 151 | 3.0 | No |
| BIOL | 371 and 371L | Genetics with Lab | BIOL 151 or BIOL 101 | 4.0 | No |
| CSC | 232 | Tech Foundations: Scripting | None | 1.0 | No |
| CSC  CSC | 147  or  247 | Survey of Artificial Intelligence  Introduction to Artificial Intelligence | None  CSC 150 and MATH 201 | 3.0 | No |
|  |  |  | Subtotal | 15.0 |  |

1. **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** | **New**  **(yes, no)** |
| CIS | 372 | Programming for Analytics | CIS 123 or CIS 130 or CSC 150 | 3.0 | No |
| CSC | 300 | Data Structures | CSC 250 | 3.0 | No |
| CSC | 447 | Artificial Intelligence | CSC 250 | 3.0 | No |
| MATH | 315 | Linear Algebra | (MATH 123 and MATH 201) or MATH 225 | 3.0 | No |
| MATH | 418 | Mathematical Modeling | MATH 125 or MATH 315 | 3.0 | No |
| BIOL | 221 | Human Anatomy | None | 3.0 | No |
| BIOL | 373 | Evolution | None | 3.0 | No |
|  |  |  | Subtotal | 3.0 |  |

Biology students are already required to complete BIOL 151, BIOL 335, and BIOL 371 as part of their major. Therefore, to meet the 18-credit requirement, they would need to select additional courses from the elective list. This will be noted in the catalog. Computer Science students pursuing the Artificial Intelligence specialization would have one overlapping course. Students in the Artificial Intelligence program would have a total of two overlapping courses (4 credits).

* 1. **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.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Program Courses that Address the Outcomes | | | | |
| Individual Student Outcome | BIOL 151 and 151L | BIOL 335 | BIOL 371/371L | CSC 232 | CSC 147 or 247 |
| Incorporate current technology into conceptual frameworks for bioinformatics. |  | X | X |  |  |
| Apply fundamental principles of bioinformatics across scientific disciplines. | X | X | X |  |  |
| Communicate science in multiple forms (written, oral, electronic) to diverse audiences. | X |  | X |  |  |
| Apply basic scientific methodology (observation, experimentation, hypothesis testing) to answer bioinformatics questions in a rigorous and ethical manner. |  | X | X |  |  |
| Write and debug basic Python programs to solve simple computational problems |  |  |  | X |  |
| Analyze large datasets and apply Artificial Intelligence, Machine Learning, and Predictive Analytics techniques to uncover patterns and make data-driven decisions. |  |  |  |  | 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.*

1. **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.*

Instructors will use a blend of hands-on labs, case studies, and project-based learning to engage students in real-world applications of bioinformatics. Courses will leverage technologies such as AI modeling tools, bioinformatics analysis platforms, and virtual lab environments to support interactive and experiential learning.

In Biology lecture courses, instructors incorporate active learning strategies (Think/Pair/Share, Data analysis, board work, literature discussions) into lectures to create a dynamic learning environment, which provides students opportunities to directly apply knowledge learned in lectures. Technical and soft skill development is also emphasized. For the Biology lab courses, there will be plenty of hands-on learning opportunities in the laboratory settings. Students will become comfortable using advanced instrumentation and will better understand bioinformatics data because they will be creating it.

1. **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.*

1. **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** | No |  | Choose an item.Choose an item. |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Yes/No** | ***If Yes, identify delivery methods***  *Delivery methods are defined in AAC Guideline* [*2.4.3.B*](https://public.powerdms.com/SDRegents/documents/1677940)*.* | ***Intended Start Date*** |
| **Distance Delivery (online/other distance delivery methods)** | No |  | Choose an item.Choose an item. |
| **Does another BOR institution already have authorization to offer the program online?** | No | **If yes, identify institutions:** | |

1. **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)** | No |  | Choose an item.Choose an item. |

1. **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

1. **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.*

There will be no additional costs for this minor since no new courses are being created and no new faculty members are being hired.

1. **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.*

1. **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.*