SOUTH DAKOTA BOARD OF REGENTS

Academic and Student Affairs
Consent

AGENDA ITEM: 5 – C (6)
DATE: May 13-15, 2024

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SUBJECT

New Program Request – SDSMT – Minors in Critical Minerals – Exploration & Development and Critical Minerals – Processing & Extraction

CONTROLLING STATUTE, RULE, OR POLICY

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

BACKGROUND / DISCUSSION

South Dakota School of Mines & Technology (SDSMT) requests authorization to offer two minors in the area of Critical Minerals: Critical Minerals – Exploration & Development, and Critical Minerals – Processing & Extraction. The proposed minors will provide students with an understanding of the current state of critical minerals, and the technical challenges and opportunities therein. The field of critical minerals is inherently interdisciplinary, and involves minted resources, and recycled products derived from them, that are essential to the sustainment and advancement of modern technologies. Each proposed minor will have coursework focused on different aspects of critical minerals, with one covering exploration & development, and the other processing & extraction.

IMPACT AND RECOMMENDATION

SDSMT plans to offer both of the proposed minors on campus. SDSMT does not request new state resources. SDSMT will require three new courses for both minors, with one of the courses being included in both minors. SDSMT estimates 8 students enrolled and 4 graduates in each minor by the fourth year of the programs.

Board office staff recommends approval.

ATTACHMENTS

Attachment I – New Program Request Summary: SDSMT – Minor in Critical Minerals – Exploration & Development

Attachment II – New Program Request Summary: SDSMT – Minor in Critical Minerals – Processing & Extraction

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DRAFT MOTION 20240513_5-C(6):

I move to authorize SDSMT to offer minors in Critical Minerals – Exploration & Development and Critical Minerals – Processing & Extraction, 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:	SDSM&T
TITLE OF PROPOSED MINOR:	**Critical Minerals—Exploration & Development**
DEGREE(S) IN WHICH MINOR MAY BE EARNED:	B.S. in Metallurgical Engineering, Mining Engineering, Geological Engineering, Geology, Chemical Engineering, and Chemistry. Other degree program students may find this minor relevant to their career pursuits.
EXISTING RELATED MAJORS OR MINORS:	**Metallurgical Engineering, Mining Engineering, Geology, Geological Engineering**
INTENDED DATE OF IMPLEMENTATION:	**Fall 2024**
PROPOSED CIP CODE:	14.2101
UNIVERSITY DEPARTMENT:	**Mining Engineering & Management**
BANNER DEPARTMENT CODE:	**MMEM**
UNIVERSITY DIVISION:	**4E**
BANNER DIVISION CODE:	**4E**

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

- The individual preparing this request has read AAC Guideline 2.8, 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.

	Click here to enter a date.
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).

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 1:10:4*
DSU:	*SDCL § 13-59*	*BOR Policy 1:10:5*
NSU:	*SDCL § 13-59*	*BOR Policy 1:10:6*
SDSMT:	*SDCL § 13-60*	*BOR Policy 1:10:3*
SDSU:	*SDCL § 13-58*	*BOR Policy 1:10:2*
USD:	*SDCL § 13-57*	*BOR Policy 1:10:1*

Board of Regents Strategic Plan 2014-2020

Although the B.S. degree program does not exist at an undergraduate level, most of the related courses proposed for this Minor are already being offered at an undergraduate level. The Minor will help address state and domestic workforce challenges surrounding critical minerals, and thus addresses the Board of Regents Strategic Plan Challenges and Opportunities (2014-2020). (*"Workforce shortages will increase as skilled job growth exceeds the growth of available skilled workers.")* The minor will help advance learning across disciplines, specifically those related to the mineral industry, and thus address the SD Mines Strategic Plan. *("Advance innovative, hands-on, project-based learning strategies integrated across disciplines.")*

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.

The purpose of the proposed minor is to provide students an understanding of the current state of critical minerals (specifically, exploration and development), and the technical challenges and opportunities therein.

The field of critical minerals is one that is inherently interdisciplinary and involves mined resources, and recycled products derived from them, that are essential to the sustainment and advancement of modern technologies.

4. How will the proposed minor benefit students?

The purpose of the proposed minor is to provide students with an interest in critical minerals an opportunity to understand and explore this complex technological area. Critical minerals exploration and development would be a value-added component to students from a wide variety of majors, particularly those associated with the mineral and chemical industries.

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 United States is expected to undergo significant structural change in the demand for an array of critical minerals (CMs). As part of the transition to a clean energy economy and battery-powered (or augmented) civilian and military vehicles, the International Energy Agency (IEA) and the Department of Energy are forecasting hundreds of percent surge in demand for previously niche commodities like lithium, Class-1 nickel, cobalt, manganese, and graphite. Similarly, as a result of Russia's invasion of Ukraine, numerous metal and mineral products imported from Russia have been subject to severe supply disruptions and punitive tariffs, such as titanium and aluminum. Though the proximate disruption from Russia's invasion has made the risk of U.S. import reliance very real, China remains the dominant global miner and processor of numerous CMs, with known control over several international CM supply chains originating in Africa. For example, the Department of Defense has reported on numerous unclassified CM shortfalls in the 100-day report under Executive Order 14017, *America's Supply Chains*.[1]

When asked the question if the United States could arm itself in a conflict in which China and Russia cut off CM supply chains, the answer is likely a resounding no. Not only does the U.S. not have sufficient active mining operations, but the talent pool of experts needed to rapidly develop minerals processing facilities and a sudden domestic supply chain (à la the early days of World War II and rapid domestic industrialization) is virtually non-existent. Thus, it is vital to develop new sources of CM supply — be it from new mines, more efficient extraction at existing mines, extraction from waste streams, or recycling — a cross-cutting enabler of this supply growth is a highly trained and well-educated workforce.

Data from the U.S. Bureau of Labor statistics indicate that the Mining Sector (less Oil & Gas, NAICS: 212) continues to follow its severe post-Cold War contraction, falling from approximately 264,700 employees in January 1993 to an estimated 186,300 employees in January 2023. Though the tremendous growth in Mining Sector employment over the past two years is a positive development, it is important to note that this employment growth is a return to pre-COVID-19 pandemic levels, not "new-growth" for the burgeoning domestic CM sector.[2]

This inability to grow the human capital pool has already begun to squeeze mining operations, with 71% of mining executives reporting that talent shortages are preventing current producers from meeting their production targets. A further 86% of mining executives have reported that recruiting and retaining talent is more challenging now than in the pre-COVID-19 era, including traditional fields like process engineering as well as emerging disciplines, like data science and industrial automation.[3] Unfortunately, the current U.S. mining educational

ecosystem is not positioned to support this growing need by the U.S. Mining Sector or the downstream CM supply chain spanning metallurgy and smelting to the post-processing refining needed for manufacturing of equipment and munitions.

The South Dakota mineral industry will undoubtedly be a key consumer of the new critical minerals workforce. Indications are that energy (e.g., lithium-bearing, rare earth element minerals) and electronic (e.g., silver) sectors will be the first to emerge in South Dakota.[4]

1. See pages 185-187 of *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth* (Executive Office of the President), June 2021, link here
2. U.S. Bureau of Labor Statistics, "Industries at a Glance: Mining (except Oil and Gas): NAICS 212" (March 2023), link here
3. "Has mining lost its luster? Why talent is moving elsewhere and how to bring them back," *McKinsey & Co.* (February 2023), link here
4. Rapid City Journal, *"Company submits notice of intent to explore land near Keystone for lithium-bearing minerals,"* July 19, 2023.

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 24	FY 25	FY 26	FY 27
Students enrolled in the minor (fall)	2	4	7	8
Completions by graduates	0	1	2	4

*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 Minor required courses are set to establish a fundamental understanding of mineral exploration and development. These, or like courses, are traditional courses found within peer undergraduate programs at Montana Tech, Colorado School of Mines and Missouri Science and Technology (all ABET accredited). The fundamental understanding from the previously mentioned Minor courses will be broadened to specific examples of relevance to critical minerals exploration and development (MET/MEM/GEOE 455, MEM 480 and MET 457). To our knowledge, the critical minerals exploration and development Minor in this context will be the first of its kind in the U.S.

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, <u>including</u> 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.

A. Distribution of Credit Hours

[Insert title of proposed minor]	Credit Hours	Percent

Requirements in minor	18	100%
Electives in minor	0	%
Total	18	100%

B. 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)**
GEOL or GEOE	201 or 221/221L	Physical Geology or Geology for Engineers/Lab	None	3	No
GEOL	351	Earth Resources and the Environment	GEOL 201 or GEOE 221/221L	3	No
MEM	480	Exploring the Future of Mining	Senior standing	3	Yes
MET	220	Mineral Processing and Resource Recovery	MATH 123 (4), CHEM 112 (3)	3	No
MET/GEOE/MEM	455	Geometallurgy	CHEM 112 (3) and senior standing	3	No
MET	457	Critical Minerals	Chem 112 (3)	3	Yes
			Subtotal	18	

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**	**New (yes, no)**
					Choose an item.
					Choose an item.
					Choose an item.
					Choose an item.
					Choose an item.
			Subtotal		

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.

	Program Courses that Address the Outcomes					
Individual Student Outcome	GEOL 201 / GEOE 221/221L	GEOL 351	MEM 480	MET 220	MET/MEM/ GEOE 455	MET 457
Demonstrate effective oral and written communication		X	X	X	X	X
Ability to acquire and apply new knowledge as needed, using appropriate learning strategies		X	X	X	X	X
Ability to recognize ethical and professional responsibilities in engineering situations			X			X
Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	X		X	X	X	X
Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare			X	X		X

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.*

Instructional technologies utilized will include lectures assisted by the Internet-based technologies using platforms such as Zoom, and YouTube. The lectures will be both directly written (chalkboard) or projected (e.g. PowerPoint, likely annotated in real time).

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.

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 2024**

	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 5.5.*	*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:**	

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)	No		Choose an item. Choose an item.

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."*

We request a waiver to BoR AAC Guideline 2.8, which states that, "Minors typically consist of eighteen (18) credit hours, including prerequisite courses." The proposed Minor will require 18 credit hours of prerequisites. However, 14 credits (MATH 123, MATH 125, CHEM 112, PHYS 207 or PHYS 211) of these prerequisites are required for all SD Mines students as part of their core first and second year courses for their chosen major. In other words, these courses will not be prerequisites for the students. The other prerequisite, MET 320, is embedded within the Minor, so students will achieve that prerequisite as they progress in the Minor. Thus, the Minor will be essentially an "in-program" minor for SD Mines students.

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.*

There will be no changes in cost, budget, or resources as faculty are set to deliver these courses regardless of minor put forth in this form.

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 Baccalaureate Degree Minor

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UNIVERSITY:	SDSM&T
TITLE OF PROPOSED MINOR:	**Critical Minerals—Processing & Extraction**
DEGREE(S) IN WHICH MINOR MAY BE EARNED:	B.S. in Mining Engineering, Geological Engineering, Geology, Chemical Engineering, and Chemistry
EXISTING RELATED MAJORS OR MINORS:	**Metallurgical Engineering**
INTENDED DATE OF IMPLEMENTATION:	**Fall 2024**
PROPOSED CIP CODE:	**14.2101 Mining and Mineral Eng.**
UNIVERSITY DEPARTMENT:	**Materials and Metallurgical Eng.**
BANNER DEPARTMENT CODE:	**MMET**
UNIVERSITY DIVISION:	**4E**
BANNER DIVISION CODE:	**4E**

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

- The individual preparing this request has read AAC Guideline 2.8, 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

Click here to enter a date.

Date

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.

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SDSMT:	*SDCL § 13-60*	*BOR Policy 1:10:3*
SDSU:	*SDCL § 13-58*	*BOR Policy 1:10:2*
USD:	*SDCL § 13-57*	*BOR Policy 1:10:1*

   Board of Regents Strategic Plan 2014-2020

   The Minor draws largely from required courses within the existing B.S. Metallurgical Engineering program, and therefore, students within that degree program cannot pursue the Minor. The Minor will help address state and domestic workforce challenges surrounding critical minerals, and thus addresses the Board of Regents Strategic Plan Challenges and Opportunities (2014-2020). (*"Workforce shortages will increase as skilled job growth exceeds the growth of available skilled workers.")* The Minor will help advance learning across disciplines, specifically those related to the mineral industry, and thus address the SD Mines Strategic Plan. *("Advance innovative, hands-on, project-based learning strategies integrated across disciplines.")*

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.**
   The purpose of the proposed minor is to provide students an understanding of the current state of critical minerals (specifically, processing and extraction), and the technical challenges and opportunities therein.

   The field of critical minerals is one that is inherently interdisciplinary and involves mined resources, and recycled products derived from them, that are essential to the sustainment and advancement of modern technologies.

4. **How will the proposed minor benefit students?**
   The purpose of the proposed minor is to provide students with an interest in critical minerals an opportunity to understand and explore this complex technological area. Critical minerals processing and extraction would be a value-added component to students from a wide variety of SD Mines majors, particularly those associated with the mineral and chemical industries.

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 United States is expected to undergo significant structural change in the demand for an array of critical minerals (CMs). As part of the transition to a clean energy economy and battery-powered (or augmented) civilian and military vehicles, the International Energy Agency (IEA) and the Department of Energy are forecasting hundreds of percent surge in demand for previously niche commodities like lithium, Class-1 nickel, cobalt, manganese, and graphite. Similarly, as a result of Russia's invasion of Ukraine, numerous metal and mineral products imported from Russia have been subject to severe supply disruptions and punitive tariffs, such as titanium and aluminum. Though the proximate disruption from Russia's invasion has made the risk of U.S. import reliance very real, China remains the dominant global miner and processor of numerous CMs, with known control over several international CM supply chains originating in Africa. For example, the Department of Defense has reported on numerous unclassified CM shortfalls in the 100-day report under Executive Order 14017, *America's Supply Chains*.[1]

When asked the question if the United States could arm itself in a conflict in which China and Russia cut off CM supply chains, the answer is likely a resounding no. Not only does the U.S. not have sufficient active mining operations, but the talent pool of experts needed to rapidly develop minerals processing facilities and a sudden domestic supply chain (à la the early days of World War II and rapid domestic industrialization) is virtually non-existent. Thus, it is vital to develop new sources of CM supply — be it from new mines, more efficient extraction at existing mines, extraction from waste streams, or recycling — a cross-cutting enabler of this supply growth is a highly trained and well-educated workforce.

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This inability to grow the human capital pool has already begun to squeeze mining operations, with 71% of mining executives reporting that talent shortages are preventing current producers from meeting their production targets. A further 86% of mining executives have reported that recruiting and retaining talent is more challenging now than in the pre-COVID-19 era, including traditional fields like process engineering as well as emerging disciplines, like data science and industrial automation.[3] Unfortunately, the current U.S. mining educational ecosystem is not positioned to support this growing need by the U.S. Mining Sector or the downstream CM supply chain spanning metallurgy and smelting to the post-processing refining needed for manufacturing of equipment and munitions.

The South Dakota mineral industry will undoubtedly be a key consumer of the new critical minerals workforce. Indications are that energy (e.g., lithium-bearing, rare earth element minerals) and electronic (e.g., silver) sectors will be the first to emerge in South Dakota.[4]

1. See pages 185-187 of *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth* (Executive Office of the President), June 2021, link here
2. U.S. Bureau of Labor Statistics, "Industries at a Glance: Mining (except Oil and Gas): NAICS 212" (March 2023), link here
3. "Has mining lost its luster? Why talent is moving elsewhere and how to bring them back," *McKinsey & Co.* (February 2023), link here
4. Rapid City Journal, *"Company submits notice of intent to explore land near Keystone for lithium-bearing minerals,"* July 19, 2023.

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 24	FY 25	FY 26	FY 27
Students enrolled in the minor (fall)	**2**	**4**	**7**	**8**
Completions by graduates	**0**	**1**	**2**	**4**

*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 Minor required courses are set to establish a fundamental understanding of mineral processing and extractive metallurgy (MET 220, MET 310, MET 320, MET 321). These or like courses are traditional courses found within peer undergraduate programs at Montana Tech, Colorado School of Mines and Missouri Science and Technology (all ABET accredited). The fundamental understanding from the previously mentioned Minor courses will be broadened to specific examples of relevance to critical minerals processing and extraction (MET/MEM/GEOL 455 and MET 457). To our knowledge, the critical minerals processing and extraction Minor in this context will be the first of its kind in the U.S.

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, <u>including</u> 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.

A. Distribution of Credit Hours

Critical Minerals—Processing & Extraction	Credit Hours	Percent
Requirements in minor	18	100%
Electives in minor		%
Total	18	100%

B. 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)
MET	220	Mineral Processing and Resource Recovery	MATH 123 (4), CHEM 112 (3)	3	No
MET	310	Aqueous Extraction, Concentration and Recycling	MET 320 (4)	3	No
MET	320	Metallurgical Thermodynamics	CHEM 112 (3), MATH 125 (4), PHYS 211/L (5) or PHYS 207 (3)	4	No
MET	321	High Temperature Extraction, Concentration and Recycling	MET 320 (4)	3	Yes
MET/GEOE/MEM	455	Geometallurgy	CHEM 112 (3) and senior standing	3	No
MET	457	Critical Minerals	CHEM 112 (3)	3	Yes
			Subtotal	33/35	

Catalog Note: No more than six credits from this minor may overlap with the specific required credits of a student's declared major.

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	New (yes, no)
					Choose an item.
					Choose an item.
					Choose an item.
					Choose an item.
					Choose an item.
			Subtotal		

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.*

	Program Courses that Address the Outcomes					
Individual Student Outcome	MET 220	MET 310	MET 320	MET 321	MET/GEOL/MEM 455	MET 457
Demonstrate effective oral and written communication	X				X	X
Ability to acquire and apply new knowledge as needed, using appropriate learning strategies	X	X	X	X	X	X
Ability to recognize ethical and professional responsibilities in engineering situations		X		X		X
Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	X	X	X	X	X	X
Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare	X	X		X		X

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.*

Instructional technologies utilized will include lectures assisted by the Internet-based technologies using platforms such as Zoom, and YouTube. The lectures will be both directly written (chalkboard) or projected (e.g. PowerPoint, likely annotated in real time).

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.

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 2024**

	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 5.5.*	*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:**	

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)	No		Choose an item. Choose an item.

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."*

We request a waiver to BoR AAC Guideline 2.8, which states that, "Minors typically consist of eighteen (18) credit hours, including prerequisite courses." The proposed Minor will require 15-17 credit hours of prerequisites. However, 14-16 credits (MATH 123, MATH 125, CHEM 112, PHYS 207 or PHYS 211/L) of these prerequisites are required for all SD Mines students as part of their core first and second year courses for their chosen major. In other words, these courses will not be prerequisites for the students. The other prerequisite, MET 320, is embedded within the Minor, so students will achieve that prerequisite as they progress in the Minor. Thus, the Minor will be essentially an "in-program" minor for SD Mines students.

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.*

There will be no changes in cost, budget, or resources as faculty are set to deliver these courses regardless of minor put forth in this form.

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.*