SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS

New Certificate

UNIVERSITY:	BHSU, DSU, NSU, SDSM&T, SDSU, USD
TITLE OF PROPOSED CERTIFICATE:	**Graduate Mathematics Certificate**
INTENDED DATE OF IMPLEMENTATION:	**8/26/2019**
PROPOSED CIP CODE:	**27.0101**
UNIVERSITY DEPARTMENT:	**BHSU:** **DSU: DMATH** **NSU:** **SDMS&T:** **SDSU: SGRMT** **USD: UMTH**
UNIVERSITY DIVISION:	**BHSU:** **DSU: College of Arts and Sciences** **NSU:** **SDMS&T:** **SDSU: Graduate School** **USD: College of Arts and Sciences**

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.

| Institutional Approval Signature | Date |
| President or Chief Academic Officer, Black Hills State University | |

| Institutional Approval Signature | Date |
| President or Chief Academic Officer, Dakota State University | |

| Institutional Approval Signature | Date |
| President or Chief Academic Officer, Northern State University | |

| Institutional Approval Signature | Date |
| President or Chief Academic Officer, South Dakota School of Mines & Technology | |

| Institutional Approval Signature | Date |
| President or Chief Academic Officer, South Dakota State University | |

| Institutional Approval Signature | Date |
| President or Chief Academic Officer, University of South Dakota | |

1. **Is this a graduate-level certificate or undergraduate-level certificate (*place an "X" in the appropriate box*)?**

   Undergraduate Certificate   ☐   Graduate Certificate   ☒

2. **What is the nature/purpose of the proposed certificate?**

Dakota State University in collaboration with all of the Universities in the SD BOR system is proposing teaching six graduate math content courses online to high school mathematics teachers (as well as to others capable of completing graduate math courses) that currently hold a masters degree or are enrolled in a masters degree program so they can become concurrent dual credit instructors and earn a Graduate Math Certificate and an Advanced Graduate Math Certificate.

The goal is to increase the number of high school teachers that can serve as concurrent dual credit instructors and decrease the number of high school students taking online classes, in particular online college algebra classes. The first three graduate math courses proposed in this request will earn the student a Graduate Mathematics Certificate.

The HLC Guidelines (http://download.hlcommission.org/FacultyGuidelines_2016_OPB.pdf) specifically address the qualifications of dual credit instructors ("Determining Minimally Qualified Faculty in the Context of Dual Credit"). Dual credit instructors are expected to meet the same faculty qualifications as university instructors. Those expectations include a Masters Degree and at least 18 graduate content credits in mathematics using the credentials criteria. To meet these guidelines participants would need to complete both the Graduate Math Certificate and the Advanced Graduate Math Certificate to earn the 18 graduate math content credits.

There are several programs across the country that have been created in an effort to provide a mechanism for high school teachers to earn the credentials necessary to meet the HLC guidelines to be concurrent dual credit instructors. Below are a few examples, but there are many more that come up in an internet search.

Indiana University East (http://www.iue.edu/nsm/math/graduate-certificate-mathematics.php) offers a program titled "Online Graduate Certificate in Mathematics." The following is the program description from the webpage linked above.

> "The Graduate Certificate in Mathematics offers graduate level education in mathematics. The program is intended for students who wish to prepare for admission to graduate studies at another institution, or for holders of a Masters degree in a discipline other than mathematics, who teach mathematics classes at the community college level. The program is also open to high school teachers who wish to obtain the qualification to teach Advanced Placement courses."

The goal of the proposed program is very similar in nature which is to provide credentials to program completers to be concurrent dual credit mathematics teachers.

In addition to requiring a total of six classes (18 credit hours), they also require students to complete one course from the areas of analysis, algebra, topology/geometry, applications and probability-statistics.

There are other programs which are similar in nature and below is a list of a few of these programs with links to their programs.

Indiana University Wesleyan - https://www.indwes.edu/adult-graduate/programs/graduate-certificate-math/requirements

George Washington University - https://math.columbian.gwu.edu/graduate-certificate-mathematics

Villanova University - https://www1.villanova.edu/villanova/artsci/mathematics/academic-programs/certificate.html

Texas Tech University - https://www.depts.ttu.edu/elearning/certificate/mathematics/

The common theme for these certificate programs is bluntly stated on the Texas Tech certificate page: *"The Graduate Certificate in Mathematics is an online 18-hour certificate designed for anyone with a master's or doctoral degree who wants to increase mastery of mathematics, particularly in-service teachers who desire to teach dual credit in high school or teach at a junior college."*

3. **Provide a justification for the certificate program, including the potential benefits to students and potential workforce demand for those who graduate with the credential.[1]**

There are very few math teachers that have 18 graduate credit hours of math content courses and a master's degree. As a result, students that take Dual Credit classes in mathematics either go to a state university, take them online or for some have a university faculty member go to their school. Most SD students either take Dual Credit courses online or they don't participate in the Dual Credit program offered to South Dakota High School students. This program would enhance the credentials of program completers which would as a result increase the education opportunities afforded to their students. This is a workforce development proposal.

While the Department of Education changes have created a larger pool of teachers that are certified to teach high school mathematics courses, it has not enhanced the pool of high school teachers that have the credentials to be concurrent dual credit instructors so their high school students can earn college credit from courses offered within the high school. That is, more teachers can become endorsed in the state of South Dakota to teach high school mathematics (any teacher that passes the middle school math praxis exam is endorsed to teach lower level high school mathematics), however there are very few high school mathematics teachers that have both a master's degree and 18 graduate math content credits which is an HLC guideline for being a dual credit instructor. Although DSU has been contacted by several schools interested in offering a concurrent dual credit college algebra course, we have yet to be contacted by a high school that has a high school math teacher with 18 graduate credit hours of math content coursework. This is a workforce development proposal.

In the August 1, 2014, a blog from the Association of School Boards of South Dakota (http://asbsd.org/index.php/plenty-of-concern/) titled "Plenty of Concern over Teacher Shortages" it was reported that 29 of the 62 spring mathematics teaching jobs in the state were still vacant on

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[1] For workforce related information, please 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.

May 28th. Mathematics is identified as a discipline in 2016-2017 having teacher shortages per information from DOE, SD, https://doe.sd.gov/oatq/shortageareas.aspx. The June 18, 2014 blog post (http://asbsd.org/index.php/positions-tough-to-fill/) reported that "75 percent of superintendents responding to the survey believed the teaching applicant pool was inadequate."

In recent years there have been certification rule modifications which has created a larger pool of teachers that are certified to teach high school mathematics. The first of those rule changes allowed secondary math education majors to take the middle school Math Praxis exam and the most recent changes removed the Praxis exam altogether for applicants with a content major in mathematics.

This is a program that would enhance the qualifications of the participating high school mathematics teachers.

4. **Who is the intended audience for the certificate program (including but not limited to the majors/degree programs from which students are expected)?**

The Graduate Mathematics Certificate and the Advance Graduate Mathematics Certificate are programs (each has 9 graduate math credits) designed for current high school mathematics teachers that are either enrolled in or have completed a master's degree that would like to become concurrent dual credit math instructors and need the 18 credit hours of gradate math content to meet HLC guidelines.

5. **List the courses required for completion of the certificate in the table below (if any new courses are proposed for the certificate, please attach the new course requests to this form List the courses required for completion of the certificate in the table below (if any new courses are proposed for the certificate, please attach the new course requests to this form):[2]**

To earn the graduate math certificate and the advanced graduate math certificate, a student would need to complete 18 graduate credit hours in mathematics meeting the HLC guidelines for being a dual credit math instructor (provided the student already has a master's degree). The only requirements in the program are that all courses used to meet the certificate requirements are math or stat prefixed courses and that there is at least one analytic and one abstract course in the collection of three courses (nine credits). Also, one course from a non-SDBOR University may be substituted. Note, all courses must be math or stat content courses so that students who complete the introductory graduate math certificate and the advanced graduate math certificate meet the HLC guidelines to be dual credit instructors. Courses cannot be used to fulfill the requirements of both the Graduate Math Certificate and the Advanced Graduate Math Certificate.

Prefix	Number	Course Title *(add or delete rows as needed)*	Credit Hours	New (yes, no)
Abstract Component: choose one of the following				
MATH	513	Abstract Algebra I	3	No
MATH	514	Abstract Algebra II		No
MATH	536	Number Theory and Cryptography		No

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[2] Regental system certificate programs typically are a subset of the curriculum offered in degree programs, include existing courses, and involve 9-12 credits for completion. Deviations from these guidelines require justification and approval.

Prefix	Number	Course Title *(add or delete rows as needed)*	Credit Hours	New (yes, no)
MATH	537	Cryptography and Codes		No
MATH	561	Geometry		No
MATH	713	Advanced Algebra I		No
MATH	714	Advanced Algebra II		No
MATH	716	Theory: Algebraic Structures		No
Analytic Component: choose one of the following				
MATH	523	Advanced Calculus I		No
MATH	524	Advanced Calculus II		No
MATH	571	Numerical Analysis		No
MATH	622	Difference Equations		No
MATH	625	Advanced Calculus	3	No
MATH	721	Complex Variables		No
MATH	723	Real Variables I		No
MATH	724	Real Variables II		No
MATH	741	Measure and Probability		No
MATH	751	Applied Functional Analysis		No
Graduate Math Elective:				
Any MATH or STAT content course 500 level or higher not used as the Abstract or Applied Mathematics course for this Certificate.			3	No
		Subtotal	9	

These graduate math courses are taught by SDBOR Universities and will enhance the content knowledge of participating teachers and give them experience using abstract knowledge in real world scenarios.

6. **Student Outcome and Demonstration of Individual Achievement. [3]**
   A. **What specific knowledge and competencies, including technology competencies, will all students demonstrate before graduation**? *The knowledge and competencies should be specific to the program and not routinely expected of all university graduates.*

   Individual Student Outcomes:

   Content Knowledge: Demonstrate depth and breadth of content knowledge in a core area of mathematics.

   Critical Thinking: Read, analyze, write and present mathematical arguments with clarity.

   Inquiry Analysis: Research current mathematical practices/theorems and communicate findings.

   B. **Complete Appendix A – Outcomes using the system form.** *Outcomes discussed below should be the same as those in Appendix A.*

7. **Complete the following charts to indicate if the university intends to seek authorization to deliver the entire certificate at any off-campus location (e.g., UC Sioux Falls, Capital**

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[3] Board Policy 2:23 requires certificate programs to "have specifically defined student learning outcomes."

University Center, Black Hills State University-Rapid City, etc.) or intends to seek authorization to deliver the entire certificate through distance technology (e.g., as an on-line program)?[4]

	Yes/No	If Yes, list location(s), including the physical address	Intended Start Date
Off-campus	No		Click here to enter a date.

	Yes/No	If Yes, identify delivery methods	Intended Start Date
Distance Delivery	Yes	018 Internet Synchronous	8/15/2019

8. **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.*

Note – the HLC requirement to be a dual credit instructor is to have a master's degree and if the masters degree is not in the content area then the instructor must have 18 graduate content credits in the discipline being taught which is why we have requested two 9-credit graduate mathematics certificates.

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

Appendix A

Individual Student Outcomes and Program Courses

List specific individual student outcomes—knowledge and competencies—in each row. Label each column with a course prefix and number. Indicate required courses with an asterisk (*). Indicate with an X the courses that will provide the student with an opportunity to acquire the knowledge or competency listed in the row. 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 Outcomes and Program Courses			
List specific individual student outcomes—knowledge and competencies—in each row. Label each column with a course prefix and number. Indicate required courses with an asterisk (*). Indicate with an X the courses that will provide the student with an opportunity to acquire the knowledge or competency listed in the row. 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	**Abstract Component**	**Analytic Component**	**Elective**
Content Knowledge: Demonstrate depth and breadth of content knowledge in a core area of mathematics.	X	X	X
Critical Thinking: Read, analyze, write and present mathematical arguments with clarity.	X	X	X
Inquiry Analysis: Research current mathematical practices/theorems and communicate findings.	X	X	X

1. **Collaborative Purpose**

    The ability to offer Graduate Certificates in Mathematics (Graduate Math Certificate and Advanced Graduate Math Certificate) for students in South Dakota is of critical interest to the South Dakota Board of Regents (SDBOR). As a result, the SDBOR has established a framework within both policy and guidelines to encourage institutions to identify collaborative opportunities that will allow for the sharing of faculty resources, expertise and infrastructure to improve efficiencies and reduce unnecessary duplication. Specifically [Academic Programs - Certificates](5) and [Section Size](6) policies and guidelines have created exemptions to foster an environment for faculty across institutions to collaborate on common programs. Within this context, the purpose of the Collaborative Certificates in Mathematics is to provide a framework for the common delivery of graduate math courses for the graduate math certificates (both face-to-face and via distance) by Black Hills State University, Dakota State University, Northern State University, South Dakota School of Mines, South Dakota State University, and the University of South Dakota.

2. **Partners & Institutional Leads**

    2.1. Participating Institutions: Black Hills State University, Dakota State University, Northern State University, South Dakota School of Mines, South Dakota State University, and the University of South Dakota.

    2.2. Each participating institution will identify a designated institutional representative appointed by the Chief Academic Affairs Officer who will be responsible for coordinating activities with other partner institutions pursuant to the terms of this agreement.

    2.3. Changes to the agreement may be made from time-to-time and must be agreed upon by the majority of designated institutional representatives.

3. **Common Learning Outcomes**

    3.1. Aligned with the purpose of graduate programs, 2A of [Policy 2:29 – Definition of Credits and Institutional Requirements, the graduate certificates in mathematics learning outcomes focus on "an in-depth study of the major field that relies upon interactions both in and out of the classroom and is not just a collection of courses" which "ensures that the student develops a mentoring relationship with the faculty" of the program.](#)

    3.1.1. The participating institutions in the collaborative will assess a common set of learning outcomes to ensure greater coordination across the courses delivered to students in the graduate math certificates. The designated learning outcomes include:

    3.1.1.1. Content Knowledge: Demonstrate depth and breadth of content knowledge in a core area of mathematics.

    3.1.1.2. Critical Thinking: Read, analyze, write and present mathematical arguments with clarity.

    3.1.1.3. Inquiry Analysis: Research current mathematical practices/theorems and communicate findings.

    3.1.2. Participating institutions shall have the flexibility to identify and assess additional learning outcomes that align with institutional priorities, but deviations from the three learning outcomes outlined in 3.1.1 of this agreement must be approved by the majority of the participating members of the consortium.

    3.2. Assessment Strategies

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[5] Section 1 of the New Certificate Program Guidelines establishes that certificate programs can "include courses offered collaboratively with another Regental university."

[6] Section 2.6 of current AAC Section Size Guidelines established that "Collaborative courses with a selected instructional method code that result from a shared program agreement among Regental institutions shall be excluded."

> *3.2.1.* Participating institutions agree to develop similar types of assessments for each course component in the certificate programs.
>
> *3.2.2.* The Math Discipline Council will create and maintain rubrics for the Critical Thinking and Inquiry Analysis learning outcomes that faculty are encouraged to use when evaluating assessments aligned to these outcomes.
>
> *3.2.3.* Review of the rubrics for Critical Thinking and Inquiry Analysis will be a standing agenda item for the MDC and any modifications to the rubrics must be approved by the MDC.
>
> *3.2.4.* The Math Discipline Council will require that all courses that satisfy at least one of the three course components of each graduate math certificate program has a written project that requires students to research a topic and that the rubric maintained by the MDC for inquiry analysis is used to evaluate these written projects.

3.3. Participating institutions agree that program completers that have also earned a masters degree have met the requirements to be concurrent dual credit mathematics instructors thus providing "pathways to further education and employment" which is part of section 2 of the South Dakota Board of Regents Certificate Guidelines.

4. **Curriculum**

4.1. A common curriculum will be used by participating institutions for the graduate math certificate and the advanced graduate math certificate. Curriculum modifications to the graduate math certificates must originate and be approved by the Math Discipline Council before moving through the traditional curriculum cycle.

4.2. The curriculum in the Graduate Math Certificate and the Advanced Graduate Math Certificate shall include:

> *4.2.1.* An abstract graduate math course.
>
> *4.2.2.* An analytic graduate math course.
>
> *4.2.3.* A graduate math elective course.

4.3. Faculty advisors and program administrators have the authority to substitute an appropriate graduate mathematics and/or graduate statistics courses for any of the courses in the graduate math certificate and the advanced graduate math certificate from an accredited university.

4.4. At least two of the three courses required to earn the graduate math certificate and the advanced graduate math certificate must be taken in the SD BOR Regental system. No course can be used to satisfy the course requirements for the graduate math certificate and the advanced graduate math certificate.

4.5. Students can earn the Advanced Graduate Math Certificate only if they have previously earned the Graduate Math Certificate.

4.6. Shared Curriculum Matrix

> *4.6.1.* Beginning with the Fall 2019 term a five year shared curriculum matrix will be developed by the institutional leads which will identify the graduate math courses being offered by participating institutions (see appendix B).
>
> *4.6.2.* The rotation will include the delivery of courses offered during the Fall, Spring and Summer terms. Each participating institution will offer graduate math courses in the rotation and the rotation will ensure that students may successfully complete the certification requirements online in a timely fashion.

5. **Textbook & Instructional Resources**

5.1. Consistent with BOR Policy 1:11 – Academic Freedom and Responsibility Institutional faculty are given academic freedom to select textbook and instructional materials they deem appropriate for the upper division coursework delivered through the consortium.

5.2. Online graduate math courses will go through the SD BOR quality matters review for online courses and meet the criteria contained in the South Dakota Online QA Rubric.

5.3. Online courses supporting the graduate math certificates will have a course site in D2L that will be used to deliver course materials and post student grades.

6. **Funding Model**
    6.1. Tuition revenue generated by the institution offering the course will remain with that institution.
    6.2. Students pursuing the completion of the graduate math certificates at a main campus location, will be assessed the off-campus rate.
    6.3. Students not enrolled in coursework at a main campus location will be assessed the established off-campus rate approved by the SDBOR.

Graduate Math Certificate

9 graduate math credits

Required Courses (6 hours):

    Abstract Component: 3 credit hours.

        The following courses taught in the BOR system meet this requirement
        MATH 513
        MATH 514
        MATH 536
        MATH 537
        MATH 561
        MATH 713
        MATH 714
        MATH 716

    Analytic Component: 3 credit hours.

        The following courses taught in the BOR system meet this requirement
        MATH 523
        MATH 524
        MATH 571
        MATH 622
        MATH 625
        MATH 721
        MATH 723
        MATH 724
        MATH 741
        MATH 751

Elective Requirements (3 hours):

    Any MATH or STAT content course 500 level or higher not used as the Abstract or Applied Mathematics course for this Certificate.

Advanced Graduate Math Certificate:

9 graduate math credits

Required Courses (6 hours):

      Abstract Component: 3 credit hours.

            The following courses taught in the BOR system meet this requirement
            MATH 513
            MATH 514
            MATH 536
            MATH 537
            MATH 561
            MATH 713
            MATH 714
            MATH 716

      Analytic Component: 3 credit hours.

            The following courses taught in the BOR system meet this requirement
            MATH 523
            MATH 524
            MATH 571
            MATH 622
            MATH 625
            MATH 721
            MATH 723
            MATH 724
            MATH 741
            MATH 751

Elective Requirements (3 hours):

      Any MATH or STAT content course 500 level or higher not used as the Abstract or Applied Mathematics course for this Certificate.

The Advanced Graduate Math Certificate can be earned only if the student has already earned the Graduate Math Certificate and no course used to meet the requirements in the Graduate Math Certificate can be used to meet the requirements in the Advanced Graduate Math Certificate.

Graduate Math Certificate Learning Outcomes

Content Knowledge: Demonstrate depth and breadth of content knowledge in a core area of mathematics.

Critical Thinking: Read, analyze, write and present mathematical arguments with clarity.

Inquiry Analysis: Research current mathematical practices/theorems and communicate findings.

Approved Course Rotation for Online & On-Campus Courses

Fall Semesters:

	Fall 19	Fall 20	Fall 21	Fall 22	Fall 23
BHSU					
DSU	MATH 561(online) MATH 537(online)	MATH 513(online) MATH 537(online)	MATH 561(online) MATH 537(online)	MATH 513(online) MATH 537(online)	MATH 561(online) MATH 537(online)
NSU	MATH 512(on campus*)			MATH 512(on campus*)	
SDSMT					
SDSU	MATH 571 (on campus) MATH 625 (on campus) STAT 601 (online)	MATH 571 (on campus) MATH 625 (on campus) STAT 601 (online)	MATH 571 (on campus) MATH 625 (on campus) STAT 601 (online)	MATH 571 (on campus) MATH 625 (on campus) STAT 601 (online)	MATH 571 (on campus) MATH 625 (on campus) STAT 601 (online)
USD	MATH 513(on campus*) MATH 524(on campus*) MATH 723(on campus*)	MATH 513(on campus*) MATH 713(on campus*)	MATH 513(on campus*) MATH 524(on campus*) MATH 723(on campus*)	MATH 513(on campus*) MATH 713(on campus*)	MATH 513(on campus*) MATH 524(on campus*) MATH 3(on campus*)

Spring Semesters:

	Spring 19	Spring 20	Spring 21	Spring 22	Spring 23
BHSU			MATH 523(online)	MATH 513(online)	MATH 523(online)
DSU	MATH 536(online)	MATH 536(online)	MATH 536(online)	MATH 536(online)	MATH 536(online)
NSU			MATH 512(on campus*)		
SDSMT					
SDSU	MATH 741 (on campus) STAT 602 (online)	MATH 741 (on campus) STAT 602 (online)	MATH 741 (on campus) STAT 602 (online)	MATH 741 (on campus) STAT 602 (online)	MATH 741 (on campus) STAT 602 (online)
USD	MATH 523(on campus*) MATH 571(on campus*)	MATH 514(on campus*) MATH 523(on campus*) MATH 721(on campus*) MATH 724(on campus*)	MATH 714(on campus*) MATH 523(on campus*) MATH 571(on campus*)	MATH 514(on campus*) MATH 523(on campus*) MATH 721(on campus*) MATH 724(on campus*)	MATH 714(on campus*) MATH 523(on campus*) MATH 571(on campus*)

Summer Sessions:

	Summer 19	Summer 20	Summer 21	Summer 22	Summer 23
BHSU					
DSU			MATH 622 (online)		MATH 622 (online)
NSU					
SDSMT					
SDSU	STAT 541 (online) STAT 600 (online)	STAT 541 (online) STAT 600 (online) MATH 523 (online)	STAT 541 (online) STAT 600 (online)	STAT 541 (online) STAT 600 (online) MATH 523 (online)	STAT 541 (online) STAT 600 (online)
USD					

*Can be taught through DDN for students unable to come to the on campus section.

Note that at least two courses meeting the algebra component, two courses meeting the analysis component and at least two additional courses are currently in the online rotation ensuring the opportunity for timely completion of both certificates. Additional classes added to the table will add flexibility for students.