



**SOUTH DAKOTA BOARD OF REGENTS  
ACADEMIC AFFAIRS FORMS**

**New Certificate**

<b>UNIVERSITY:</b>	DSU
<b>TITLE OF PROPOSED CERTIFICATE:</b>	Mathematical Foundations of Cryptography
<b>INTENDED DATE OF IMPLEMENTATION:</b>	8/15/2019
<b>PROPOSED CIP CODE:</b>	27.0101
<b>UNIVERSITY DEPARTMENT:</b>	DMATH
<b>UNIVERSITY DIVISION:</b>	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  
*President or Chief Academic Officer of the University*

5/2/2018

\_\_\_\_\_  
Date

**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 has a technology mission and an approved center of excellence in cyber operations. Modern cryptography, the study and practice of secure communication under the assumptions of third party adversaries, applies theory from mathematics, computer science, and electrical engineering to design and implement strong encryption methods. Students at DSU who want to highlight their knowledge of mathematical theory (e.g., algorithms and protocols used to secure information) and enhance their employability can complement the technology certificate(s) and degree(s) with a certificate in the mathematical foundations of cryptography.

**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.<sup>1</sup>**

<sup>1</sup> 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.

As a university with a large percentage of students majoring in STEM related fields, there is a strong interest for mathematics courses tied to technology and cyber security, in particular cryptography. According to the U.S. Bureau of Labor Statistics there is a projected national job growth (2016 – 2024) for mathematicians (including cryptographers) of 33%.<sup>2</sup> This certificate aims to accomplish the following goals: (a) provide students who take upper level mathematics courses with a credential that stacks into the mathematics, computer science, cyber operations majors as well as the math and computer science double major (the 400-level math courses can be used as electives while Math 201 and CSC 250 are required courses); (b) help DSU meet its mission as a leader in the computer and cyber sciences.

**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 Mathematical Foundations of Cryptography certificate is for STEM majors (in particular, mathematics, computer science, cyber operations, and the math and computer science double major) who would like to enhance their skills and knowledge of mathematics related to technology by understanding the mathematical underpinnings of algorithms and protocols used to secure information.

**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):<sup>3</sup>**

<b>Prefix</b>	<b>Number</b>	<b>Course Title</b> <i>(add or delete rows as needed)</i>	<b>Credit Hours</b>	<b>New (yes, no)</b>
CSC	250	Computer Science II	3	No
MATH	201	Introduction to Discrete Mathematics	3	No
MATH	436	Number Theory and Cryptography	3	Yes
MATH	437	Cryptography and Codes	3	Yes
Subtotal			12	

It is recognized that CSC 250 has a prerequisite of CSC 150 Computer Science I. As part of DSU’s technology mission, all students are required to complete at least one semester of course work in programming. For the majors cited in this request, specifically math, computer science, cyber operations, and the math and computer science double major the CSC 150 is the required programming course in those majors thereby meeting the prerequisite requirement. This is true for many of the STEM majors.

**6. 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 University Center, Black Hills State University-Rapid City, etc.) or intends to seek**

<sup>2</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Mathematicians and Statisticians, on the Internet at <https://www.bls.gov/ooh/math/mathematicians-and-statisticians.htm> (visited June 6, 2018).

<sup>3</sup> 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.

authorization to deliver the entire certificate through distance technology (e.g., as an on-line program)?<sup>4</sup>

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

	Yes/No	If Yes, identify delivery methods	Intended Start Date
<b>Distance Delivery</b>	Yes	Online	8/15/2019

**7. 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.

The new courses proposed in the certificate are expected to be offered on a regular basis since they are courses that computer science majors are interested in taking as math electives. The two new 400-level courses will be cross-listed with the 500-level courses. The graduate courses will be taken by those pursuing a graduate certificate in mathematics which would make high school math teachers eligible to teach concurrent courses in conjunction with the Universities.

### Appendix A

<b>Individual Student Outcomes and Program Courses</b>
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.

<b>Individual Student Outcome:</b>	<b>MATH 201*</b>	<b>MATH 436*</b>	<b>MATH 437*</b>	<b>CSC 250*</b>
Upon completion of the Mathematical Foundations of Cryptography certificate, students will:				
understand and apply elementary probability, divisibility, and modular arithmetic arguments.	X	X	X	
perform mathematical calculations used in cryptographic techniques.		X	X	
understand and apply cryptographic techniques.		X	X	

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

understand information security algorithms and protocols.		X	X	
understand fundamental abstract algebra principles used in classical and modern cryptosystems.		X	X	
develop skills in problem solving and programming concepts.				X