

Institutional Effectiveness Report

2021-22

Programs: Mathematics MS

College and Department: College of Arts & Sciences - Mathematics

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Mission: All undergraduate degree programs at Tennessee Tech require at least one course in mathematics and many require several courses. The Department of Mathematics provides a variety of general education courses, introductory and advanced undergraduate courses in support of STEM majors, and graduate-level courses for the MS in mathematics and other graduate programs.

As a central part of a STEM-infused comprehensive institution, the Department of Mathematics strives to create successful learners of the subject of mathematics in the university community and in the community where we live. Learning opportunities are provided to students of all disciplines to advance their understanding of mathematical concepts and their effective use of analytic practices and critical thinking as useful in their studies and everyday life. The departmental faculty conduct research in mathematics and as part of interdisciplinary teams and provide service to the department, college, University, and mathematical community.

The mission of the TTU Department of Mathematics is to promote the learning of mathematics through effective teaching, research, and public service. Such learning opportunities are provided to students of all disciplines in support of the mission of the University.

Program Goals:

PG 1: The MS in Mathematics degree program will average at least 5 graduates per year.

PG 2: Mathematics graduate students will participate in extracurricular activities related to mathematics.

Student Learning Outcomes:

SLO 1: All MS in Mathematics graduates will demonstrate knowledge of graduate-level Algebra and Analysis.

Mathematics MS graduates will demonstrate knowledge of graduate-level Algebra and Analysis by earning grades of B or better in Math 6110-Abstract Algebra and a 6000-level course in Analysis (Math 6010-Functional Analysis, Math 6310-Complex Analysis, or Math 6410-Real Analysis).

SLO 2: All MS in Mathematics graduates will demonstrate a depth of knowledge in an area of mathematics.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods:

PG 1: Average 5 graduates per year

Count of the number of MS in Mathematics graduates in the previous July 1-June 30 time period: The number of students earning the MS in Mathematics in the previous year is determined and trends are tracked using a 5-year average of the number of graduates.

Threshold of Acceptability: Five-year running average of 5 graduates per year.

PG 2: Participation in extracurricular activities

Count of the number of presentations by graduate students and guest speakers: The number of presentations during the previous year by graduate students (in the Graduate Seminar and Teaching Seminar, at Student Research Day, or at a conference) is counted. A count of the number of presentations by guest speakers is also made.

Threshold of Acceptability: Each graduate assistant should actively participate in the Teaching Seminar and present at least 1 talk in the Graduate Seminar.

SLO 1: Demonstrate knowledge of graduate-level Algebra and Analysis

Assessment of MS student breadth of knowledge: A student's knowledge of Algebra and Analysis is assessed by course grades in Math 6110-Abstract Algebra and the required 6000-level course in Analysis (one of Math 6010-Functional Analysis, Math 6310-Complex Analysis, or Math 6410-Real Analysis) and the course grades in the year-long course sequences on the student's program of study.

Threshold of Acceptability: Common questions in the areas of Algebra and Analysis were asked on all comprehensive exams by all committee chairs in the areas of Algebra and Analysis. Students were to answer both questions correctly.

SLO 2: Demonstrate a depth of knowledge in an area of mathematics

Assessment of MS student depth of knowledge: Non-thesis students' depth of knowledge is assessed by comprehensive exams covering 2 of the 3 year-long course sequences such students are required to take. The exams are prepared and scored by the instructors of the course sequences. Thesis students' depth of knowledge is assessed by their written thesis and their oral thesis defense.

Threshold of Acceptability: A passing score on both comprehensive exams for the non-thesis students or a passing score on the oral exam and defense for the thesis students.

Results:*PG 1: Average 5 graduates per year*

The MS in MATH program graduated 2 students during the 2021-22 academic year. While this is not on target of for our goal of graduating 5 students each academic year, we currently have 8 students in the program, which is the maximum number of assistantships the math department has available. Over the last five academic years, the number of graduate of our MS program has averaged 3.8.

Number of Degrees Awarded July 1-June 30

	2017-18	2018-19	2019-20	2020-21	2021-22
Male	1	2	3	5	1
Female	3	1	2	0	1
Total MS in MATH	4	3	5	5	2

PG 2: Participation in extracurricular activities

During Spring Semester 2022, all eight masters students presented in our graduate seminar series. A list of the titles of their talks can be found in the appendix. In addition, a student won their division at Tech's Research and Creative Inquiry Day for a research project, "An Introduction to Wavelets and Multiresolution Analyses with an Application to Digital Signal Processing."

In addition, all students presented lessons and participated in the Graduate Teaching Seminar in the fall and the spring.

SLO 1: Demonstrate knowledge of graduate-level Algebra and Analysis

Both graduates of the 2021-22 academic year demonstrated a breadth of knowledge of mathematics by completing Math 6110-Abstract Algebra and a 6000-level course in Analysis. They also correctly answered the Algebra and Analysis questions posed to them during their oral exams. For Math 6110, there was one A and one B. For the Analysis courses, there was one A and one C.

SLO 2: Demonstrate a depth of knowledge in an area of mathematics

Both 2021-22 graduates completed a thesis and demonstrated a depth of knowledge by defending their theses and having them approved by their advisory committees. The attached files contain the rubric used by thesis committees to assess student mastery of thesis topics and the oral exam portion of the thesis defense. The students names have been removed for anonymity.

Modifications for Improvement

PG 1: Average 5 graduates per year

Along with the undergraduate program, the department has considered two practical ways to increase enrollment in our graduate program. Two main ideas are the following:

i. Strongly advertise the FastTrack program

As has been the case for many years, many of our masters students come directly from the pool of graduates of our bachelors program. With this in mind, we plan to make the possibility of the Mathematics Masters FastTrack program more widely known. Currently, one of the eight masters students came directly from the FastTrack program, and one undergraduate math major is currently in the program. Getting more students from the undergraduate program involved in FastTrack is one clear way to boost our graduate enrollment.

ii. Create more flexibility with remote access to the program

A subcommittee of our Graduate Committee met several times in the academic year 2021-2022 (and currently) to discuss creating some online options for students wanting to pursue an MS degree in Mathematics from Tennessee Tech. The desired goal is to create the possibility of obtaining an online degree. There are some obvious obstacles in creating such options, including the time it takes for faculty members to create such classes and the compensation for such faculty members. After meeting, committee members determined that it is feasible to come up with a list of specific graduate level courses that would fulfill the requirements of an MS degree that may be taught online. This is something we plan to consider more. This type of online option will be particularly intriguing for high school mathematics teachers in surrounding areas who want to pursue a masters degree but require flexibility to do so.

PG 2: Participation in extracurricular activities

The extracurricular activities have been limited. The faculty advisors will be encouraged to have their students present more at conferences, Research day, etc.

SLO 2: Demonstrate a depth of knowledge in an area of mathematics

Two graduate courses were created last year to give our graduate students the academic credit for teaching and research seminars we already require of them. The two courses are Math 6001 and Math 6002. Math 6001 provides the graduate students with the practical training in the teaching of mathematics. Math 6002 provides the graduates students with the training in writing, typesetting, and presentation of mathematical research.

Because of a curriculum error, we were not able to offer these courses officially but have been offering them unofficially for the last year. Dr. Alexander Shibakov created an online version of Math 6002 of which all the graduate students last year participated. Also, Dr. Amy Chambers, our graduate coordinator, has been teaching Math 6001 by having guest lecturers come in and discuss their teaching methodologies. Our goal this semester to fix the curriculum issue.

Appendices

1. Math MS Curriculum Map
2. Rubric for Master's Defenses/Oral Exams
3. List of Graduate Seminar Talks
4. Thesis Oral Defense Results

Appendix 1: Math MS Curriculum Map

MS in MATH Curriculum Map				
	Courses & Degree Requirements			
Student Learning Outcomes	MATH 6110 (3 cr hours of Algebra)	MATH 6410, 6310 or 6010 (3 cr hours of Analysis)	Minimum of 30 graduate credit hours in MATH	3 Required Sequences and passing 2 comprehensive exam or 2 Required Sequences & Thesis
Students will demonstrate breadth of mathematical knowledge	X	X	X	X
Students will demonstrate depth of mathematical knowledge			X	X

Appendix 2: Rubric for Master's Defenses/ Oral Exam

Rubric for Master's Defenses/Oral Exams

Student demonstrated knowledge of general graduate-level mathematics in

- Area 1 Outside Specialty:

Question(s) asked during oral

exam:

Student generally answered these questions

___ completely ___ satisfactorily ___ unsatisfactorily ___ not at all

- Area 2 Outside Specialty:

Question(s) asked during oral

exam:

Student generally answered these questions

___ completely ___ satisfactorily ___ unsatisfactorily ___ not at all

Student demonstrated knowledge of his or her mathematical area of emphasis

- student explained the ideas contained in his or her thesis

___ completely ___ satisfactorily ___ unsatisfactorily ___ not at all

Comments:

- student answered questions related to his or her thesis

___ completely ___ satisfactorily ___ unsatisfactorily ___ not at all

Comments:

Appendix 3: List of Mathematics Graduate Seminar Talks by Graduate Students in Spring 2022

“Coefficients of the Characteristic Polynomial”

“Nonstandard Analysis and Differential Forms”

“Probability Space and Measure”

“An Introduction to Wavelets and Multiresolution Analysis”

“Cooperative Games and the Characteristic Function”

“Zero Knowledge Proofs and Interactive Probabilistic Protocols”

“Support Vector Machines”

“Time Series Analysis Using Arima Model in R”