Operational Plan for the Mathematics Program

Section A

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Welcome to the Mathematics Program!

The Mathematics Program at Greenville University prepares students for many different callings. Our emphasis on precise deductive thought, problem solving, careful communication, and work with technology allows graduates to move comfortably into many fields. While teaching mathematics and graduate work in mathematics is something many of our graduates pursue, an even greater number head into diverse fields such as telecommunications, computing, medicine, the aerospace industry, statistics, accounting, and actuarial science. Mathematics graduates have also been successful as ministers, professional artists, lawyers, and coaches. One of the advantages of the mathematics program is its flexibility. Double majoring in mathematics and most any other major is possible, leading to even more powerful preparation for what and where you are being called.

Program Mission Statement

The principal goals of the mathematics program at Greenville University are to foster students who value mathematics for its own sake and value it as a means of describing and experiencing God's universe. The program seeks to prepare students for advanced study in mathematics and to perform in the work force, through training in precise deductive thought, problem solving, careful communication, real-world applications, and work with technology. This training also serves to assist in the preparation of students for advanced work in complementary fields. The Mathematics Department seeks to integrate Christian faith by emphasizing the pursuit of truth and by demonstrating the compatibility of mathematics and faith.

Programmatic Faith Integration

The Mathematics Department seeks to integrate faith into the program by emphasizing the pursuit of truth and by demonstrating the compatibility of mathematics and faith. This is done in several stages. The pursuit of truth begins with Calculus and other lower division classes and understanding how well these mathematical concepts describe the world in which we live. It is then developed further when the student is trained in the practice of proof writing, so they may pursue and logically deduce truth on their own.

The professors, being accessible mathematicians who are open and honest about their own Christian faith, provide the initial demonstration of the compatibility of mathematics and faith. This sort of demonstration is reiterated for those who take History of

Mathematics, as we study many prominent mathematicians throughout history whose Christian faith was fundamental in their worldview.

Finally, the two goals of pursuing truth and demonstrating compatibility of mathematics and faith merge in the study of axiomatic systems. Here we begin to understand that our assumptions about the world effect what is deduced to be true. We develop humility in our inability to fully grasp ultimate truth about the world around us in a purely rational and logical way, and we touch on fundamental results in logic and mathematics which confirm this. However, it is ultimately this confirmation which also provides such compatibility with faith. While mathematics and faith can each help us understand the beauty, nuance, and truth of the other, neither speaks directly about the other, allowing them to coexist.

Section B

Program/Major Objectives: *Qualities and competencies expected in graduates from this program/major*

At the close of their degree, students should be able to:

1. Integrate a variety of mathematical concepts and skills into problem solving.
2. Construct and communicate creative work, including proofs, using the language and symbolism of mathematics.
3. Solve problems using technology.
4. Develop a breadth of knowledge in the applications of mathematics.

Mathematics Program Fulfillment of the SLOs

By pursuing this program, we are enabling the students to fulfill the mission of GU by becoming skilled problem solvers. The problem solving skills of a mathematics major position a graduate to serve in many different fields. We help students fulfill our SLOs primarily through SLOs 2 and 4. Mathematics graduates are strong in critical inquiry through training in deductive reasoning. Their communication skills are primarily built through carefully constructed and conveyed proofs.

Mathematics Program Connections to Greenville University as a Whole

The Mathematics Department relies heavily on the general education curriculum to produce graduates transformed for lives of character and service. Our courses develop strong thinking and communicating skills and prepare students for problem solving in the

workplace. However, we believe in the value of broadly educated people who are self-aware, able to collaborate across disciplines, recognize the value of diversity, and are aware of ways Christian faith can integrate into their lives. These skills and values are taught through the general education program and reinforced in the upper-division classes within our program through lecture, discussion, certain assignments, and outside-of-class interactions.

Section C

Program Learning Objectives	Required Courses / Learning Opportunities					Elective Courses/Learning Opportunities							
	115	116	217	218	312	170	199	301	302	304	306	308	319
1		I	D					M	M	M	M	M	M
2		I			D				M		M	M	M
3	I			D		M	M				M		
4		I		D				M		M	M	M	

Key: I = Introduced, D = Developed, M = Mastered

Section D

SLOs	Program Objective	Level of Mastery (IDM)	Term	Course number	Learning Activity	Benchmark	Assessment method
Year One							
SLO 2	3	I	Fall	115	Newton's Method and Simpson's Rule HW	>=60%	Average HW score
	1	I	Spring	116	Lectures and Homework	>=55%	Final Exam
	2	I	Spring	116	Sequence and Series Lectures & HW	>=60%	Seq. & Series Exam
	4	I	Spring	116	Applied Integration and Vector Space HW	>=60%	App. Int. & Vect. Space Exam Average
Year Two							
SLO 2, 4	1	D	Fall	217	Various types and uses of multidim. Integ.	>=60%	Select problems from the Final
	4	D	Fall	218	Newtonian Mech & Pop.Growth Material	>=55%	Applied Content Exam
	3	D	Fall	218	Numerical Solutions of Diff. Eq.	>=70%	Average of Numerical HW
	2	D	Spring	312	Proof writing all semester	>=60%	Score on proof problems from Final
	3	M	Spring	199/170/ CIST210	Computer Programming Work	>=70%	Final project and progs./quiz Average
Year Three/Four due to even year/odd year variance							
SLO 2, 4	1	M	Fall	308	Lectures and Homework	>=55%	Final Exam
	2	M	Fall	308	Algebra Proof Writing	>=60%	Chapter Exam Ave
	4	M	Fall	308	Group Theory Material	>=60%	Group Theory Exam Ave
	1	M	Fall	319	Lectures and Homework	>=55%	Exam Average
	2	M	Fall	319	Analysis Proof Writing	>=60%	Final Exam
	1	M	Spring	301	Lectures and Homework	>=55%	Final Exam

	4	M	Spring	301	Statistics Material	>=60%	Stats Exam Average
	1	M	Spring	302	Historical Problems Solved	>=65%	3 Problem-heavy Exam Ave
	2	M	Spring	302	Statistics Material	>=60%	Average of Geometry Exams
	1	M	Spring	304	Lectures and Homework	>=55%	Final Exam
	4	M	Spring	304	Projects	>=70%	Project Grade Ave
	1	M	Spring	306	Lectures and Homework	>=55%	Final Exam
	2	M	Spring	306	Projects	>=60%	Exam Average
	3	M	Spring	306	Programming Assignments	>=70%	Ave. of Programming Assignments
	4	M	Spring	306	Projects	>=60%	Exam Average
Annual Indirect Assessment Methods							
	All		Spring/Summer		Senior Survey		

Formative Learning Experiences

The students in the Mathematics Program begin, typically in their freshman year, with MATH115 and MATH116. These two courses provide a beginning to their mathematical education. They are assessed in these two classes at the introductory level in all four of our Departmental Objectives. They are taught the rudiments of problem solving, logical deduction, numerical solutions, and mathematical applications. The assessment of these objectives is through exams and graded homework. Much support is provided through tutoring and office hours for students who are beginning. In their second year, most students will take MATH217 and MATH218 in the fall, followed by MATH312 in the spring. In the first two courses students develop somewhat more advanced skills in problem solving, numerical techniques, and applications. In the spring, MATH312 gives them a powerful new tool in mathematical communication

and creativity, the proof. Somewhere in the first two years the student usually takes a course in computer programming (MATH170, MATH199, CIST140, or CIST210) which further develops and provides some low-level mastery of numerical processes. At the end of their second year all students in the program are assessed as to how they are doing with respect to the four Departmental Objectives and how we are doing in our teaching and assessing these objectives. Finally, in their last two years students take between 12 and 24 credits of upper-division mathematics beyond MATH312. By taking any three of these classes the students can reach the mastery level in each of our four learning objectives. It becomes very clear by examining proofs in exams, problems solved in projects and on exams, and programming projects how students are doing across our four objectives. At the end of their senior year all students are given a survey. In it they will be asked to assess a number of things, one of which is where they think they are in each of the departmental objectives. They will also be asked how they think we did in our instruction. At the end of the year all seniors are assessed by the faculty as to their level in these four objectives.

Assessment and Timetable

1. **Overall expectation of students**

We expect students to demonstrate competency with regard to our objectives at the level indicated in the Learning Objective Alignment Table.

2. **Measures used**

We will consider the performance of our students in the assessments laid out in the Learning Objective Alignment Table. We expect 75% of our students to be meeting all or all but one of the objectives as measured in the course assessments.

Furthermore, we will assess all our graduates for each of the four learning outcomes giving them a numerical score for each objective based on a rubric for each objective. These numbers can be averaged across the graduates to see how we did as a whole per objective.

The data used will include performance in the upper division classes mapped to the objectives, a global assessment coming from the faculty members who had the student in class (typically multiple classes), and a senior survey. We will do a smaller but similar assessment of students after they finish the introductory upper division class of Linear Algebra (MATH312), usually as sophomores but sometimes as juniors. Measuring students at two points in their careers will allow us to note longitudinal changes.

The survey of seniors will allow us to get their impression on where they think they are with respect to these four objectives and what they believe worked and what might have been better.

3. Data collection

Mid-spring we will survey our seniors. At the end of the school year we will gather data from all upper division classes taken in the last two years by our seniors. We will also gather the performance of the students, mostly sophomores, in MATH312. Finally, we will gather the final projects from the programming class (MATH170 or CIS210) for our seniors

4. Data analysis and compilation

Every spring during the week of assessment the departmental faculty members will gather for a day to examine the collected data and agree upon the numbers assigned to each graduating student for the four objectives as well as the numbers for the MATH312 completers. This agreement will come through using the rubric and discussion. During that same day the averages can be computed and compared to past data sets. The seniors' data will also be compared to their data from the assessment after their completion of MATH312. This is also the meeting where data is examined to see if past changes have had the desired effect. The Mathematics Department Chair will compile the findings.

5. Making improvements

While each year we will consider parts of all four objectives, we will focus on one objective per year. This objective will receive extra scrutiny and we will always consider what changes could be made to improve our delivery and assessment. The objective receiving focus will rotate each year so that all four will have focus in a four-year period. In the 2019-2020 year we will focus on objective 3. The following year will focus on objective 4, followed by 1 and then 2. By looking for consistent weaknesses in one or more objectives (with particular focus on our objective for the year), reading the survey results, and considering the longitudinal performance we will consider ways to strengthen the curriculum to deal with any problems found. The data will be stored and used as needed in the spring meetings and in a departmental meeting in August during the two-weeks before classes begin. The spring meeting will possibly come with recommendations for changes for the next year. These will be reinforced and fleshed out in the August meeting. Changes for fall and spring classes will be discussed. Also, in the August meeting we will discuss any changes to

the assessment process we would like to make for the upcoming school year. The data will also be used in departmental reviews. Minutes will be taken at each of the meetings to record decisions and provide history. The minutes will be reviewed at the next meeting to prompt reflection on the previous changes and proposed changes. For MATH 312 changes, we may see results in a single year, although data across multiple years would be more reliable. Most changes will require two or three years to judge their effectiveness.