Program Review Report
Mathematics Program
Florida Gulf Coast University
January, 2004

Introduction

The mathematics program at Florida Gulf Coast University (FGCU) provides service course offerings to students in fulfillment of general education and Gordon Rule requirements and program prerequisites, as well as a major in Mathematics and a minor in Mathematics. This program review report is the initial program review since the major was started in 1997. We will examine the history and current status of the mathematics program, establish benchmarks for measuring future performance, and make recommendations for further study and possible changes to the program.

Program Description

Demand Analysis

The FGCU mathematics program performs the following university functions:

- Providing service courses in mathematics and statistics to enable students to meet general education and Gordon Rule requirements,
- Providing an Intermediate Algebra course (MAT 1033) to students who need to enhance their algebra skills before attempting general education courses,
- Providing mathematics and statistics courses needed by other university majors to fulfill common prerequisites for their programs,
- Offering a BA degree in Liberal Studies with major in Mathematics, as well as a minor in Mathematics, to interested students, and
- Offering advanced mathematics courses required for students in programs such as Computer Science and the FIU engineering partnership.

The demand for these functions is shown by the following table of enrollments, which necessarily combines a couple of these functions where there is heavy overlap:

	Fall 2000		Fall 2001		Fall 2002		Fall 2003	
	Count	FTE	Count	FTE	Count	FTE	Count	FTE
MAT 1033	246	18.5	276	20.7	384	28.8	419	31.4
General Ed and Common Prereq.	620	47.6	789	60.6	1159	88.9	1324	102.0
Majors' and advanced	58	5.2	60	5.5	47	4.1	75	6.4
Total	924	71.3	1125	86.8	1590	121.8	1818	139.8

Table 1: Enrollments in mathematics courses, Fall 2000-Fall 2003 (Fall terms only)

From the table, it is clear that enrollments in mathematics are steadily increasing. By Fall 2006, it is expected that headcount enrollment in mathematics courses will top 2,500, and FTEs will be over 210.

Mission and Goals

The mission statement for the mathematics program is the following:

> The mathematics major aims to develop rigorous habits of thought and analytical skills in students, and to prepare students for a career in which critical thinking and symbolic modeling and analysis of processes are a central feature. Students will receive a broad training in the major areas of mathematics, and receive guidance in preparing themselves specially for their chosen career paths, whether that is graduate school in the discipline, post-graduate professional studies, a mathematics-related profession, or teaching in the K-12 system. Students will gain an appreciation and understanding of the role of mathematics in society, and the skills needed to study mathematics independently as a lifelong pursuit and recreation.

The Integrated Program Matrix for mathematics (Appendix A) shows the relationship between the goals for the mathematics major and the university student learning outcomes. It appears that neither the mission statement nor the goals directly address the role that the program plays in fulfilling the general education needs of students.

The Mathematics program was administered by a Program Leader (Chuck Lindsey) until July 2000, when the College of Arts & Sciences reorganized into a divisional structure. At that time, the program was placed in the Division of Science and Mathematics, where it still resides. Some administrative functions were assumed by the division chair, Dr. Jose Barreto, with Dr. Lindsey continuing to handle course scheduling and staffing, and meeting with the faculty in the program. Through these meetings, the program faculty reviewed the mission statement program goals periodically, up through Spring 2002. In Fall 2003, the duties of program leader were assumed by Jerry Ellis.

Program Overview: Main Features

The general education portion of the mathematics program is largely determined by state mandates and prerequisites for other FGCU degree programs. The one unique feature of FGCU’s mathematics requirement is that a statistics course (usually STA 2023, Statistical Methods) is required of all students. The faculty felt that today’s students are constantly barraged with data and statistics, and having a basic knowledge of statistical concepts and methods is an essential part of quantitative literacy. Intermediate Algebra (MAT 1033) and College Algebra (MAC 1105) are taught in an innovative format that has resulted in significantly higher success rates for students; details will be given in a later section.

The goals and objectives for the mathematics major are listed in Appendix B, as well as program goals in research, service, and other areas. The student learning objectives, as well as the curriculum for the major, were designed to acknowledge the fact that nearly 90% of mathematics majors do not go on to graduate school in mathematics. The curriculum emphasizes applied mathematics, especially the mathematics needed by professional workers in a technology-intensive, computerized environment, while retaining enough flexibility to offer students interested in graduate school the ability to take the courses needed to prepare for that career path. The major includes a capstone seminar, designed to afford students the opportunity to complete a senior research project in a topic of interest to them.

There are currently five full-time faculty whose assignment is entirely within the mathematics program, and two others with split assignments. Specifically, the mathematics faculty consists of the following personnel:

Name	Rank	Highest Degree	Date of Hire	Pct Assignment in Mathematics
Tom Beatty	Assistant Professor	Ph.D.	1999	100%
Terry Dubetz	Assistant Professor	Ph.D.	2001	25%
Jerry Ellis	Instructor	M.S.	1999	100%
Tom Hair	Assistant Professor	Ph.D.	1998	100%
Jacques Kuitche	Instructor	M.S.T.	2003	100%
Chuck Lindsey	Associate Professor	Ph.D.	1994	12.5%
Tony Planas	Instructor	M.S.	2003	100%

Terry Dubetz teaches and coordinates the introductory Chemistry sequence, and teaches one math section per semester on average; Chuck Lindsey currently serves as Associate Dean of the College of Arts & Sciences, and has a teaching load of one course per year.

In addition to the full time faculty listed above, the program utilizes 8-9 adjunct faculty each semester, with most teaching multiple sections. Many of the full time faculty regularly teach overloads as well, in order to meet student needs for course sections. Moreover, mathematics faculty are active in scholarship and in professional societies, are well-represented on College and University committees, and are active in community service. Faculty loads, scholarship and service activities, and adjunct use are discussed in more detail in the Program Implementation section below.

The number of declared mathematics majors has steadily increased since the opening of the University. The table below shows the number of declared mathematics majors each Fall term over the past five years:

Year	1999	2000	2001	2002	2003
Number of majors	8	17	22	33	35

The 35 math majors in Fall 2003 represents 0.8% (35 out of 4412) of the undergraduate population at FGCU, which is equal to the proportion nationally in 4-year institutions (NCES data). Of the 35 math majors, 20 were female (57%), and 7 (20%) were from underrepresented ethnic minority groups (Black or Hispanic).

Course Offerings and Curricula

The mathematics courses offered to meet general education requirements are listed on the general education fact sheet (Appendix C). All these courses meet both FGCU's general education and Gordon Rule requirements; all these courses are offered every Fall and Spring semester, and many are offered in the summer as well. Most are offered in multiple sections, with the prominent exception being the Calculus sequence (MAC 2311-2312-2313). Since FGCU does not have degree programs in physics, chemistry, or engineering, there are few majors that require courses from this sequence. In fact, only the computer science and mathematics majors require any mathematics beyond Calculus I (MAC 2311).

The courses offered in general education are intended to meet prerequisites for other degree programs as well as general education outcomes, so there are competing demands and priorities that impact the coherence of the general education offerings. However, we have been able to take a very important step toward coherence, namely by instituting a required statistics course (STA 2023, Statistical Methods) as part of general education mathematics. Such a course contributes to fulfilling university learning outcomes in problem-solving, technological literacy, and critical thinking skills, and has helped to make more efficient use of university resources by preventing the proliferation of specialized statistics courses for business, health professions, social sciences, etc., that are common at many institutions. STA 2023 currently enrolls over 500 students each semester, so it is becoming difficult to meet demand, both in terms of instructors and classroom space available.

In addition to general education courses, FGCU offers Intermediate Algebra (MAT 1033), a preparatory course which earns college elective credit but does not count toward general education requirements. Students are advised to take this course based on results of a placement test, which is required of all incoming students. Approximately 50% of incoming freshmen each year receive placement scores indicating they need this course, and most elect to enroll in it. This results in a total course enrollment of about 500 students per year. Over the past few years, we have changed the format of this course to one that features a large lecture once a week, and puts most of the class time into "lab" sections, where students work on selected problems under the supervision of an undergraduate teaching assistant. The lecturer is responsible for course coordination, syllabus development, writing quizzes and exams, and assigning grades. This new format, which emphasizes active participation by the students in group problem-solving, has increased success rates (completing the course with a grade of C or above) in the course from 50% to over 70%, while reducing the overall cost of instruction by reducing our dependence on adjuncts teaching stand-alone sections. The results have been encouraging enough to lead us to adopt the same format for College Algebra (MAC 1105), which has even larger enrollments and has suffered from the same attrition problems as MAT 1033.

The course requirements for the mathematics major are listed on the program fact sheet (Appendix C). The required core of courses is intended to accomplish the following goals, which can easily be seen to match well the program's learning objectives for students:

- give students significant exposure (at least one semester's worth) to six major areas of mathematics: modern algebra, real analysis, linear algebra, differential equations, mathematical statistics, and discrete optimization,
- emphasize those areas of mathematics that students going into the workforce with a Bachelor's degree are more likely to need, while allowing those interested in graduate school to use the depth options and elective courses to prepare for that alternative,
- enable students to gain a second semester's worth of study in at least one of these six areas (depth requirement),
- through the senior seminar, to complete an independent research project, and
- improve students' communication skills in reading and writing mathematics, to give them the tools to be independent learners after graduation.

A unique feature of the major is the inclusion of a required course in discrete optimization (MAP 3163, Methods of Applied Math III). Some undergraduate programs offer this course as an elective, but very few require mathematics majors to take a course that exposes them to many of the mathematical tools of decision science such as linear and integer programming, network flows, and matching algorithms. When coupled with our increased emphasis on linear algebra in the undergraduate curriculum, students completing the degree are well-prepared for positions in business and industry.

Since there are still relatively few students in the math major, required courses are offered once a year in a regular rotation. This rotation is published and disseminated to math majors via the College advisors, and informally through the math faculty. Elective courses are offered on a rotating basis, depending to some extent on anticipated student interests; these are included on the long range schedule along with the required courses. The course rotation is carefully determined so as to enable a transfer student entering with an AA degree, and common prerequisites completed, to complete the program in two years, regardless of which term (s)he enters the university.

Program Implementation

Benchmarks

Since this is the initial program review for mathematics, there are no previously-established benchmarks against which to measure performance. Therefore, the benchmarks developed in each section below will be baseline measures for use in subsequent reviews.

Entering Student Profile

The Mathematics major is not a limited access program at FGCU, so the standards for admission are those of the university. Of the 35 math majors in Fall 2003, 14 entered the university as FTIC students, 20 as transfer students, and 1 seeking a second bachelor's degree.

The average SAT scores of entering math majors for the years 2000-03 are given in the table below. It should be noted that AA transfer students do not report test scores.

Year	Number of new majors	Number with SAT scores	Mean verbal	Mean quant	Mean overall
2000-01	15	11	556	631	1187
2001-02	14	7	576	611	1187
2002-03	19	12	502	596	1098

It is difficult to draw any solid conclusions due to the low numbers of students, but there appears to be a downward trend in the test scores of incoming math majors. This may be related to the problematic persistence rates, which will be discussed in more detail below.

Student Performance/Accomplishments

Since FGCU's opening in 1997, a total of 14 students have graduated with a mathematics major. The current employment status of these graduates is as follows:

Middle or High School teacher:	4
Enrolled in Master's program in Education:	5
Enrolled in graduate mathematics program:	1
Working in computer industry:	1
Employment unrelated to degree:	1
Unknown:	2

As is the case nationally, less than 10% of mathematics graduates have gone directly to graduate school in mathematics, and the majority are working in the education field.

Overall, persistence rates of students in the mathematics major have not been very high. The table below shows the persistence of the 48 students who entered the math major during the years 2000-03:

	2000-01	2001-02	2002-03	Total
Graduated with math major	6	1	0	7
Still enrolled, as math major	3	4	11	18
No longer math major	6	9	8	23

Again, trends are difficult to discern with small numbers, but overall, 52% are either still in the math program or have graduated. The ones who have left may be in another major at FGCU, may have transferred to another university, or dropped out altogether.

Typically, attrition rates are high for students entering as math majors, especially those beginning college as math majors. Many of them have mistaken impressions of what the program will be like, and change majors when reality hits. At larger institutions, they are usually replaced by refugees from engineering programs: however, since FGCU has no engineering program, this attrition has an adverse impact on overall enrollments in the program. This is an area that requires further study, to determine the reasons for this large—and apparently increasing—attrition rate.

FGCU math majors have been active in extracurricular events as well. Five students took the Putnam exam in 2002, with one scoring in the 70th percentile of all participants. Eight took the exam in 2003, and we are still awaiting results. Teams of math majors have participated in the Mathematical Contest in Modeling for the past two years, and the 2003 team earned Honorable Mention in the contest. These national and international contests provide some external validation that our top math majors are indeed learning a great deal.

The capstone seminar (MAT 4907) was created primarily as a vehicle for allowing students to complete a senior research project. This was carried out from 1997-2002, with 11 senior math majors submitting research papers over that period. The results have been quite different from what was originally expected, and it became clear that a single semester is not nearly enough time for students to develop and refine a research topic, carry out some independent study of the topic, and present their results in a suitable written form. The experience has caused the faculty to rethink the idea of the senior project, and to reconsider the whole plan for having students carry out such a task. We are currently looking at the model used in FGCU’s science programs, where students develop research ideas and plans during their junior year as part of a required research methods course, and then carry out the research and writing during their senior year. This seems to be a much better model, and it has been successful in the sciences. If the faculty decide to continue with a required research project for majors, then some curricular changes will likely occur to implement a process similar to what is done in the science programs.

SWOT Analysis

Strengths, weaknesses, opportunities and threats are as listed below.

Strengths

Dedicated faculty
Sound curriculum, developed for 21st century
Highly qualified, collegial faculty who participate in a lot of service activities
Students are few but good
Establishing record of good graduates, high placement rate in teaching positions and grad schools
Innovative model for instruction in general education

Weaknesses

Too many adjuncts
Lack of space, especially office space
Not enough full-time faculty
Small number of majors makes scheduling difficult
Faculty too busy teaching to pursue scholarship
Senior project part of curriculum weak, needs revision
Lack of assessment process
High attrition in major

Opportunities

Engineering programs and biotechnology will provide more students strong in math
Math contest gives us recruiting tool
Increasing enrollment will naturally boost number of majors
Other areas of the college that are active in research provide opportunities for collaboration
COE’s discontinuation of the secondary education major may allow the program to create a secondary education track within the program.

Threats

Over reliance on adjuncts and instructors
Lack of office space for adjuncts big problem for Gen Ed students
Weak (and getting weaker) incoming students
Lack of planning and reflection on part of the faculty—overextended
Other majors and pre-professional programs decreasing emphasis on mathematics
Lack of classroom space will become major constraint on growth and ability to meet basic demands.

Recommendations

Since this is the first program review for FGCU's mathematics program, we cannot consider changes resulting from earlier reviews, and therefore all these recommendations—and in fact the review itself--should be considered as steps to be taken now in establishing a set of benchmarks and implementing a continuous improvement process for the program.

Recommendations for program improvement:

1) Increase the number of full-time faculty in the program to 14 by Fall 2006, in order to achieve a ratio of 25 FTE per full-time faculty.
2) Review the mission statement for the mathematics program to be sure the service mission of the program to provide general education courses is addressed.
3) Examine the feasibility of creating a secondary education track within the mathematics major.
4) Work to increase gender diversity in faculty
5) Hire full-time staff to teach lab sections of MAT 1033 and MAC 1105
6) Persistence rates for mathematics majors should be studied to determine the source of apparent downward trends, and appropriate action should be taken.

Appendix A

Appendix B

Goals for the Mathematics Program at FGCU

Mission Statement

The mathematics major aims to develop rigorous habits of thought and analytical skills in students, and to prepare students for a career in which critical thinking and symbolic modeling and analysis of processes are a central feature. Students will receive a broad training in the major areas of mathematics, and receive guidance in preparing themselves specially for their chosen career paths, whether that is graduate school in the discipline, post-graduate professional studies, a mathematics-related profession, or teaching in the K-12 system. Students will gain an appreciation and understanding of the role of mathematics in society, and the skills needed to study mathematics independently as a lifelong pursuit and recreation.

Teaching

Student Learning Goals and Outcomes for the Mathematics Major

Goal 1: To receive a broad introduction to the major areas of study in the mathematical sciences.

> Outcome 1.1: Students will be exposed to basic principles and techniques of the following major areas of mathematics: calculus and analysis, geometry, linear and abstract algebra, probability and statistics, symbolic logic and set theory, linear programming, differential equations, combinatorics.
>
> Outcome 1.2: Students will be able to identify and explain key mathematical ideas which span several branches of mathematics (e.g., linearity, duality).
>
> Outcome 1.3: Students will pursue study in depth in at least one of the major areas.

Goal 2: To use mathematical techniques effectively for modeling and problem-solving

> Outcome 2.1: Students will develop proficiency in the use of computer algebra systems and statistical packages to solve problems and analyze mathematical models of phenomena.
>
> Outcome 2.2: Students will be able to make appropriate choices of techniques from the major areas to solve problems.

Outcome 2.3: Students will be able to make simplifying assumptions about problems and formulate deterministic, probabilistic, and statistical models of problems, and to critically assess assumptions made in other models.

Outcome 2.4: Students will develop probabilistic models of problems in business, economics, and science, and use simulation methods to evaluate the models and make predictions.

Goal 3: To develop skills in oral and written communication in a style appropriate to the discipline.

Outcome 3.1: Students will be able to present results of mathematical analyses, both orally and in writing, to a variety of audiences.

Outcome 3.2: Students will develop skills in formulating and writing proofs.

Goal 4: To understand the relationship between advances in mathematics and in other disciplines, especially the sciences.

Outcome 4.1: Students will know the historical origins of mathematical techniques in applied problems.

Outcome 4.2: Students will be able to identify instances of application of abstract results to make advances in the sciences.

Goal 5: To become active, independent learners of mathematics.

Outcome 5.1: Students will have an in-depth investigative experience with a mathematical problem or topic of significance.

Outcome 5.2: Students will become proficient at reading and understanding mathematics books and articles independently

Outcome 5.3: Students will use technology as an aid to understanding new concepts and testing new conjectures.

Goal 6: To understand the distinctive nature of mathematical knowledge and methods for acquiring knowledge.

Outcome 6.1: Students will be able to explain the difference between inductive and deductive reasoning.

Outcome 6.2: Students will be able to explain the historical origins of the mathematical method, and the historical origins of the major areas of mathematics.

Outcome 6.3: Students will be exposed to the differences in the practice of mathematics among various cultures.

Outcome 6.4: Students will know the role of abstraction in mathematics, and be able to explain the idea of an axiomatic system.

Student Learning Outcomes for Service Courses

Goal 7: To meet FGCU's Undergraduate Learning Outcomes, particularly regarding problem-solving abilities, technological literacy, information literacy, and effective communication.

Objective 7.1: Students will be able to utilize mathematical techniques to solve problems in their chosen fields of study.

Objective 7.2: Students will learn the background mathematics and problem-solving abilities needed to be successful in their chosen majors.

Objective 7.3: Students will be able to use technological tools such as calculators and computer software to perform quantitative analyses and to accurately interpret the results.

Objective 7.4: Students will be able to communicate results of quantitative analyses in both oral and written formats.

Research

Goal 8: The mathematics faculty at FGCU will develop significant contributions in research and in externally-funded grant activity, appropriate to the mission of the university.

Objective 8.1: The mathematics faculty will develop a program of regular publications in mathematical and/or pedagogical journals, averaging one publication per person annually by 2005-06.

Objective 8.2: The mathematics faculty will pursue external grants, building to $100,000 in funded grants and/or contracts annually by 2005-06.

Service

Goal 9: The mathematics program at FGCU will develop ongoing relationships with schools, businesses, and government agencies throughout the university's service area.

Objective 9.1: The math program will develop regular internship and/or co-op opportunities for students in regional businesses and agencies.

Objective 9.2: FGCU will become the host institution for most or all of the regional mathematics competitions for middle and high school students.

Objective 9.3: The math faculty will develop and offer regular summer enrichment opportunities for students in the region.

Objective 9.4: FGCU will pursue opportunities to host professional conferences in the mathematical sciences.

Other Departmental Goals

Goal 10: To increase the number of students majoring in mathematical sciences.

Objective 10.1: Develop one or more specialized tracks in the undergraduate program

Objective 10.2: Increase the number of students majoring in the mathematical sciences to 1% of all FGCU undergraduates by 2005-06.

Goal 11: To increase faculty resources dedicated to the program.

Objective 11.1: Increase the number of full-time faculty in mathematics to 12 by the 2005-06 academic year.

Objective 11.2: To increase the percentage of sections taught by full-time faculty to 65% by the 2005-06 academic year.

Appendix C

Fact Sheets for General Education and Mathematics

GENERAL EDUCATION

(941) 590-7150

General Education

The university experience at FGCU is designed to prepare students for a rapidly changing world and workplace where professional careers demand a wide breadth of knowledge and value critical thinking and analysis, communication skills, teamwork, independent learning, and creative problem-solving. This preparation begins with a general education program that blends innovation with tradition. Interdisciplinary courses demonstrate the relationship of knowledge across academic fields, while traditional courses offer depth or breadth in specific disciplines and fulfill upper division program prerequisites or accreditation requirements. Introductory and capstone experiences tie general education into a coherent whole and launch the student toward acquiring the broad knowledge and perspective necessary for personal growth and success.

The general education program at Florida Gulf Coast University, in accordance with state mandates, consists of 36 credit hours of coursework in the subject areas of communication, social sciences, humanities, natural sciences, and mathematics. Approved courses for each area are listed below. Where applicable, courses taken to meet state common prerequisites for a program may also be used to fulfill general education requirements. All first-time-in-college students are expected to take ENC 1101 Composition I and IDS 1301L Styles and Ways of Learning their first semester at FGCU.

In accordance with the state articulation agreement (State Board of Education Rule 6A-10.024), a transfer student who has completed general education requirements at any public university or community college in Florida prior to enrolling as a degree-seeking student at FGCU shall be considered to have completed general education. All other transfer students are expected to satisfy FGCU's general education requirements. Transfer students' transcripts will be evaluated to determine course equivalencies and fulfillment of FGCU general education requirements.

All courses listed are approved for meeting general education requirements at FGCU. Courses marked with (W) can be used to satisfy a portion of the Gordon Rule writing requirement, and the mathematics courses can be used to satisfy a portion of the Gordon Rule computation requirement (State Board of Education Rule 6A-10.030). A grade of C or higher is required for all Gordon Rule coursework.

Communication (6 hours)

Each student must complete a two-semester sequence (ENC 1101-1102) in English composition. The sequence develops students' communication skills in written formats; this includes reading critically as well as writing clearly in a variety of styles. Students may satisfy all or part of this requirement by satisfactory CLEP or AP English scores.

ENC 1101	Composition I (W) (3)
ENC 1102	Composition II (W) (3)

Mathematics (6 hours

Mathematics and statistics courses give students competence in quantitative methods and an understanding of how those methods are used to describe and analyze the natural world. These courses also give students exposure to the theories and practice of mathematics, and to the unique nature of mathematical knowledge. They will have a practical component, giving students the opportunity to apply mathematical and statistical methods to "real-world" problems. All students must successfully complete either STA 2023 Statistical Methods or STA 2037 Statistics with Calculus, and an additional 3 credit hours of approved coursework at the college algebra level or higher.

One of the following:

STA 2023	Statistical Methods (3)
STA 2037	Statistics with Calculus (3)

Plus one of the following:

MAC 1105	College Algebra (3)
MAC 1147	Precalculus (4)
MAC 2233	Elementary Calculus (3)
MAC 2311	Calculus I (4)
MAC 2312	Calculus II (4)
MAC 2313	Calculus III (4)
MAS 2121	Linear Operators & Diff Equations (4)
MGF 1106	Liberal Arts Math I (3)
MGF 1107	Liberal Arts Math II (3)

Humanities (9 hours)

At FGCU, the area of humanities includes literature, philosophy, religion, and the fine arts. Humanities courses provide students the opportunity to study the aesthetic dimension of human experience and to learn how people have given creative interpretations to events from differing perspectives. Students will learn the methods, suppositions, and theories of the chosen areas of study.

The following required courses:

IDS 1301L	Styles & Ways of Learning (1)
IDS 2110	Connections (2)
HUM 2510	Understanding the Visual & Performing Arts (3)

Plus one of the following:

AML 2010	Literature & Culture of US I (W) (3)
AML 2020	Literature & Culture of US II (W) (3)
ARH 2050	History of Visual Arts I (3)
ARH 2051	History of Visual Arts II (3)
CRW 2100	Intro to Fiction Writing (W) (3)
CRW 2300	Intro to Poetry Writing (3)
ENC 2160	Intro to Nature Writing (W) (3)
ENL 2012	British Literature & Culture I (W) (3)
ENL 2022	British Literature & Culture II (W) (3)
LIT 2110	World Literature & Culture I (W) (3)
LIT 2120	World Literature & Culture II (W) (3)
PHH 2000	Intro to Philosophy (W) (3)
REL 2306	Contemporary World Religions (W) (3)

Social Sciences (6-9 hours

Students must successfully complete 6 to 9 semester hours of approved coursework in the social science disciplines. Social sciences courses include the disciplines of history, economics, anthropology, sociology, area studies, geography, political science, and psychology. Students will gain an understanding of historical and sociocultural perspectives and a sense of the evolution of societies and the various modes of interaction among peoples of the world.

Select 6-9 hours from the following:

AFA 2000	Intro Afr & Diaspora Studies (W) (3)
AFS 2250	Culture & Society in Africa (3)
AMH 2010	American History until 1877 (W) (3)
AMH 2020	US History since 1877 (W) (3)
ANT 2000	Introduction to Anthropology (3)
ANT 2100	Introduction to Archaeology (3)
ANT 2211	Peoples of the World (W) (3)
ANT 2410	Cultural Anthropology (3)
ASN 2005	Intro to Asian Studies (W) (3)
DEP 2004	Principles of Development (3)
ECO 2013	Principles of Macro Economics (3)
ECO 2023	Principles of Micro Economics (3)
EUH 1000	The Western Tradition, Part I (3)
EUH 1001	The Western Tradition, Part II (3)
EUH 2011	Ancient European History (3)
EUH 2031	Modern European History (3)
GEA 2000	Introduction to Geography (3)
ISS 2011	Interdisciplinary Social Sciences (3)
ISS 2200	Intro to International Studies (3)
LAS 2000	Intro to Latin Amer Studies (W) (3)
POS 2041	American National Government (3)
POS 2112	State & Local Govt & Politics (3)
PSY 2012	General Psychology (3)
SYD 3622	Intro to SW Florida (W) (3)
SYG 2231	Intro to African Studies (W) (3)
SYG 2000	Introduction to Sociology (3)
SYG 2010	Social Problems (3)
SYG 2012	Global Studies (3)
SYG 2250	Multicultural Issues (3)
SYG 2310	Introduction to Human Relations (3)
WOH 1023	World Civilization 1500 -1815 (W) (3)
WOH 1030	World Civilization since 1815 (W) (3)

Natural Sciences (6-9 hours

Students must successfully complete 6 to 9 semester hours of approved coursework in the natural sciences which include biology, chemistry, geology, environmental studies, marine science, and physics. Students are encouraged to select courses with a laboratory or field component. Courses will give students experience in the theories, principles, and practices of the natural sciences and will address the relationship of science with the modern world.

Select 6-9 hours from the following:

AST 2201C	Stellar Astronomy (4)
BSC 1010C	General Biology w/Lab I (4)
BSC 1011C	General Biology w/Lab II (4)
BSC 1020C	Human Systems (3)
BSC 1051C	Environmental Biology-SW Florida (3)
BSC 1085C	Human Anat & Physiology w/Lab I (4)
BSC 1086C	Human Anat & Physiology w/Lab II (4)
BSC 2024C	Human Species (3)
BSC 2300C	Biological Systems I (4)
BSC 2301C	Biological Systems II (4)
CHM 1045C	General Chemistry w/Lab I (4)
CHM 1046C	General Chemistry w/Lab II (4)
CHM 1084C	Environmental Chemistry (3)
CHM 2210C	Organic Chemistry w/Lab I (4)
CHM 2211C	Organic Chemistry w/Lab II (4)
GLY 1010C	Physical & Historical Geology (4)
ISC 1004C	Integrated Natural Sciences I (3)
ISC 1005C	Integrated Natural Sciences II (3)
ISC 1210C	Integrated Science & Math I (4)
ISC 1211C	Integrated Science & Math II (4)
ISC 2212C	Integrated Science & Math III (4)
ISC 2213C	Integrated Science & Math IV (4)
MCB 2010C	Intro Microbiology w/Lab (4)
OCE 1001C	Marine Systems (3)
PHY 2048C	General Physics w/Lab I (4)
PHY 2049C	General Physics w/Lab II (4)
PHY 2053C	College Physics w/Lab I (4)
PHY 2054C	College Physics w/Lab II (4)

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FLORIDA GULF COAST UNIVERSITY

The Liberal Studies Degree

The College of Arts and Sciences offers a Bachelor of Arts in Liberal Studies with majors in art, biology, earth systems science, English, environmental studies, history, mathematics, psychology, social sciences, Spanish, and theatre. Students who wish to develop unique programs of study to meet individual interests or who wish to develop programs of study in areas such as pre-medical, pre-law, or communication should contact a College of Arts and Sciences advisor to discuss the individualized program of study option, which may be substituted for the major. The Liberal Studies degree program integrates the traditional major in a discipline with a required core of issues-based interdisciplinary courses, called the Collegium of Integrated Learning. During the first 60 credit hours of study, students complete lower division courses, including general education requirements and common prerequisites. At the upper division, students complete coursework in the major or individualized program of study (36 hours), the Collegium of Integrated Learning (21 hours), and the University Colloquium (3 hours).

Mathematics Major

The world is rapidly becoming more quantitative, and mathematicians and statisticians are in increasing demand in a wide range of fields, including business, agriculture, computer science, communications, engineering, environmental studies, government, and the natural and social sciences. Mathematically trained graduates are being sought for these fields because of their general analytical and problem-solving skills, as well as for specific knowledge. Students choosing the mathematics major will study up-to-date discoveries in mathematics that are being used in modern theory and applications, making use of the latest technological tools for investigating mathematical and statistical concepts and problems. They will get practice in solving real-world problems, formulating and analyzing quantitative models, and presenting results.

It is strongly recommended that transfer students complete a course in differential equations and an introductory statistics course during the first two years. (Note: Students completing general education at FGCU should take STA 2037 to fulfill the statistics requirement.) No pass/fail grades, satisfactory/unsatisfactory grades, or grades below a C will count to fulfill the common prerequisites or the requirements for the major.

The following is a general overview of requirements for this program. It is provided for informational purposes only, and interested individuals should contact appropriate university personnel for details and recent updates. (Note: Credit hours associated with specific courses are listed in parenthesis following the course title.)

Common prerequisites:

The State of Florida has identified common prerequisites for all university programs. All students entering a particular field of study must complete these courses, and universities must accept and apply the specified courses toward the degree. The common prerequisites should be taken in the first two years of study. Some courses may meet general education requirements, as well as fulfill common prerequisite requirements; however, a course may not be used as both a common prerequisite and a required or elective course within a major. Common prerequisites for College of Arts and Sciences programs must be completed with a grade of C or higher prior to beginning coursework in the major.

COP xxxx	Computer Language (3) Pascal, FORTRAN, C, C+, or C++
MAC 2311	Calculus w/Analytic Geometry I (4)
MAC 2312	Calculus w/Analytic Geometry II (4)
MAC 2313	Calculus w/Analytic Geometry III (4)

Plus successful completion of two of the following laboratory-based science courses for respective science majors:
BSC xxxx/xxxxL (4-8)
Or CHM xxxx/xxxxL (4-8)
Or PHY xxxx/xxxxL (4-8)

NOTE: Combined lecture and laboratory courses (marked with C) are equivalent to taking the lecture and lab separately as two courses. Completion of PHY2048C and PHY 2049C is highly recommended for students entering the mathematics major.

Collegium of Integrated Learning (21 hours):

IDS 3301	Issues in Culture & Society (3)
IDS 3302	Issues in Politics & Economics (3)
IDS 3303	Issues in Science & Technology (3)
IDS 3304	Issues in Ecology & Environment (3)
IDS 3305	Issues in Media, Literature & Arts (3)
IDS 4910	Integrated Core Senior Seminar (3)
XXX 3-4000	Upper division elective (3)*

*The collegium elective should be chosen from arts and sciences courses outside of the student's major (unless otherwise permitted by the College of Arts and Sciences advisor) or courses from another college, with permission of that college and the College of Arts and Sciences advisor.

University Colloquium (3 hours):

IDS 3920	University Colloquium (3)

Coursework for the major (36 hours):

Core courses (27 hours):

MHF 2191	Mathematical Foundations (3)
MAS 2121	Linear Operators and Differential Equations (4)
MAP 3161	Methods of Applied Math I (4)
MAP 3162	Methods of Applied Math II (4)
MAP 3163	Methods of Applied Math III (3)
MAS 4301	Abstract Algebra I (3)
MAA 4226	Advanced Calculus (4)
MAT 4937	Senior Seminar (2)

Plus one of the following (depth requirement; 3 hours)*:

MAA 4227	Foundations of Real Analysis (3)
MAP 4231	Introduction to Operations Research (3)
MAP 4314	Dynamical Systems (3)
MAS 4106	Matrix Analysis (3)
MAS 4302	Abstract Algebra II (3)
STA 4234	Introduction to Regression Analysis (3)

*A course used to satisfy the depth requirement may not be used as an elective.

Plus 6 hours of mathematics elective coursework numbered 3000 or higher.

Academic Advising

Students must meet with a College of Arts and Sciences advisor prior to entrance into any of the programs and prior to beginning coursework for an individualized program of study. A signed advising contract, which serves as a check sheet of requirements, is required. The academic advisor will assist students in preparing an academic plan that incorporates university, college, and program requirements including general education, CLAST (College Academic Skills Test), foreign language, Gordon Rule writing and computation, and Eagles Connect-Service Learning. Service learning activities provide structured learning experiences in community settings and are designed to fulfill specific undergraduate learning goals and outcomes, reinforce and enhance classroom learning, and meet community needs.