DEPARTMENT OF MATHEMATICS
MILLERSVILLE UNIVERSITY

2022-2023 STUDENT HANDBOOK
FOR MATHEMATICS MAJORS AND MINORS

Brief Version – Degree Programs and Four-year plans

Contents

I. MATHEMATICS DEGREE PROGRAMS AT M. U.

BACHELOR'S DEGREE PROGRAMS:

The Department of Mathematics at Millersville University offers the following bachelor's degree programs:

      (1)   Bachelor of Arts (B.A.) in Mathematics

      (2)   Bachelor of Science (B.S.) in Mathematics

      (3)   Bachelor of Science in Education (B.S.Ed.) (Mathematics major; Secondary Education)

Both the B.A. and B.S. degree programs allow considerable freedom of choice, within the major and without. The B.S.Ed. program in mathematics, however, has less latitude because one entire year is devoted to field placements and student teaching. These programs are described in detail in the next few pages.

ELECTIVES:

Students should be aware of the importance of choosing their electives wisely. Those who are preparing for a career in applied mathematics are advised to develop some interest and knowledge in one or more "related areas", which will make them attractive to an employer. Knowledge of computer science is very important for those seeking a career in applied mathematics. Students planning to continue on to Master's and Doctoral programs must be especially careful to take electives that will prepare them for the rigors of graduate study.

SECOND MAJORS:

With careful planning and hard work, an energetic student can graduate from M.U. with two majors. A student wishing to "double major" is advised to consult the university catalog for the regulations to be followed, and to obtain a special "double major" form from the registrar's office. However, only one degree is granted: either a B.A. or a B.S., but not both.

MINORS:

Students are encouraged to develop an area of interest outside their major. An excellent way to do this is to minor in another subject.

In fact, the Mathematics Department welcomes students from other majors to elect either a minor in Mathematics or a minor in Statistics. These minors are described in section VIII of this handbook.

II. THE B.A. DEGREE IN MATHEMATICS

The B.A. degree program in mathematics is a flexible curriculum designed to accommodate the widest possible range of career objectives. It is structured according to the traditional liberal arts approach to college education.

In addition to the "general education" requirements common to all B.A. programs at Millersville (see the University catalog, or the appropriate "curriculum record form") this program requires the student to take:

A. Required Core Courses   **25-26 s.h.**

MATH 161 - Calculus I	4 s.h.	
(or MATH 163 - Honors Calculus I	5 s.h.)	
MATH 211 - Calculus II	4 s.h.	
MATH 310 - Intro. to Mathematical Proof	3 s.h.	
MATH 311 - Calculus III	4 s.h.	
MATH 322 - Linear Algebra I	4 s.h.	
MATH 345 - Abstract Algebra I	3 s.h.	
MATH 464 - Real Analysis I	3 s.h.	

B. MATH Electives   **18 s.h.**

- A minimum of 6 additional courses (18-19 s.h.) chosen from among those listed below.

- These 6 courses must include:

  (i)   **At least one** of MATH 335 or MATH 365

  and

  (ii)   **At least one** of MATH 422, MATH 435, MATH 445, or MATH 467; others may be substituted by departmental permission.

MATH 335 - Mathematical Statistics I	3 s.h.
MATH 354 – Geometry: Classical and Trans.	4 s.h.
MATH 365 - Ordinary Differential Equations	3 s.h.
MATH 370 - Operations Research	3 s.h.
MATH 372 – Financial Mathematics I	3 s.h.
MATH 375 - Numerical Analysis	3 s.h.
MATH 393 - Number Theory	3 s.h.
MATH 395 - Introduction to Combinatorics	3 s.h.
MATH 422 - Linear Algebra II	3 s.h.
MATH 435 - Mathematical Statistics II	3 s.h.
MATH 445 - Abstract Algebra II	3 s.h.
MATH 457 - Elementary Differential Geometry	3 s.h.

MATH 465 - Real Analysis II   3 s.h.
MATH 467 - Partial Differential Equations   3 s.h.
MATH 471 - Mathematical Modeling   3 s.h.
MATH 472 - Financial Mathematics II   3 s.h.
MATH 483 - Point-set Topology   3 s.h.
MATH 4_8 - Topics in _____   1-3 s.h.
MATH 535 - Statistical Methods I   3 s.h.
MATH 536 - Statistical Methods II   3 s.h.
MATH 566 - Complex Variables   3 s.h.
MATH 592 – Graph Theory   3 s.h.

(Selected 500-level courses may be substituted for the above with the approval of the department.)

C.   Required Related Courses   13-19 s.h.

1.   Foreign Lang. through elem. level (102 or higher).   3-6 s.h.

2.   CSCI 161 - Introduction to Computing I   4 s.h.

3.   One of the following options: 6-9 s.h.

       a.   Two courses (at least 3 credits each) chosen from the departments of Biology, Chemistry, Computer Science, Earth Sciences and Physics, which count toward the major in that department, or PHIL 312 (Mathematical Logic).
or
       b.   Three courses (at least 3 credits each) from a single department, chosen from courses counting toward the major in that department.

Note: Sample four-year plans of study for students in this program are found on the next two pages.

SAMPLE FOUR YEAR PLAN OF STUDY

THE BACHELOR OF ARTS IN MATHEMATICS

FIRST SEMESTER

MATH 161 Calculus I	4
CSCI 161 Intro to Comp I (G2 #1)	4
ENGL 110 Composition	3
UNIV 103 (Math majors section)	3
Total s.h.	14

SECOND SEMESTER

MATH 211 Calculus II	4
COMM 100 Fund of Speech	3
G1 #1	3
G3 #1	3
WELL 175	3
Total s.h.	16

THIRD SEMESTER

MATH 311 Calculus III	4
MATH 310 Intro to Math Proof	3
Foreign Language (G1 #2)	3
G3 #2	3
G2 #2	3
Total s.h.	16

FOURTH SEMESTER

MATH 322 Linear Algebra I	4
Humanities/Fine Arts #2	3
Foreign Language (G1 #3)	3
G2 #3 (L)	4
Total s.h.	14

FIFTH SEMESTER

MATH 335 Math Stat I	
(**OR** MATH 365 Ord Diff Eq)	3
MATH Elective	3
G2 #3	3
Elective (D)	3
Elective	3
Total s.h.	15

SIXTH SEMESTER

Advanced Writing	3
MATH 345 Abstract Algebra I	3
MATH Elective	3
Elective*	3
Elective	3
Total s.h.	15

SEVENTH SEMESTER

MATH 464 Real Analysis I	3
MATH Elective	3
435, 445, or 467)	3
Elective (P)	3
Elective	3
Elective	3
Total s.h.	15

EIGHTH SEMESTER

MATH Elective	3
MATH Elective	
	(422,
Elective	3
Elective	3
Elective	3
Total s.h.	15

Total S.H. = 120 (minimum)

* Note that 2-3 Electives are needed to fulfill the Required Related Courses. See Section C.3.

BACHELOR OF ARTS IN MATHEMATICS

SAMPLE FOUR-YEAR PLAN OF STUDY
FOR STUDENTS STARTING WITH MATH 160

FIRST SEMESTER

MATH 160 Precalculus	4
CSCI 161 Intro to Comp I (G2 #1)	4
ENGL 110 Composition	3
UNIV 103 (Math majors section)	3
Total s.h.	14

SECOND SEMESTER

MATH 161 Calculus I	4
COMM 100 Fund of Speech	3
WELL 175	3
G3 #1	3
G2 #2	3
Total s.h.	16

THIRD SEMESTER

MATH 211 Calculus II	4
Foreign Language (G1 #1)	3
G3 #2	3
Elective*	3
Elective	3
Total s.h.	16

FOURTH SEMESTER

MATH 311 Calculus III	4
MATH 310 Intro Math Proof	3
Foreign Language (G1 #2)	3
G3 #3	3
Elective	3
Total s.h.	16

FIFTH SEMESTER

MATH 322 Linear Algebra I	4
MATH 335 Math Stat I	
(OR MATH 365 Ord Diff Eq)	3
G2 #3 (L)	5
G1 #3	3
Total s.h.	15

SIXTH SEMESTER

MATH 345 Abstract Algebra I	3
MATH Elective	3
Advanced Writing	3
Elective	3
Elective	4
Total s.h.	16

SEVENTH SEMESTER

MATH 464 Real Analysis I	3
MATH Elective	3
Elective (P)	3
Elective (D)	3
Elective	3
Total s.h.	15

EIGHTH SEMESTER

MATH Elective	3
MATH Elective	3
MATH Elective	
(422, 435, 445, or 467)	3
Elective	3
Total s.h.	12

Total S.H. = 120 (minimum)

* Note that 2-3 Electives are needed to fulfill the Required Related Courses. See Section C.3.

III. THE B.S. DEGREE IN MATHEMATICS

The B.S. degree program differs from the B.A. degree program in that it is specifically application-oriented. It requires greater concentration in mathematical analysis and science, and thus it is somewhat less flexible than the B.A. program. However, there is no foreign language requirement for the B.S. degree.

In addition to the "general education" requirements common to all B.S. programs at Millersville (see the University catalog, or the appropriate "curriculum record form") this program requires the student to take:

A.   **Required Core Courses**   **34-35 s.h.**

MATH 161 - Calculus I	4 s.h.
(or MATH 163 - Honors Calculus I 5 s.h.)	
MATH 211 - Calculus II	4 s.h.
MATH 310 - Intro. to Mathematical Proof	3 s.h.
MATH 311 - Calculus III	4 s.h.
MATH 322 - Linear Algebra I	4 s.h.
MATH 335 - Mathematical Statistics I	3 s.h.
MATH 345 - Abstract Algebra I	3 s.h.
MATH 365 - Ordinary Differential Equations	3 s.h.
MATH 375 - Numerical Analysis	3 s.h.
MATH 464 - Real Analysis I	3 s.h.

B.   **Math Electives**   **9-10 s.h.**
Any three courses (9 s.h. minimum) chosen from among:

MATH 354 – Geometry: Classical & Trans.	4 s.h.
MATH 370 - Operations Research	3 s.h.
MATH 372 – Financial Mathematics I	3 s.h.
MATH 393 - Number Theory	3 s.h.
MATH 395 - Introduction to Combinatorics	3 s.h.
MATH 422 - Linear Algebra II	3 s.h.
MATH 435 - Mathematical Statistics II	3 s.h.
MATH 445 - Abstract Algebra II	3 s.h.
MATH 457 - Elementary Differential Geometry	3 s.h.
MATH 465 - Real Analysis II	3 s.h.
MATH 467 - Partial Differential Equations	3 s.h.
MATH 471 - Mathematical Modeling	3 s.h.
MATH 472 – Financial Mathematics II	3 s.h.
MATH 483 - Point Set Topology	3 s.h.
MATH 4_8 - Topics in _____	1-3 s.h.
MATH 535 - Statistical Methods I	3 s.h.
MATH 536 - Statistical Methods II	3 s.h.
MATH 566 - Complex Variables	3 s.h.
MATH 592 – Graph Theory	3 s.h.

These 3 courses must include: **at least one** of MATH 422, MATH 435, MATH 445, or MATH 467 (others may be substituted with departmental approval).

C.   Required Related Courses   18-22 s.h.

1.   CSCI 161 - Intro. to Computing I   4 s.h.

2.   PHYS 231 - General Physics I   5 s.h.

3.   One of the following options: 9-13 s.h.

a.   Three courses (at least 3 credits each) chosen from the departments of Biology, Chemistry, Computer Science, Earth Sciences and Physics, which count toward the major in that department and **to include at least one of**: BIOL 375, CSCI 162, ESCI 340, ESCI 341, ESCI 342, or PHYS 232.

or

b.   Four courses (at least 3 credits each) chosen from a single department, which count toward the major in that department.

For descriptions of these courses, and their prerequisites, consult the university catalog.

Note: Sample four-year plans of study for students in this program are found on the next two pages.

SAMPLE FOUR YEAR PLAN OF STUDY

THE BACHELOR OF SCIENCE IN MATHEMATICS

FIRST SEMESTER

MATH 161 Calculus I	4
CSCI 161 Intro to Comp I (G2 #1)	4
ENGL 110 Composition	3
UNIV 103 (Math majors section)	3
Total s.h.	14

SECOND SEMESTER

MATH 211 Calculus II	4
COMM 100 Fund of Speech	3
G3 #1	3
G1 #1	3
WELL 175	3
Total s.h.	16

THIRD SEMESTER

MATH 311 Calculus III	4
PHYS 231 Gen Physics I (G2 #2, L)	5
MATH 310 Intro to Math Proof	3
G1 #2	3
Total s.h.	15

FOURTH SEMESTER

MATH 322 Linear Algebra I	4
MATH 365 Ord Diff Eq	3
G2 #3	4
G3 #2	3
Total s.h.	14

FIFTH SEMESTER

MATH 335 Math Stat I	3
Advanced Writing	3
Elective*	3
G3 #3	3
Elective	4
Total s.h.	16

SIXTH SEMESTER

MATH 345 Abstract Algebra I	3
G1 #3	3
Elective (P)	3
MATH 375 Numerical Analysis	3
Elective	3
Total s.h.	15

SEVENTH SEMESTER

MATH 464 Real Analysis I	3
MATH Elective	3
Elective (D)	3
Elective	3
Elective	3
Total s.h.	15

EIGHTH SEMESTER

MATH Elective	3
MATH Elective	
(422, 435, 445, or 467)	3
Elective	3
Elective	3
Elective	3
Total s.h.	15

Total s.h. = 120 (minimum)

* Note that 3-4 Electives are needed to fulfill the Required Related Courses. See Section C.3.

BACHELOR OF SCIENCE IN MATHEMATICS

SAMPLE FOUR-YEAR PLAN OF STUDY
FOR STUDENTS STARTING WITH MATH 160

FIRST SEMESTER

MATH 160 Precalculus	4
CSCI 161 Intro to Comp I (G2 #1)	4
ENGL 110 Composition	3
UNIV 103 (Math majors section)	3
Total s.h.	**14**

SECOND SEMESTER

MATH 161 Calculus I	4
COMM 100 Fund of Speech	3
G1 #1	3
WELL 175	3
G2 #2	3
Total s.h.	**16**

THIRD SEMESTER

MATH 211 Calculus II	4
Elective*	3
G1 #2	3
G3 #1	3
Elective	3
Total s.h.	**16**

FOURTH SEMESTER

MATH 311 Calculus III	4
MATH 310 Intro to Math Proof	3
G1 #3	3
G3 #2	3
Elective	3
Total s.h.	**16**

FIFTH SEMESTER

MATH 322 Linear Algebra I	4
MATH 335 Math Stat I	3
PHYS 231 Gen Physics I (G2#3, L)**	5
G3 #3	3
Total s.h.	**15**

SIXTH SEMESTER

MATH 345 Abstract Algebra I	3
MATH 365 Ord Diff Eq	3
Elective (P)	3
Elective	4
Elective	3
Total s.h.	**16**

SEVENTH SEMESTER

MATH Elective	3
MATH Elective	3
Advanced Writing	3
Elective (D)	3
Elective	3
Total s.h.	**15**

EIGHTH SEMESTER

MATH 464 Real Analysis I	3
MATH 375 Numerical Analysis	3
MATH Elective	3
Elective	3
Total s.h.	**12**

Total S.H. = 120 (minimum)

* Note that 3-4 Electives are needed to fulfill the Required Related Courses. See Section C.3.
** Note that either 1 additional Physics course or 2 Natural Science courses will be needed to complete the Science block.

IV. THE B.S. DEGREE IN EDUCATION (MATHEMATICS)

The B.S.E. is the degree program for prospective teachers of mathematics in secondary schools.

The Mathematics Education curriculum at Millersville is structured to enable students to discover early in the college experience whether or not the teaching profession is appropriate for them. The program was recently restructured to give students frequent and consistent opportunities to prepare for their careers in education, and students now start thinking about teaching during their first semester in the UNIV 103 course. During their sophomore year, they take the first of two methods courses in the teaching of secondary mathematics, and when possible, combine this with two education courses that more formally expose them to middle and senior high school students in "Foundations Block" in-school field experiences. During their junior year, they examine the mathematical connections found between their college mathematics and the secondary mathematics programs in MATH 325, and then fulfill "Professional Block" with the second mathematics methods course that places them in secondary school classrooms for a full semester of in-school experiences. The program is capped off in the last semester with full-time student-teaching placement in a local middle or high school.

After earning the B.S.E. degree in mathematics with the required overall 3.0 grade point average, satisfying required background clearances (Act 34/114/151) and passing the Praxis I and Praxis II content exams, you will receive an Instructional I certificate to teach mathematics in any secondary school in Pennsylvania. This certificate is easily applied to certifications in other states (note state guidelines). Instructional II certificates require additional coursework and teaching experience.

In addition to the general education and professional requirements common to all B.S.E. programs at Millersville (see the university catalog, or the appropriate "curriculum record form") this program requires the student to take:

A.   Required Core Courses   39-42 s.h.

MATH 161 - Calculus I   4 s.h.
    (or MATH 163 - Honors Calculus I   -   5 s.h.)
MATH 211 - Calculus II   4 s.h.
MATH 301 – History of Mathematics   3 s.h.
MATH 310 - Intro. to Mathematical Proof   3 s.h.
MATH 311 - Calculus III   4 s.h.
MATH 322 - Linear Algebra I   4 s.h.
MATH 325 - Mathematical Connections   3 s.h.
MATH 333 - Intro. to Probability and Statistics   4 s.h.
    or $\begin{cases} \text{MATH 335 - Mathematical Statistics I - 3 s.h., and} \\ \text{MATH 435 - Mathematical Statistics II - 3 s.h.} \end{cases}$
MATH 345 - Abstract Algebra I   3 s.h.
MATH 354 – Geometry: Classical and Trans.   4 s.h
MATH 464 - Real Analysis I   3 s.h.

B.   MATH Electives   **2-3 s.h.**

Any two courses not taken in the required core, chosen from among:
MATH 365 - Ordinary Differential Equations   3 s.h.
MATH 370 - Operations Research   3 s.h.
MATH 372 - Financial Mathematics I   3 s.h.
MATH 375 - Numerical Analysis   3 s.h.
MATH 393 - Number Theory   3 s.h.
MATH 395 - Introduction to Combinatorics   3 s.h.
MATH 422 - Linear Algebra II   3 s.h.
MATH 445 - Abstract Algebra II   3 s.h.
MATH 457 - Elementary Differential Geometry   3 s.h.
MATH 465 - Real Analysis II   3 s.h.
MATH 467 - Partial Differential Equations   3 s.h.
MATH 471 - Mathematical Modeling   3 s.h.
MATH 472 - Financial Mathematics II   3 s.h.
MATH 483 - Point-set Topology   3 s.h.
MATH 4_8 - Topics in _____   1-3 s.h.
MATH 535 - Statistical Methods I   3 s.h.
MATH 536 - Statistical Methods II   3 s.h.
MATH 566 - Complex Variables   3 s.h.
MATH 592 - Graph Theory   3 s.h.
(Selected 500-level courses may be substituted for the above with the approval of the department.)

C.   Required Related Courses   **8 s.h.**

CSCI 161 - Introduction to Computing I   4 s.h.
CSCI 140 – Discrete Structures   4 s.h.

D.   Professional Education Courses   **32 s.h.**

MATH 305 - Teaching of Mathematics in the
          Secondary School I   2 s.h.

Foundations Bloc
EDFN 211 - Foundations of Modern Education(D)   3 s.h.
EDFN 241 - Psych. Foundations of Teaching   3 s.h.

Professional Bloc
MATH 405 - Teaching of Mathematics in the   3 s.h.
          Secondary School II
EDSE 321 - Issues in Secondary Education   3 s.h.
SPED 346 - Inclusive Settings   3 s.h.
EDSE 340 - Literacy for Diverse Classes   3 s.h

Student Teaching Bloc

EDMA 461 - Student Teaching   9 s.h
SPED 471 - Differentiating Instr. in St. Teaching   3 s.h.

Note 1: In order to graduate in 4 years, students in the B.S.E. program must complete all their academic coursework in 6 semesters. The seventh and eighth semesters are spent in Professional Bloc and full-time student teaching experiences. (If necessary, although not advised, students may be able to take one 3-credit class during Professional Bloc.) Consequently, students in this program must carefully plan their program of study in consultation with their advisor. Although not required, students may find it helpful to take one or two courses during a summer or winter session.

Note 2: B.S.E. students are required to maintain samples of work for their content portfolios to be completed as part of MATH 325.

Note 3: Prior to ANY/ALL field placements, students must have all three background checks completed through Castlebranch (FBI Finger-print, Child Abuse Clearance, Criminal Background Check) and a negative TB test – all within the last year.

Note 4: In addition to other requirements, all BSE majors must successfully complete a course in English Literature.

Note 5: Sample four-year plans of study for students in this program are found on the next two pages.

ADVISING; SAMPLE FOUR YEAR PLAN OF STUDY
BSE (MATHEMATICS); <u>Starting MATH 161</u>

FIRST SEMESTER

MATH 161: Calc I	4
CSCI 161: Intro to CompI (RR/G2#1)	4
ENGL 110: Composition	3
WELL 175: Wellness	3
UNIV 103: (BSE Math section)	3
Total s.h.	**17**

SECOND SEMESTER

MATH 211 Calc II	4
COMM 100 Fund of Speech	3
G1#1	3
CSCI 140 (RR)	4
Lab/G2#2 (BIO 100 rec)	3
Total s.h.	**17**

THIRD SEMESTER

MATH 310 Proof (W)	3
MATH 311: Calc 3	4
EDFN 211: Found of Mod Ed (D)	3
EDFN 241: Psych Found Tchg	3
G3#1	3
Total s.h.	**16**

FOURTH SEMESTER

MATH 333: Prob/Stat	4
MATH 322: Linear Algebra	4
MATH 305: Tchg Math I	2
G3#2	3
ENGL Literature (G1#2)	3
Total s.h.	**16**

FIFTH SEMESTER

MATH 354: Geometry	4
MATH 345: Abstract Algebra	3
Advanced Writing (ENGL 312 rec)	3
G3#3	3
MATH Elective	2-3
Total s.h.	**15-16**

SIXTH SEMESTER

MATH 464 Real Analysis	3
MATH 325: Math Connections	3
MATH 301: History of Math (P)	3
G2#3/W (BIO 204, 207, 256 rec)	3
G1#3 (PHIL 211/312 suggested)	3
Total s.h.	**15**

SEVENTH SEMESTER

MATH 405: Tchg Math/Sec Sch	3
EDSE 321: Issues in Secondary Ed	3
SPED 346: Inclusive Settings	3
EDSE 340: Lit. Diverse Classes	3
XXXX XXX	<u>3*</u>
Total s.h.	**12/15**

EIGHTH SEMESTER

EDMA 461: Student Teaching	9
EDSE 471: Diff. Instruction	<u>3</u>
Total s.h.	**12**

Total S.H. = 120 (minimum)

- An additional 3-credit course can be scheduled during the 7th semester if needed, but it is NOT recommended.
- ALL Clearance AND TB tests MUST now be updated EVERY year for ANY Field Placement semester
- PAPA 1; prior to Seventh Semester (preferably earlier); PRAXIS 2; prior to program completion (pref. prior to Seventh semester, but must have completed MATH 345 and 354).

ADVISING; SAMPLE FOUR YEAR PLAN OF STUDY
BSE (MATHEMATICS); <u>Starting MATH 160</u>

FIRST SEMESTER		SECOND SEMESTER	
MATH 160: Pre-Calculus	4	MATH 161: Calc I	4
CSCI 161: Intro to Comp I (RR/G2#1)	4	COMM 100: Fund of Speech	3
ENGL 110: Composition	3	G1#1	3
UNIV 103: (BSE Math section)	3	CSCI 140 (RR)	4
WELL 175	3	G2#2 (BIOL 100 rec)	3
Total s.h.	17	Total s.h.	17

THIRD SEMESTER		FOURTH SEMESTER	
MATH 211: Calc II	4	MATH 305: Tchg Math I	2
G3#1	3	MATH 310: Proof (W)	3
ENGL Literature (G1#2)	3	MATH 311: Calc 3	4
EDFN 211: Found of Mod Ed (D)	3	G3#2	3
EDFN 241: Psych Found Tchg	3	G1#3 (PHIL 211/312 rec)	3
Total s.h.	16	Total s.h.	15

FIFTH SEMESTER		SIXTH SEMESTER	
G2#3/W (BIOL 204, 207, 256 rec)	3	Adv Writing (ENGL 312 rec)	3
MATH 322: Linear Algebra	4	MATH 345: Abstract Algebra	3
MATH 354: Geometry	4	MATH 325: Math Connections	3
G3#3	3	MATH 301 (P)	3
MATH Elective	2-3	MATH 333: Prob/Stat	4
Total s.h.	17-18	Total s.h.	15

SEVENTH SEMESTER		EIGHTH SEMESTER	
MATH 405: Tchg Math/Sec Sch	3	EDMA 461 Student Teaching	9
EDSE 321: Issues in Secondary Ed	3	EDSE 471 Differentiated. Instr.	3
SPED 346: Inclusive Settings	3		
EDSE 340: Lit. for Diverse Classes	3		
MATH 464: Real Analysis	3		
Total s.h.	15	Total s.h.	12

Total S.H. = 124 (minimum)

- ALL Clearance AND TB tests MUST now be updated EVERY year for ANY Field Placement semester
- PAPA 1; prior to Seventh Semester (preferably earlier); PRAXIS 2; prior to program completion (pref. prior to Seventh semester, but must have completed MATH 345 and 354).

V. THREE SPECIALTY OPTIONS:

ACTUARIAL SCIENCE
APPLIED MATHEMATICS
STATISTICS

A.   The Actuarial Science Option

The Actuarial Science option is designed to prepare students for a career as an actuary. Students successfully completing the option will be prepared to take the first 2-3 examinations administered by the Society of Actuaries. Students enrolled in any of the B.A., B.S. or B.S.E. programs may complete the Actuarial Science Option by including the following courses among the courses taken to fulfill their major.

      1.   Required Courses

MATH 335 - Mathematical Statistics I (required for B.S.)	3 s.h.
MATH 372 – Financial Mathematics I	3 s.h.
MATH 419 - Calculus and Actuarial Sci Probl Solv Sem	1 s.h.
MATH 435 - Mathematical Statistics II	3 s.h.
MATH 535 - Statistical Methods I	3 s.h.

      2.   Required Related Courses

ECON 101 – Principles of Macroeconomics	3 s.h.
ECON 102 - Principles of Microeconomics	3 s.h.

      3.   Recommended Courses

MATH 472 – Financial Mathematics II	3 s.h.
MATH 536 - Statistical Methods II	3 s.h.
* BUAD 161 – Introduction to Financial Accounting	3 s.h.
* BUAD 162 – Introduction to Managerial Accounting	3 s.h.

      *Note that the courses BUAD 161, 162 do not count in the general education curriculum. Therefore, students are recommended to take theses courses only if their schedules will permit them.

Note: A sample four-year plan of study for students in this program is found on page 19.

B.   The Applied Mathematics Option

The Applied Mathematics option is designed to give students a focus in those areas of mathematics used most often in applications. The program is designed to prepare students for jobs applying mathematics in STEM fields or for graduate study in mathematics. Students enrolled in the B.S. program may complete the Applied Mathematics Option by including the following courses among the courses taken to fulfill their major.

1.   **Required MATH courses**

MATH 335* - Mathematical Statistics I	3 s.h.
MATH 365* - Ordinary Differential Equations	3 s.h.
MATH 375* - Numerical Analysis	3 s.h.
MATH 467 - Partial Differential Equations	3 s.h.

   and two of:

MATH 370 – Operations Research	3 s.h.
MATH 372 – Financial Mathematics I	3 s.h.
MATH 471 - Mathematical Modeling	3 s.h.
MATH 472 – Financial Mathematics II	3 s.h.
MATH 478 – Topics in Applied Mathematics	3 s.h.

2.   **Required Related Courses**

PHYS 231* - Physics I with Calculus	5 s.h.

   and one of:

PHYS 232 - Physics II with Calculus	5 s.h.
ESCI 341** - Atmospheric Thermodynamics	3 s.h.
ESCI 342** - Atmospheric Dynamics I	3 s.h.

3.   **Recommended Courses**

CSCI 406 - Topics in Computer Science (FORTRAN programming)	1-3 s.h.
PHYS 311*** - Mechanics I	3 s.h.
PHYS 312*** - Mechanics II	3 s.h.

* These courses are already required for students in the B.S. program.
** These courses have a prerequisite of ESCI 241.
*** These courses have a prerequisite of PHYS 232.

C.   The Statistics Option

The Statistics option is intended to prepare students for work as statisticians as well as for graduate study in statistics. Students enrolled in any of the B.A., B.S. or B.S.E. programs may complete the Statistics Option by including the following courses among the courses taken to fulfill their major.

     1.   Required Courses

          MATH 335 - Mathematical Statistics I (req. B.S.)   3 s.h.
          MATH 435 - Mathematical Statistics II   3 s.h.
          MATH 535 - Statistical Methods I   3 s.h.
          MATH 536 - Statistical Methods II   3 s.h.
          MATH 537 - Statistical Problem Solving Seminar   1 s.h.

     2.   Recommended Courses

          MATH 370 - Operations Research   3 s.h.
          MATH 375 - Numerical Analysis   3 s.h.
          MATH 422 - Linear Algebra II   3 s.h.

<u>**Note:**</u> A sample four-year plan of study for students in this program is found on page 21.

SAMPLE FOUR YEAR PLAN OF STUDY
THE BACHELOR OF SCIENCE IN MATHEMATICS
ACTUARIAL SCIENCE OPTION

FIRST SEMESTER

MATH 161 Calculus I	4
ENGL 110 Composition	3
CSCI 161 Intro to Comp I (G2 #1)	4
UNIV 103 (Math majors section)	3
Total s.h.	14

SECOND SEMESTER

MATH 211 Calculus II	4
COMM 100 Fund of Speech	3
WELL 175	3
G3 #1	3
G1 #1	3
Total s.h.	16

THIRD SEMESTER

MATH 311 Calculus III	4
PHYS 231 Gen Physics I (G2 #2, L)	5
MATH 310 Intro to Math Proof	3
ECON 101 Macroeconomics (G3 #2)	3
Total s.h.	15

FOURTH SEMESTER

MATH 322 Linear Algebra I	4
MATH 365 Ord Diff Eq	3
Elective*	3
ECON 102 Microeconomics (G3 #3)	3
Total s.h.	13

FIFTH SEMESTER

MATH 335 Math Statistics I	3
G1 #2	3
G2 #3**	3
Elective	3
BUAD 161 (recommended)	3
Total s.h.	15

SIXTH SEMESTER

Advanced Writing	3
MATH 435 Math Stats II	3
MATH 345 Abstract Alg I	3
MATH 419 Calc/Act Sci Sem	1
Elective (D)	3
BUAD 162 (recommended)	3
Total s.h.	16

SEVENTH SEMESTER

MATH 535 Stat Methods I	3
MATH Elective	3
Elective (P)	3
G1 #3	3
Elective	3
Total s.h.	15

EIGHTH SEMESTER

MATH 464 Real Analysis I	3
MATH 375 Numerical Analysis	3
Elective	3
Elective	3
Elective	3
Total s.h.	15

Total S.H. = 120 (minimum)

* Note that 3-4 Electives are needed to fulfill the Required Related Courses. See Section C.3., page 8.

** Note that either 1 additional Physics course or 2 Natural Science courses will be needed to complete the Science block.

SAMPLE FOUR YEAR PLAN OF STUDY
THE BACHELOR OF SCIENCE IN MATHEMATICS
APPLIED MATHEMATICS OPTION

FIRST SEMESTER

MATH 161 Calculus I	4
CSCI 161 Intro to Comp I (G2 #1)	4
ENGL 110 Composition	3
UNIV 103 (Math majors section)	3
Total s.h.	14

SECOND SEMESTER

MATH 211 Calculus II	4
COMM 100 Fund of Speech	3
WELL 175	3
G3 #1	3
G1 #1	3
Total s.h.	16

THIRD SEMESTER

MATH 311 Calculus III	4
PHYS 231 Gen Physics I (G2 #2, L)	5
MATH 310 Intro to Math Proof	3
G3 #2	3
Total s.h.	15

FOURTH SEMESTER

MATH 322 Linear Algebra I	4
MATH 365 Ordinary Differential Eqn	3
G2 #3**	3-5
G3 #3	3
Total s.h.	13-15

FIFTH SEMESTER

MATH 335 Math Stats I	3
Elective*	3
MATH 467 Partial Differential Eqn	3
G1 #2	3
Elective	3
Total s.h.	15

SIXTH SEMESTER

Advanced Writing	3
MATH 345 Abstract Alg I	3
MATH 375 Numerical Analysis	3
Elective (D)	3
Elective	3
Total s.h.	15

SEVENTH SEMESTER

MATH 478 Topics in Appl Math	3
MATH 471 Mathematical Modeling	3
Elective (P)	3
G1 #3	3
Elective	3
Total s.h.	15

EIGHTH SEMESTER

MATH 464 Real Analysis	3
MATH Elective	3
Elective	3
Elective	3
Elective	3
Total s.h.	15

Total S.H. = 120 (minimum)

* Note that 3-4 Electives are needed to fulfill the Required Related Courses. See Section C.3., page 8.

** It is suggested that students take PHYS 232 (G2, L) for 5 s.h., otherwise an additional course should be taken in this semester to achieve the aggregate of 120 s.h. in 8 semesters.

SAMPLE FOUR YEAR PLAN OF STUDY
BACHELOR OF SCIENCE IN MATHEMATICS
STATISTICS OPTION

FIRST SEMESTER

MATH 161 Calculus I	4
CSCI 161 Intro to Comp I (G2 #1)	4
ENGL 110 Composition	3
UNIV 103 (Math majors section)	3
Total s.h.	14

SECOND SEMESTER

MATH 211 Calculus II	4
COMM 100 Fund of Speech	3
WELL 175	3
G3 #1	3
G1 #1	3
Total s.h.	16

THIRD SEMESTER

MATH 311 Calculus III	4
PHYS 231 Gen Physics I (G2 #2, L)	5
MATH 310 Intro to Math Proof	3
G3 #2	3
Total s.h.	15

FOURTH SEMESTER

MATH 322 Linear Algebra I	4
MATH 365 Ord Diff Eq	3
G2 #3	3
G3 #3	3
Total s.h.	13

FIFTH SEMESTER

MATH 335 Math Stat I	3
Elective*	3
Humanities/Fine Arts #2	3
G3 #3	3
Elective	4
Total s.h.	16

SIXTH SEMESTER

Advanced Writing	3
MATH 435 Math Stats II	3
MATH 345 Abstract Alg I	3
Elective (D)	3
MATH 375 Numerical Analysis	3
Total s.h.	15

SEVENTH SEMESTER

MATH 535 Stat Methods I	3
MATH Elective	3
Elective (P)	3
G1 #3	3
Elective	3
Total s.h.	15

EIGHTH SEMESTER

MATH 536 Stat Methods II	3
MATH 464 Real Analysis I	3
MATH 537 Stat Prob Solv Sem	1
Elective	3
Elective	3
Elective	3
Total s.h.	16

Total S.H. = 120 (minimum)

* Note that 3-4 Electives are needed to fulfill the Required Related Courses. See Section C.3., page 8.

VI. THE COOPERATIVE EDUCATION PROGRAM

The Cooperative Education Program is a non-traditional college curriculum combining on-campus studies with off-campus job experiences. It is a cooperative venture in which the student, the employer, and Millersville University *cooperate*--working hand-in-hand sharing resources and knowledge. See the 2020-2021 university catalog for details, pages 70, and 222.

After successfully completing at least the freshman year, the cooperative education student is employed in a full-time or part-time paid position closely aligned with his or her major areas of career interest. This position is held for one semester (or up to eight months including a summer), after which the student returns to Millersville University for a normal semester of academic coursework. The student may continue some pattern of alternating his/her semesters (including summers) between working at his/her position of employment and studying toward his/her degree at MU. Students who complete the program earn academic credits for their job experiences.

Students wishing to enter this program (or simply learn more about it) should contact Dr. James Fenwick, the Cooperative Education Coordinator in the Department of Mathematics. The coordinator screens candidates, helps arrange employment, and counsels the students. A co-op supervisor from the department is then appointed to evaluate the on-the-job experience and the student's performance.

The Cooperative Education office on campus works closely with the student in co-op placement and provides valuable advice in resume preparation and job interviewing.

The department believes that this program provides students with an excellent opportunity to gain a career awareness, along with a greater understanding of the practical applications of their academic studies. Through work experiences in an area related to their field of study, this program enables students to develop self-confidence and maturity. Another attractive feature of this program is that it provides students with an opportunity to finance a part of the cost of his/her own education.

VII. ADVICE IN PLANNING YOUR PROGRAM

There are many courses available for you to take at Millersville. You need to decide which of them to take and when to take them in order to fulfill degree requirements and to reach your career and personal goals.

A.   Frequency of Course Offerings

As you progress through your program, you will find that some courses are not offered every semester, and indeed some are offered only once every several years. Careful advance planning is recommended to assure that you will get all the courses you want.

Although the department does not follow any schedule of course offerings precisely (due to changing course demands and resources), what follows is a **rough** guideline. Certainly do not expect courses to be offered any more frequently than in the following guide; however, in addition to Calculus I, II, and III, some upper level courses have been offered each summer. To be absolutely certain, you should check with your faculty advisor.

ROTATION OF UPPER LEVEL MATH COURSE OFFERINGS

Every Fall/Spring Semester:
MATH 310 – Intro to Math Proof
MATH 322 – Linear Algebra
MATH 345 – Abstract Algebra I
MATH 365 – Ord Diff Eq
MATH 464 – Real Analysis I

FALL only
MATH 335 – Math Stats I
MATH 354 – Geometry: Classical/Trans.
MATH 405 – Teaching of Math II (Prof. Bloc, BSE)
MATH 467 – Partial Diff Eqns
MATH 535 – Stat Methods I
MATH 422 – Linear Algebra II (even years)

SPRING only
MATH 301 – History of Mathematics
MATH 305 – Teaching of Math I
MATH 325 – Mathematical Connections (BSE only)
MATH 333 – Intro Prob/Stat
MATH 375 – Num Analysis
MATH 419 – Actuarial Science Seminar
MATH 435 – Math Stats II
MATH 536 – Stat Methods II
MATH 537 – Stat Prob Solv
MATH 393 – Number Theory (odd years)
MATH 395 – Combinatorics (odd years)

The following courses are offered as the demand and resources permit:

     MATH 370 – Operations Research
     MATH 372 – Financial Mathematics I
     MATH 438 – Topics in Statistics
     MATH 445 – Abstract Algebra II
     MATH 457 – Differential Geometry
     MATH 465 – Real Analysis II
     MATH 471 – Math Modeling
     MATH 472 – Financial Mathematics II
     MATH 483 – Topology

B.   **Courses Recommended for Graduate Study**

Students planning to enter a master's degree or doctoral degree program in pure or applied mathematics or statistics need to pursue a strong undergraduate degree program. Such students often seek advice in selecting courses that will be especially helpful in preparing them for the rigors of graduate study. There are several courses that may be regarded as containing standard graduate-prep material. These courses should not be overlooked by anyone considering graduate school:

     MATH 335 - Mathematical Statistics I
     MATH 422 - Linear Algebra II
     MATH 365 - Ordinary Differential Equations
     MATH 393 - Number Theory
     MATH 435 - Mathematics Statistics II
     MATH 445 - Abstract Algebra II
     MATH 465 - Real Analysis II
     MATH 566 - Complex Variables

C.   **Recommended Computer Science Courses**

It is required for students majoring in mathematics to acquire some knowledge of computer science as well. For most post baccalaureate endeavors knowledge of computer science is necessary. If you are interested in follow-up courses to CSCI 161 (required of all math majors) we recommend the following:

     CSCI 162 - Introduction to Computing II
     CSCI 240 - Computational Models
     CSCI 362 - Data Structures
     CSCI 440 - Theory of Computation

D.   **Independent Study**

This is a project-oriented experience designed to allow a student to extend and deepen his/her knowledge in an area of keen interest, through a program of study which is not available through an established course. It involves supervision by a faculty member competent in that area of study.

E.   **Departmental Honors Program**

The purpose of the Mathematics Departmental Honors program is to provide advanced undergraduate students with a research experience in statistics, pure or applied mathematics or mathematics education.

The minimum eligibility requirements to participate in the departmental honors program are: completion of Math 310, 322, 311 and one mathematics major course at the 300 level or higher, a Millersville QPA of 3.00 or higher, a Millersville Math QPA of 3.35 or higher and the recommendation of a mathematics faculty member who is willing to be the project supervisor and thesis advisor.

Types of acceptable projects include:

a. original research in an area of statistics, pure or applied mathematics or mathematics education;

b. creative exposition of material from one of the above four areas not covered in a regular Math Department course offering;

c. creative mathematical modeling for the solution of a real-world problem of substantial complexity.

Additional information is available in the current university catalog, **Departmental Honors Program**, page 54. Specific guidelines and additional details are given in the Mathematics Departmental Honors Program Policy Statement which is available from the departmental office. Students wishing to participate must meet departmental criteria and follow formal application procedures. Further information may be obtained from your faculty advisor and the department chairperson.