Fiscal Unit/Academic Org	Mathematics - D0671
Administering College/Academic Group	Mathematical And Physical Sci
Co-adminstering College/Academic Group	Biological Sciences Education & Human Ecology
Semester Conversion Designation	New Program/Plan
Proposed Program/Plan Name	Master of Mathematical Sciences
Type of Program/Plan	Graduate degree program
Program/Plan Code Abbreviation	MATH-MM
Proposed Degree Title	Master of Mathematical Sciences

Credit Hour Explanation

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program				31	
Required credit hours offered by the unit	Minimum			16	
	Maximum			25	
Required credit hours offered outside of the unit	Minimum			6	
	Maximum			16	
Required prerequisite credit hours not included above	Minimum			0	
	Maximum			0	

Program Learning Goals

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

Program Learning Goals

- Strong background and maturity in relevant areas of math & ability to apply to specialization.

Training through interdisciplinary, practical experience and thesis writing.

Preparation for professions and doctoral programs in specialization.

Assessment

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

Is this a degree program (undergraduate, graduate, or professional) or major proposal? Yes

Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs? No

DIRECT MEASURES (means of assessment that measure performance directly, are authentic and minimize mitigating or intervening factors)

Standardized tests

- Local comprehensive or proficiency examinations

Classroom assignments

- Embedded testing (i.e. specific questions in homework or exams that allow faculty to assess students' attainments of a specific learning goal)

- Other classroom assessment methods (e.g., writing assignments, oral presentations, oral exams)

Evaluation of a body of work produced by the student

- Practicum, internship or research evaluation of student work

Direct assessment methods specifically applicable to graduate programs

- Thesis/dissertation oral defense and/or other oral presentation
- Thesis/dissertation (written document)

INDIRECT MEASURES (means of assessment that are related to direct measures but are steps removed from those measures)

Surveys and Interviews

- Student survey
- Alumni survey
- Employer feedback or survey
- Student evaluation of instruction

Additional types of indirect evidence

- Job or post-baccalaureate education placement
- Curriculum or syllabus review
- Grade review
- Comparison or benchmarking

USE OF DATA (how the program uses or will use the evaluation data to make evidence-based improvements to the program periodically)

- Meet with students directly to discuss their performance
- Analyze and discuss trends with the unit's faculty
- Analyze and report to college/school
- Make improvements in curricular requirements (e.g., add, subtract courses)
- Make improvements in course content
- Make improvements in course delivery and learning activities within courses
- Make improvements in learning facilities, laboratories, and/or equipment
- Periodically confirm that current curriculum and courses are facilitating student attainment of program goals
- Benchmark against best programs in the field

Program Specializations/Sub-Plans

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

Program Specialization/Sub-Plan Name	Track for Mathematical Biology (New)
Program Specialization/Sub-Plan Goals	• Training in math modeling of biological processes & evaluation using methods of differential equations and numerical analysis. Preparation for math related biomedical research in private and government sector & doctoral programs in math or biology.
Program Specialization/Sub-Plan Name	Track for Educators (New)
Program Specialization/Sub-Plan Goals	• Solid foundation & advanced understanding in core areas of math. Training in communication of math via special courses, mentored teaching, thesis. Preparation for doctoral programs in math-ed, education professions, other math-based employment.

Pre-Major

Does this Program have a Pre-Major? No

Attachments

- MMS-ALL-Jan14.pdf: MMS Conversion Proposal

(Program Proposal. Owner: Kerler,Thomas)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Kerler,Thomas	01/14/2011 04:12 PM	Submitted for Approval
Approved	Shapiro,Daniel B	01/14/2011 08:36 PM	Unit Approval
Pending Approval	Andereck,Claude David	01/14/2011 08:36 PM	College Approval

Department of Mathematics

100 Mathematics Building
231 West 18th Avenue
Columbus, OH 43210-1174

Phone (614) 292-4975

To: Office of Academic Affairs
From: Luis Casian, Chair, Department of Mathematics
Date: January 2011
Re: Semester program proposals for degree programs in the Department of Mathematics

The following programs in the Department of Mathematics are being converted from the quarter system to the semester system, with minimal changes:

1. BS in Mathematics
2. BA in Mathematics
3. Minor in Mathematics
4. BS in Actuarial Science
5. BA in Actuarial Science
6. MS in Mathematics
7. MMS in Mathematics
8. PhD in Mathematics

During the past year, the Department's Undergraduate Committee and Graduate Studies Committee have worked on semester conversions of those programs. This process involved frequent consultations with faculty members involved with particular courses or course sequences, and involved repeated editing of the conversion documents.

Many changes will also be made to the structure and flow of freshman-level math courses. Since those courses do not involve students enrolled in those eight programs, their changes are not discussed in these program conversion documents.

These proposed conversion plans and transition policies were approved by the Undergraduate and Graduate Committees, and were discussed during a faculty meeting in December 2, 2010. The semester conversion plans were approved by the Department's tenure-track faculty, by a vote of 49 yes and 0 no.

Luis Casian
Professor and Chair

Program Rationale

Master of Mathematical Sciences

- Proposals for both current tracks of the MMS degree are conversions with only minor modifications.
- In both tracks of lists of electives was extended as well as addition of most common allowed substitutions for required courses included. These have emerged as sensible extensions as a result of our experience with the first couple of cohorts in the MMS programs and frequent requests by incoming students or petitions with the Graduate Studies Committee for more flexibilities in the selection or required and elective courses.
- Required hours in the Mathematical Biosciences track remain same, with minor increase in required mathematics hours due to conversion of the two quarter numerical analysis to full year sequence and minor decrease in required biology hours due to conversion of two quarter course sequence into one semester course.
- To compensate for the shift towards mathematics in the required courses the Mathematical Biosciences track requires at least one of the electives to be from biology in the semester version.
- Minor reduction in required hours in the Educators track – resulting mainly from the Analysis requirement being reduced from two quarters to one semester. All other requirements are essentially time-neutral.
- Required courses in education includes new courses to be selected from due to restructuring of courses in the education program.

Table of Mathematics Graduate Semester Courses

The tables in the following four pages list the semester courses proposed by the graduate program of the mathematics department. They are grouped by sequences and subjects together with the quarter equivalent courses and sequences.

New and Discontinued Courses

The only new course is Math 5603 (although this also fits into an existing sequence). The only course sequence that is not continued, although it was regularly taught during the academic year until now, is Math 872-874. See the included justification.

Several quarter courses have been discontinued and not converted since they have not been taught in several years. They include Math 650 (Principles of Mathematical Analysis), Math 667 (Introduction to the Mathematics of Cryptography), Math 669 (Introduction to Number Theory), Math 705 (Special Functions), Math 712-714 (Applied Functional Analysis I-III), Math 767-768 (Approximation Theory I-II), and Math 863 (Potential Theory).

Further summer courses were discontinued and not converted since they were part of our Headstart program which due to budget reasons has been restructured and no longer uses regularly scheduled classes. These include Math 735, 736 (Teaching College Mathematics), Math 787.xx (Graduate Problem Seminars), and Math 609 (Applications of Mathematical Software).

Finally a few quarter courses in topology and geometry do not occur in the conversion table due to the new topology/geometry curriculum that started on AU 2010. Particularly, Math 655-657 (Elementary Topology I-III) and Math 860 (Algebraic Topology I) were converted or absorbed into the current Math 640 and Math 756-757 quarter courses. These, in turn, have been converted to Math 5801, 6801, and 6802 in the semester proposal.

Credit Hour Balances

The table accounts for the overall balance of credit hours as follows.

For each semester (quarter) course the number of semester (quarter) credit hours and frequency of offering are recorded. (e.g., Freq.=1 means offered annually, Freq.=2 means offered biennially). The average annual semester (quarter) credit hours invested in the course is computed as Ave Cred=Credit/Freq.

For each group the total annual average quarter credits of the quarter courses are computed. Similarly the semester credits for the semester courses, which are then converted 2:3 to quarter credits. (results in blue numbers for the quarter and semester versions).

The difference (in average annual quarter credits) is recorded in the DIFF column. Increases in credits due to conversion are in red and decreases in green.

Summary

There is an overall increase of about 6 quarter credit hour equivalents in planned regular offerings of mathematics graduate courses. If the missing summer courses are counted in we have indeed a decrease in offered hours.

There are two notable shifts in credit hours. The first is an increase at the Master (600/5000) level at the cost of a decrease of offered hours at the PhD (700/6000) level. This is motivated by the introduction of our new MMS program, and a respective reduction in size of our PhD program. The second is a shift from topology to geometry hours within the topology/geometry curriculum. See the included justifications.

Semester Conversion Table for Mathematics Graduate Courses

	QUARTER				SEMESTER					
Semester Transcr Name	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**DIFF**	**Justification**
Ess Numer Methods	606	3	1	3	5602	3	1	3		Quarter sequence Math 606, 607 (at 3 and 5 q-cr) converted to semester sequence Math 5602, 5601 (3 s-cr each)
Computational PDEs	607	5	1	5	5601	3	1	3		
Balance (in quarter credits)				**8**				**9**	**1.0**	
Numer Linear Algeb				0	5603	3	1	3		New Course. Limitations in hardware require better algorithms in handling of large data, particularly large matrices. The demands on training successful students in computing have thus change and are addressed with this course.
Balance (in quarter credits)				**0**				**4.5**	**4.5**	
Math Mod Bio Proc	865L	3	1	3	5651	3	1	3		Math 865L (3 q-cr) provides the foundation for the required summer internships of our Math-Biology MS program. The time allotted in Mathy 865L was too shirt so that it is extended to the 3 hour semster course Math 5651.
Balance (in quarter credits)				**3**				**4.5**	**1.5**	
Meth Relativ Thy 1 &2	665	4	1	4	5756	3	1	3		Quarter sequence Math 665, 666 (4 q-cr each) converted to semester sequence Math 5756, 5757 (3 s-cr each)
	666	4	1	4	5757	3	1	3		
Balance (in quarter credits)				**8**				**9**	**1.0**	
Variat & Tens Calc	701	5	2	2.5	5451	3	2	1.5		Conversion of quarter course Math 701 (5 q-cr) to semester course Math 5451 (3 s-cr)
Balance (in quarter credits)				**2.5**				**2.25**	**-0.3**	
Appl Diff Eqs 1 & 2	615	3	1	3	5401	3	1	3		Quarter sequence Math 615, 616, 617 (3 q-cr each) converted to semester sequence Math 5401, 5402 (3 s-cr each)
	616	3	1	3	5402	3	1	3		
	617	3	1	3						
Balance (in quarter credits)				**9**				**9**	**0.0**	
Intro Set Theory	647	3	1	3	5001	3	1	3		Math 647 (3 q-cr) converted to Math 5001 (3 s-cr). While Math 647 was an introduction to set theory targeted at logic students, Math 5001 will be a general introduction to basic set theoretic techniques used throughout mathematics. The quarter sequence Math 648, 649 converted to semester course Math 5051 (3 s-cr).
Intro Math Logic	648	3	1	3	5051	3	1	3		
	649	3	1	3						
Balance (in quarter credits)				**9**				**9**	**0.0**	
Intro Real Analy 1 & 2	651	5	1	5	5201	5	1	5		Quarter sequence Math 651, 652, 653 (5 q-cr each) converted to semester sequence Math 5201, 5202 (5 s-cr each).
	652	5	1	5	5202	5	1	5		
	653	5	1	5						
Balance (in quarter credits)				**15**				**15**	**0.0**	
Int Compl Analysis	660	5	1	5	5221	3	1	3		Conversion of quarter course Math 660 (5 q-cr) to semester course Math 5221 (3 s-cr). Increase in time from 654 to 5251 is balanced with decrease in time from 660 to 5221.
Complex Var & App	654	3	1	3	5251	3	1	3		
Balance (in quarter credits)				**8**				**9**	**1.0**	
Finite Linear Math	601	3	1	3	5101	3	1	3		Quarter sequence Math 601, 602, 603 (3 q-cr each) converted to semester sequence Math 5101, 5102 (3 s-cr each)
Infin Linear Math	602	3	1	3	5102	3	1	3		
	603	3	1	3						
Balance (in quarter credits)				**9**				**9**	**0.0**	
Algebra 1 & 2	670	5	1	5	5111	5	1	5		Quarter sequence Math 670, 671, 672 (5 q-cr. each) converted to semester sequence Math 5111, 5112 (5 s-cr. each)
	671	5	1	5	5112	5	1	5		
	672	5	1	5						
Balance (in quarter credits)				**15**				**15**	**0.0**	

Semester Conversion Table for Mathematics Graduate Courses

	QUARTER				SEMESTER					
Semester Transcr Name	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**DIFF**	**Justification**
Intro Number Thy	683	4	1	4	5152	3	1	3		Conversion of quarter course Math 683 (4 q-cr) to semester course Math 5152 (3 s-cr).
				4				**4.5**	**0.5**	
Gen Topol & Knots	640	3	1	3	5801	3	1	3		Quarter sequence Math 640, 641, 642 (3 q-cr each) converted to semester sequence Math 5801, 5702 (3 s-cr each)
Curves & Surfaces	641	3	1	3	5702	3	1	3		
	642	3	1	3						
Balance (in quarter credits)				**9**				**9**	**0.0**	
Num Meth Sc Comp 1 & 2	707	3	1	3	6601	4	1	4		Quarter sequences Math 727, 728, 729 (1 q-cr each) and Math 707, 708, 709 (3 q-cr each) are combined and converted to semester sequence Math 6601, 6602 (3 s-cr each)
	708	3	1	3	6602	4	1	4		
	709	3	1	3						
	727	1	1	1						
	728	1	1	1						
	729	1	1	1						
Balance (in quarter credits)				**12**				**12**	**0.0**	
Appl Comp Vars 1 & 2	804	3	2	1.5	7651	3	2	1.5		Quarter sequence Math 804, 805, 806 (3 q-cr each) converted to semester sequence Math 7651, 7652 (3 s-cr each)
	805	3	2	1.5	7652	3	2	1.5		
	806	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Computationl PDE 1 & 2	807	3	2	1.5	7611	3	2	1.5		Quarter sequence Math 807, 808, 809 (3 q-cr each) converted to semester sequence Math 7611, 7612 (3 s-cr each)
	808	3	2	1.5	7612	3	2	1.5		
	809	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Ordin Differ Eqs 1	715	3	1	3	6411	3	1	3		Quarter sequence Math 715, 716, 717 (3 q-cr each) converted to semester sequence Math 6411, 6451 (3 s-cr each)
Part Differ Eqs 1	716	3	1	3	6451	3	1	3		
	717	3	1	3						
Balance (in quarter credits)				**9**				**9**	**0.0**	
Ordin Differ Eqs 2 & 3	820	3	2	1.5	7412	3	2	1.5		Quarter sequence Math 820, 821, 822 (3 q-cr each) converted to semester sequence Math 7412, 7413 (3 s-cr each)
	821	3	2	1.5	7413	3	2	1.5		
	822	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Part Differ Eqs 2 & 3	835	3	2	1.5	7452	3	2	1.5		Recent changes in the composition of our faculty and student interest have increased the need in a more thorough training in PDE. The two quarter sequence Math 835-836 thus needed to be extended to a standard two semester sequence Math 7452-7453.
	836	3	2	1.5	7453	3	2	1.5		
Balance (in quarter credits)				**3**				**4.5**	**1.5**	

Semester Conversion Table for Mathematics Graduate Courses

	QUARTER				SEMESTER					
Semester Transcr Name	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**DIFF**	**Justification**
Adv Math Logic 1-4	745	3	1	3	6001	3	2	1.5		Quarter sequence Math 745, 746, 747 (3 q-cr each, offered annually) converted to two-year semester sequence Math 6001, 6002, 6003, 6004 (each course 3 s-cr and offered biennially)
	746	3	1	3	6002	3	2	1.5		
	747	3	1	3	6003	3	2	1.5		
					6004	3	2	1.5		
Balance (in quarter credits)				**9**				**9**	**0.0**	
Thy Probability 1 & 2	722	4	2	2	6251	4	2	2		Quarter sequence Math 722, 723, 724 (4 q-cr each) converted to semester sequence Math 6251, 6252 (4 s-cr each)
	723	4	2	2	6252	4	2	2		
	724	4	2	2						
Balance (in quarter credits)				**6**				**6**	**0.0**	
Real Analysis 1 & 2	750	5	1	5	6211	5	1	5		Quarter sequence Math 750, 751, 752 (5 q-cr each) converted to semester sequence Math 6211, 6212 (5 s-cr each)
	751	5	1	5	6212	5	1	5		
	752	5	1	5						
Balance (in quarter credits)				**15**				**15**	**0.0**	
Functnl Analysis 1 & 2	857	3	2	1.5	7211	3	2	1.5		Functional analysis quarter sequence was offered as Math 857 in autumn and continued as Math 961 in winter and spring and thus equivalent to a 3 quarter sequence of 3 q-cr each. It is converted to semester sequence Math 7211, 7212 (3 s-cr each)
	961 (Wi)	3	2	1.5	7212	3	2	1.5		
	961 (Sp)	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Ergodic Theory 1 & 2	931	3	2	1.5	7221	3	2	1.5		Ergodic Theory quarter sequence was offered as Math 931, 932 in autumn and winter and as Math 950 in spring and and thus equivalent to a 3 quarter sequence of 3 q-cr each. It is converted to semester sequence Math 7221, 7222 (3 s-cr each)
	932	3	2	1.5	7222	3	2	1.5		
	933/950	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Complex Analysis 1 & 2	753	5	1.5	3.3333333	6221	3	1.5	2		Quarter sequence Math 753, 754 (5 q-cr each) converted to semester sequence Math 6221, 6222 (3 s-cr each)
	754	5	1.5	3.3333333	6222	3	1.5	2		
Balance (in quarter credits)				**6.6666667**				**6**	**-0.7**	
Combin Graph Thy 1 & 2	775	5	1	5	6501	5	1	5		Quarter sequence Math 775, 776, 777 (5 q-cr each) converted to semester sequence Math 6501, 6502 (5 s-cr each)
	776	5	1	5	6502	5	1	5		
	777	5	1	5						
Balance (in quarter credits)				**15**				**15**	**0.0**	
Abstract Algebra 1 & 2	770	5	1	5	6111	5	1	5		Quarter sequence Math 770, 771, 772 (5 q-cr each) converted to semester sequence Math 6111, 6112 (5 s-cr each).
	771	5	1	5	6112	5	1	5		
	772	5	1	5						
Balance (in quarter credits)				**15**				**15**	**0.0**	
Commutativ Algebra	978	3	2	1.5	6151	3	2	1.5		Quarter course Math 978 (2-5 q-cr) converted to semester course Math 6151 (3 s-cr). This course will be offered, by demand, biennially during school year or during summer.
NonCommut Algebra	982	5	2	2.5	6152	3	2	1.5		
Balance (in quarter credits)				**4**				**4.5**	**0.5**	

Semester Conversion Table for Mathematics Graduate Courses

	QUARTER				SEMESTER					
Semester Transcr Name	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**Num**	**Credit**	**Freq**	**Ave. Cred.**	**DIFF**	**Justification**
Algebr Numb Theory	780	3	2	1.5	7121	3	2	1.5		Quarter sequence Math 780, 781, 782 (3 q-cr each) converted to semester sequence Math 7121, 7122 (3 s-cr each)
Analyt Numb Theory	781	3	2	1.5	7122	3	2	1.5		
	782	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Basic Algeb Geomet	840	3	2	1.5	7141	3	2	1.5		Quarter sequence Math 840, 841, 842 (3 q-cr each) converted to semester sequence Math 7141, 7142 (3 s-cr each)
Adv Algeb Geomet	841	3	2	1.5	7142	3	2	1.5		
	842	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Algebr Topology 1 & 2	756	4	1	4	6801	3	1	3		Quarter seq. Math 756,757,758 (4 q-cr ea) → semester seq. Math 6801,6802 (3 s-cr ea). Hour reductions for topology courses (6801,6802,7811) in favor of increases for geometry courses (6701,6702,7711,7721) correct curricular imbalance between fields.
	757	4	1	4	6802	3	1	3		
	758	4	1	4						
Balance (in quarter credits)				**12**				**9**	**-3.0**	
Differen Manifolds	765	4	1	4	6701	3	1	3		Quarter seq. Math 765, 766 (4 q-cr ea) → semester seq. Math 6701, 6702 (3 s-cr ea). Hour reductions for topology courses (6801,6802,7811) in favor of increases for geometry courses (6701,6702,7711,7721) correct curricular imbalance between fields.
	766	4	1	4	6702	3	1	3		
Balance (in quarter credits)				**8**				**9**	**1.0**	
Different Geometry	851	3	2	1.5	7711	3	2	1.5		Quarter seq. Math 851, 852 (3 q-cr ea) → semester seq. Math 7711, 7721 (3 s-cr ea). Hour reductions for topology courses (6801,6802,7811) in favor of increases for geometry courses (6701,6702,7711,7721) correct curricular
	852	3	2	1.5	7721	3	2	1.5		
Balance (in quarter credits)				**3**				**4.5**	**1.5**	
Differ Topology 1 & 2	866	3	2	1.5	7851	3	2	1.5		Quarter sequence Math 866, 867, 868 (3 q-cr each) converted to semester sequence Math 7851, 7852 (3 s-cr each).
	867	3	2	1.5	7852	3	2	1.5		
	868	3	2	1.5						
Balance (in quarter credits)				**4.5**				**4.5**	**0.0**	
Homotopy Theory	861	3	2	1.5	7811	3	2	1.5		Quarter sequence Math 861, 862 (3 q-cr ea) → semester course Math 7811 (3 s-cr). Hour reductions for topology courses (6801,6802,7811) in favor of increases for geometry courses (6701,6702,7711,7721) correct curricular imbalance between fields.
	862	3	2	1.5						
Balance (in quarter credits)				**3**				**2.25**	**-0.8**	
Lie Algebras	854	3	2	1.5	7161	3	2	1.5		The Lie theory sequence satisfies a strong cross-disciplinary demand and absorbs several topics from the discontinued Math 872-874 sequence. The 2 quarter sequence Math 854-855 (3 q-cr) is thus extended to a semester sequence Math 7161-7162 (3 s-cr).
Lie Grps & Rep Thy	855	3	2	1.5	7162	3	2	1.5		
Balance (in quarter credits)				**3**				**4.5**	**1.5**	
(Group Theory)	872	3	2	1.5	no replacement					Anticipated retirements and departures of faculty in the area led to the decision not to continue the course sequence under semesters.
	873	3	2	1.5						
	874	3	2	1.5						
Balance (in quarter credits)				**4.5**				**0**	**-4.5**	

Transition Policy

Master of Mathematical Sciences

- Required courses are in a one-to-one correspondence as listed below

Track for Educators

Semester Required Courses	Quarter Required Courses
Math 5101	Math 601, 602
Math 5151	Math 683
Math 5201	Math 651, 652
Math 5801	Math 640, 641
Math 5702	Math 642
Two of EDU 7717, 7718, 7742, 7743, 7745	EDU 802.1, 802.2, 802.3

Mathematical Biosciences Track

Semester Required Courses	Quarter Required Courses
Math 5401, 5402	Math 615, 616, 617
Math 5601	Math 607
Math 5602	Math 606
Math 5651	Math 865L
Stat 6301	Stat 610
Stat 6302	Stat 623
MOLGEN 5660	MOLGEN 660, 661

Cases where a course sequence itemized above is not completed under the quarter sequence will be handled individually (we have 6 or less students per year per track in our program).

- Hour requirements for electives will translate with the standard 2/3 factor.
- Internship and thesis requirements are the same.

Master of Mathematical Sciences

Semester Version of Handbook

I. General Requirements

I.1. Course Work Requirements

Required and electives courses as well as specific hours requirements are listed separately for each specialization track in the following sections. A student will need to pass all required and electives courses in the respective specialization with at least a grade of "C-" by the end of the spring semester of the second year.

The total credits earned from required and elective courses must be at least 30 semester credit hours. Independent studies, group studies, and research credit hours or hours from unapproved courses not on the lists below do **not** count towards the required 30 hours of course work.

I.2. Internship Requirement

Each student is required to complete an internship during the summer semester between the first and second year. Internships are individually arranged and approved by the advisor and the chair of the MMS committee. The internship will have two mentoring faculty, one from mathematics and one possibly from another department. A student needs to sign up for at least one credit hour of MATH 6998 with the mathematics mentor for the internship, and pass with a grade of Satisfactory.

I.3. Thesis

By the end of the fall quarter of the second year each student must have elected a thesis advisor, and submitted an advisor change form to the Graduate Office. The thesis advisor needs to be a graduate faculty (category M level or higher) at the mathematics department. Typically (but not necessarily) this is the mathematics mentor for the summer internship.

Thesis research and thesis writing will occur during the second year, and should be completed at the end of the spring break of the second year. During this time students should generally be signed up for MATH 6999 with the supervising thesis advisor.

I.4. Examination Committee, Defense, and Graduation

The thesis will be written during the second year under the supervision of the thesis advisor, and prepared in compliance with university rules. The thesis should be completed early during the spring semester.

All students are expected to apply to graduate with Masters degree via the Thesis-Option before the second Friday of the spring semester of their second year with the Graduate School. In order to apply a student also has to choose a second member of the examination committee by the beginning of the same semester. This has to a Graduate Faculty member but may be from anther OSU unit related to the specialization. Typically (but not necessarily) this can be the second mentor of the summer internship. The Non-thesis Option is not open to MMS students.

The oral examination has to be scheduled and passed during the spring semester of the second year, after submission of a draft of the thesis. An additional written examination is not required. The thesis needs to follow university formatting guidelines, be approved by the committee, and be submitted to the Graduate School and OhioLink..

For further details see Section VI of the Graduate School Handbook.

II. Required and Elective Courses in Mathematical Biosciences Specialization

II.1. Required Courses [26 hours]

MATHEMATICS

- Math 5401 (3 cr. hrs.) Applied Differential Equations I
- Math 5402 (3 cr. hrs.) Applied Differential Equations II
- Math 5601 (3 cr. hrs.) Essentials of Numerical Analysis
- Math 5602 (3 cr. hrs.) Introduction to Numerical Analysis of PDEs
- Math 5651 (3 cr. hrs.) Modeling in Mathematical Biology

MOLECULAR GENETICS

- MOL GEN 5660 (5 cr. hrs.) Integrated Molecular and Cellular Biology for Non-Biologists

STATISTICS

- Stat 6301 (3 cr. hrs.) Probability for Statistical Inference
- Stat 6302 (3 cr. hrs.) Theory of Statistical Analysis

II.2. Substitutions of Required Courses

The following substitutions of required course sequences are allowed with permission of the advisor.

- Math 5401-5402 may be substituted by Math 6411-6412.
- Math 5601-5602 may be substituted by Math 6601-6602.

A student may request additional substitutions of required courses. The request should be submitted by the advisor to the Graduate Studies Committee for approval.

II.3. Elective Courses.

Requirements for choosing electives have are as follows:

1. All electives must be chosen from the list below.
2. Electives must include at least two courses.
3. The number of credit hours of chosen electives must add up to at least 5 cr hrs.
4. At least one elective course has to be from BIOCHEM, BIOMED, EEOB, MOLGEN, or PCMB.

A student may request to use other courses to satisfy the elective requirement. The request should be submitted by the advisor to the Graduate Studies Committee for approval.

BIOCHEMISTRY

- BIOCHEM 5613 (3 cr. hrs.) Biochemistry and Molecular Biology I
- BIOCHEM 5614 (3 cr. hrs.) Biochemistry and Molecular Biology II
- BIOCHEM 5615 (3 cr. hrs.) Biochemistry and Molecular Biology III

BIOMEDICAL ENGINEERING

- BIOMEDE 8000 (1 cr. hr.) Scientific Methods in Biomedical Engineering

Evolution, Ecology, and Organismal Biology

- EEOB 7720 (4 cr. hrs) Theoretical Ecology
- EEOB 8894 (1 cr. hr.) Grad student seminar

Molecular Genetics

- MOLGEN 5606 (4 cr. hrs.) Molecular Genetics
- MOLGEN 5607 (3 cr. hrs.) Cell Biology
- MOLGEN 5608 (3 cr. hrs.) Genes and Development
- MOLGEN 5640 (3 cr. hrs.) The Genetic Basis of Evolution
- MOLGEN 6700 (3 cr. hrs.) Systems of Genetic Analysis
- MOLGEN 6701 (4 cr. hrs.) DNA Transactions and Gene Regulation

Plant Cellular and Molecular Biology

- PCMB 6623 (3 cr. hrs) Genetics and Genomics
- PCMB 6631 (3 cr. hrs) Plant Physiology

Statistics

- STAT 6540 (3 cr. hrs.) Applied stochastic processes I
- STAT 6194 (2-5 cr. hrs.) Topics in Mathematical Statistics
- STAT 6194 (2-5 cr. hrs.) Statistical Methods for Analyzing Genetic Data

Mathematics

- MATH 6411 (3 cr. hrs.) Differential Equations I
- MATH 6412 (3 cr. hrs.) Differential Equations II
- MATH 6601 (3 cr. hrs.) Numerical Methods in Scientific Computing I
- MATH 5101 (3 cr. hrs.) Finite Dimensional Linear Mathematics
- MATH 5102 (3 cr. hrs.) Infinite Dimensional Linear Mathematics
- MATH 5201 (5 cr. hrs.) Introduction to Real Analysis I
- MATH 5202 (5 cr. hrs.) Introduction to Real Analysis II
- MATH 6251 (3 cr. hrs.) Theory of Probability I
- MATH 6252 (3 cr. hrs.) Theory of Probability II

III. Required and Elective Courses in Specialization for Mathematics Educators

III.1. Required courses [23 semester hours]

Mathematics

- MATH 5101 (3 cr. hrs.) Linear Mathematics in Finite Dimensions
- MATH 5152 (3 cr. hrs.) Introduction to Number Theory with Applications
- MATH 5201 (5 cr. hrs.) Introduction to Real Analysis I
- MATH 5801 (3 cr. hrs.) General Topology and Knot Theory
- MATH 5702 (3 cr. hrs.) Curves and Surfaces in Euclidean three-space

EDUCATION AND HUMAN ECOLOGY

- Two of the following five courses (each 3 cr. hrs.)
  - EDU 7717 Teaching Mathematics
  - EDU 7718 Student Learning Processes in Mathematics
  - EDU 7742 Knowledge Representations in STEM Learning
  - EDU 7743 Curriculum across Secondary and Post-Secondary STEM Education
  - EDU 7745 Classroom Discourse in STEM Learning

III.2. Allowed Substitutions of Required Courses

The following substitutions of required course sequences are allowed with permission of the advisor.

- MATH 5101+5152 may be replaced by Math 5111+5112 or Math 6111+6112.
- MATH 5201 may be replaced by Math 6211.
- MATH 5801 may be replaced by Math 6801.
- MATH 5702 may be replaced by Math 6701.

A student may request additional substitutions of required courses. The request should be submitted by the advisor to the Graduate Studies Committee for approval.

III.3. Elective courses

Requirements for choosing electives have are as follows:

1. All electives must be chosen from the list below.
2. Electives must include at least two courses.
3. The number of credit hours of chosen electives must add up to at least 7 cr hrs.
4. At most one elective course can be outside of mathematics.

A student may request to use other courses to satisfy the elective requirement. The request should be submitted by the advisor to the Graduate Studies Committee for approval.

MATHEMATICS

- MATH 5221 (3 cr. hrs.) Introduction to Complex Analysis
- MATH 5601 (3 cr. hrs.) Essentials of Numerical Analysis
- MATH 5602 (3 cr. hrs.) Computational Partial Differential Equations
- MATH 5401 (3 cr. hrs.) Applied Differential Equations I
- MATH 5402 (3 cr. hrs.) Applied Differential Equations II
- MATH 5001 (3 cr. hrs.) Set theory
- MATH 5051 (3 cr. hrs.) Introduction to Mathematical Logic
- MATH 5601 (3 cr. hrs.) Essentials of numerical methods
- MATH 5602 (3 cr. hrs.) Computational partial differential equations
- MATH 5111 (3 cr. hrs.) Algebra 1
- MATH 5112 (3 cr. hrs.) Algebra 2
- MATH 5603 (3 cr. hrs.) Numerical Linear Algebra
- MATH 5451 (3 cr. hrs.) Calculus of Variations

- All MATH courses at the 6000-Level.

Statistics

- STAT 6801 (4 cr. hrs.) Statistical Theory I
- STAT 6802 (4 cr. hrs.) Statistical Theory II
- STAT 6302 (3 cr. hrs.) Theory of Statistical Analysis

IV. Appendix: Sample Schedules

IV.1. Sample schedule for mathematical biosciences specialization

Year	Semester	Courses			Course hrs	Res/Int hrs
Year 1	Autumn	MATH 5401 (3 cr)	MOLGEN 5660 (5 cr)		8	
	Spring	MATH 5402 (3 cr)	MATH 5651 (3 cr)	Elective (3 cr)	9	
	Summer	Internship (Lab/Project) as MATH 6998 (5 cr)*		MATH 5193 (3 cr)*		8
Year 2	Autumn	MATH 5601 (3 cr)	STAT 6301 (3 cr)	Elective (3 cr)	9	
	Spring	MATH 5602 (3 cr)	STAT 6302 (3 cr)	MATH 6999 (2 cr)*	6	2
				Total	32	10

IV.2. Sample schedule for specialization for mathematics educators

Year	Semester	Courses			Course hrs	Res/Int hrs
Year 1	Autumn	MATH 5101 (3 cr)	MATH 5201 (5 cr)		8	
	Spring	MATH 5152 (3 cr)	Elective (3 cr)	Elective (3 cr)	9	
	Summer	Internship (Mentored Teaching) MATH 6998 (5 cr)*		MATH 5193 (3 cr)*		8
Year 2	Autumn	MATH 5801 (3 cr)	EDU 7717 (3 cr)	Elective (3 cr)	9	
	Spring	MATH 5702 (3 cr)	EDU 7718 (3 cr)	MATH 6999 (3 cr)*	6	3
				Total	32	11

*) Additional MATH 6999, MATH 6998 and MATH 5198 beyond the required hours for the degree are chosen here so that that minimum hour requirements per semester to hold a GA appointment are met.