FINAL FACULTY SENATE APPROVAL ON FEBRUARY 13, 2018

MEMORANDUM

TO: Faculty Senate

FROM: Jack Kirby

DATE: January 17, 2018

SUBJECT: Curriculum Proposal #17-18-10, REV #1

Math History

I recommend approval of the attached REVISION #1 of Curriculum Proposal 17-18-10. This proposal seeks to make changes to meet national accreditation standards for students majoring in mathematics education.

Dr. Christina Lavorata
Dr. Don Trisel
Dr. Robert Niichel
Dr. Stephanie Jones
Mr. Brian Floyd
Ms. Laura Ransom
Ms. Cheri Gonzalez

FAIRMONT STATE UNIVERSITY

MEMORANDUM

TO: Curriculum Committee

FROM: Jack Kirby JRK

DATE: November 3, 2017

SUBJECT: Curriculum Proposal #17-18-10

Math History

I recommend approval of the attached Curriculum Proposal 17-18-10. This proposal seeks to make changes to meet national accreditation standards for students majoring in mathematics education.

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CURRICULUM PROPOSAL (Submit one hard copy and an electronic copy to the Associate Provost by the second Tuesday of the month.)

Proposal Number: 17-18-10

School/Department/Program: Sci/Tech, Computer Science & Mathematics, Mathematics

Preparer/Contact Person: Stephanie Jones & Bob Niichel

Telephone Extension: 4307 & 4701

Date Originally Submitted: November 3, 2017

Revision (Indicate date and label it Revision #1, #2, etc.): Revision #1

Implementation Date Requested: August 13, 2018

I. **PROPOSAL**. Write a brief abstract, not exceeding 100 words, which describes the overall content of the proposal.

1. To meet national accreditation standards, students majoring in mathematics education must demonstrate proficiency in math history. Currently, a dedicated math history course does not exist; the required documentation is compiled throughout multiple classes. To streamline the process, a math history course is added.

2. The name and description of MATH 3550 is being changed from "Probability and Statistics" to "Probability" to better reflect the course content that has been taught for the past decade.

3. The course description of MATH 3503-Calculus III is slightly adjusted.

4. Biology and geology courses are added as possible science electives for math majors.

II. **DESCRIPTION OF THE PROPOSAL**. Provide a response for each letter, A-H, and for each Roman Numeral II–V. If any section does not apply to your proposal, reply N/A.

A. Deletion of course(s) or credit(s) from program(s)

Total hours deleted. 0

B. Addition of course(s) or credit(s) from program(s)

MATH 2554 – Topics in Math History

Total hours added. 2

C. Provision for interchangeable use of course(s) with program(s)
N/A

D. Revision of course content. Include, as an appendix, a revised course description, written in complete sentences, suitable for use in the university catalog.

MATH 3503—Calculus III
MATH 3550—Probability

E. Other changes to existing courses such as changes to title, course number, and elective or required status.

N/A

F. Creation of new course(s). For each new course

1. Designate the course number, title, units of credit, prerequisites (if any), ownership (FSU or shared) and specify its status as an elective or required course. If you are creating a shared course, attach a memo from the Deans of the affected Schools explaining the rationale for the course being shared.

MATH 2554 – Topics in Math History (2 hrs.)
PR: MATH 2562 or concurrent enrollment in MATH 2562

FSU course
Required by Math Education (5-adult) and Math Education (5-9)

2. Include, as an appendix, a course description, written in complete sentences, suitable for use in the college catalog.

See Appendix B.

3. Include, as an appendix, a detailed course outline consisting of at least two levels.

See Appendix C.

4. In order to meet the requirements as outlined in Goal One of the Strategic Plan, please include Outcome Competencies and Methods of Assessment as an appendix. Examples are available upon request from the Chair of the Curriculum Committee.

See Appendix D.

G. Attach an itemized summary of the present program(s) affected, if any, and of the proposed change(s).

Describe how this proposal affects the hours needed to complete this program. Specifically, what is the net gain or loss in hours? Use the format for Current and Proposed Programs in Appendix A.

Two hours are added to the Math 5-adult and Mathematics 5-9 programs. See Appendix A.

III. **RATIONALE FOR THE PROPOSAL**.

A. **Quantitative Assessment**: Indicate the types of assessment data, i.e., surveys, interviews, capstone courses, projects, licensure exams, nationally-normed tests, locally developed measurements, accreditation reports, etc., that were collected and analyzed to determine that curricular changes were warranted. Quantitative data is preferred.

The NCTM CAEP Standards, which outline the requirements for national accreditation of mathematics education programs, require that students demonstrate proficiency in five or six math history standards (depending upon whether they are pursuing a degree to teach math 5-9 or math 5-adult). In order to fulfill these requirements, we made changes last year in the type of data we collected from students and how we score that information. These changes led to national accreditation for the mathematics education programs. The accreditation reports are available upon request.

In 2013, The National Academic Press published *The Mathematical Sciences in 2025*, which highlighted the growing importance of the field of probability to the study of biology, computer science, etc. Since MATH 3550 is already primarily focused on probability (as it has been for a number of years), the course name should be changed to inform potential employers and graduate schools about the content of the course.

As far as the changes to the required science courses for Math and Math Ed. Majors are concerned, new fields of study like bio-statistics (now a Master's program at WVU, for example) suggest that math majors would benefit from taking a biology or geology course as much as they would from a physics or chemistry class.

B. **Qualitative Assessment**: Based upon the assessment data above, indicate why a curricular change is justified. Indicate the expected results of the change. Be sure to include an estimate of the increased cost, or reduction in cost of implementation. FOR EXAMPLE: Will new faculty, facilities, equipment, or library materials be required?

The changes made in data collection for the math history standards required students to submit work in multiple classes with multiple professors. Logistically, it was difficult to ensure that all students were completing the necessary assignments. However, it made sense to use these measures temporarily until we knew whether they would meet accreditation standards. Now that we know CAEP approves of our means of assessing the math history standards, we would like to put a more streamlined data collection process in place.

Allowing students to complete all of these requirements in a single class would provide the following benefits:

- Students would have time dedicated to studying math history
- Students would earn credit for their work in math history
- We would have a single point of data collection for accreditation
- Math History topics would be removed from MATH 4531: Methods & Materials for Teaching Mathematics, allowing more time for students to focus on the actual work of teaching.

With the probability course (MATH 3550), we would like to better serve our majors who do not want to teach or attend graduate school. One option for many math majors nationwide is actuarial science. While FSU does not offer everything needed for the actuarial process, the new probability course is better suited to prepare students for one of the first actuarial exams.

The current catalog description for Calculus III does not include any statement about vector calculus, which is standard material for the course in most universities. The current description also includes sequences and series, which is NOT typical for most Calculus 3 courses.

Changing the science requirement will help improve the chances of math minors from the biology and geology programs. The probability of double majors will also be slightly improved.

IV. Should this proposal affect any course or program in another school, a memo must be sent to the Dean of each school impacted and a copy of the memo(s) must be included with this proposal. In addition, the Deans of the affected schools must sign below to indicate their notification of this proposal.

By signing here, you are indicating your college's/school's notification of this proposal.

College/School	Dean	Signature
SOE - HHP	Carolyn Crislip-Tacy	Carolyn Crislip-Tacy
Sci Tech	Don Irisel	Don Irisel

V. Should this proposal affect any course to be added or deleted from the general studies requirements, a memo from the chair of the General Studies Committee indicating approval of the change must be included with this proposal.
N/A

VI. ADDITIONAL COMMENTS.

APPENDIX A

B.A. ED. Degree in Mathematics Education (5-adult)
Current Program

Required Major Courses			HRS
MATH	1561	Introduction to Mathematical Reasoning	3
MATH	1550	Applied Statistics	3
MATH	2501	Calculus I	4
MATH	2502	Calculus II	4
MATH	2510	Mathematical Logic	3
MATH	2562	Introduction to Discrete Mathematics	3
MATH	2563	Transition to Higher Mathematics	3
MATH	3503	Calculus III	4
MATH	3520	Linear Algebra	3
MATH	3550	Probability & Statistics	3
MATH	3570	Modern Geometry	3
MATH	4520	Abstract Algebra	3
MATH	4531	Methods & Materials of Teaching Math	3
COMP	1102	Principles of Programming I	3
		Any one of the following science courses:	
CHEM	1101	General Chemistry I	Counted
CHEM	1105	Chemical Principles I	As
PHYS	1101	Introduction to Physics I	General
PHYS	1105	Principles of Physics I	Studies
TOTAL Required Major Courses			45
Major Electives			3
		Choose one course from the following:	
MATH	4580	Topology	
MATH	4590	Real Analysis	
Professional Education as required by School of Education			33
Note: Six hours of Education courses are counted as General Studies hours.			
TOTAL HOURS FOR MAJOR (and minor if required)			**81**

Required General Studies Courses		
Outcome 1 – Critical Analysis		3
	ENGL 1102 (Institutional Requirement)	
Outcome 2 – Quantitative Literacy		X
	MATH 1507 or 1407 or higher in Outcome 2 (satisfied in major)	
Outcome 3 – Written Communication		3
	ENGL 1101(Institutional Requirement)	
Outcome 4 - Teamwork		3
	COMM 2200* or any course listed in Outcome 4	
Outcome 5 – Information Literacy		X
	ENGL 1102* (met in Outcome 1) or any course listed in Outcome 5	
Outcome 6 – Technology Literacy		3
	EDUC 2201* or any course in Outcome 6	

Outcome 7 – Oral Communication		X
	COMM 2200* (met in Outcome 4) or any course in Outcome 7	
Outcome 8 - Citizenship		3
	POLI 1103* or any course in Outcome 8	
Outcome 9 - Ethics		3
	ENGL 2220* or any course in Outcome 9	
Outcome 10 - Health		3
	EDUC 2203* or any course in Outcome 10	
Outcome 11 - Interdisciplinary		X
	POLI 1103* (met in Outcome 8) or any course in Outcome 11	
Outcome 12 - Arts		3
	Any course in Outcome 12	
Outcome 13 - Humanities		X
	ENGL 2220* (met in Outcome 9) or any course in Outcome 13	
Outcome 14 – Social Sciences		3
	GEOG 2210* or any course in Outcome 14	
Outcome 15 - Natural Science		4-5
	PHYS 1101, PHYS 1105, CHEM 1101, or CHEM 1105 (satisfied in major)	
Outcome 16 – Cultural Awareness		X
	GEOG 2210* (met in Outcome 14) or any course in Outcome 16	
Additional General Studies hours		X
	MATH 4520 (WIC – satisfied in major)	
TOTAL GENERAL STUDIES HOURS		**31-32**
TOTAL FREE ELECTIVES		**8**
TOTAL HOURS *(depending on whether a student takes a 4 or 5 hour science course)*		**120-121**

APPENDIX A

B.A. ED. Degree in Mathematics Education (5-adult)
Proposed Program

Required Major Courses			HRS
MATH	1561	Introduction to Mathematical Reasoning	3
MATH	1550	Applied Statistics	3
MATH	2501	Calculus I	4
MATH	2502	Calculus II	4
MATH	2510	Mathematical Logic	3
MATH	2562	Introduction to Discrete Mathematics	3
MATH	2563	Transition to Higher Mathematics	3
MATH	2554	Topics in Math History	2
MATH	3503	Calculus III	4
MATH	3520	Linear Algebra	3
MATH	3550	Probability	3
MATH	3570	Modern Geometry	3
MATH	4520	Abstract Algebra	3
MATH	4531	Methods & Materials of Teaching Math	3
COMP	1102	Principles of Programming I	3
		Any one of the following science courses:	
CHEM	1101	General Chemistry I	Counted
CHEM	1105	Chemical Principles I	As
PHYS	1101	Introduction to Physics I	General
PHYS	1105	Principles of Physics I	Studies
BIOL	1105	Biological Principles I	
BIOL	1106	Biological Principles II	
GEOL	1101	Physical Geology	
TOTAL Required Major Courses			47
Major Electives			3
		Choose one course from the following:	
MATH	4580	Topology	
MATH	4590	Real Analysis	
Professional Education as required by School of Education			33
Note: Six hours of Education courses are counted as General Studies hours.			
TOTAL HOURS FOR MAJOR (and minor if required)			**83**

Required General Studies Courses		
Outcome 1 – Critical Analysis		3
	ENGL 1102* or any course in Outcome 1	
Outcome 2 – Quantitative Literacy		X
	MATH 2501 (satisfied in major)	
Outcome 3 – Written Communication		3
	ENGL 1101* or any course in Outcome 3	
Outcome 4 - Teamwork		3
	COMM 2200* or any course in Outcome 4	
Outcome 5 – Information Literacy		X
	ENGL 1102* (met in Outcome 1) or any course in	

	Outcome 5	
Outcome 6 – Technology Literacy		3
	EDUC 2201 (required for major)	
Outcome 7 – Oral Communication		X
	COMM 2200* (met in Outcome 4) or any course in Outcome 7	
Outcome 8 - Citizenship		3
	POLI 1103* or any course in Outcome 8	
Outcome 9 - Ethics		3
	ENGL 2220* or any course in Outcome 9	
Outcome 10 - Health		3
	EDUC 2203 (required for major)	
Outcome 11 - Interdisciplinary		X
	POLI 1103* (met in Outcome 8) or any course in Outcome 11	
Outcome 12 - Arts		3
	Any course in Outcome 12	
Outcome 13 - Humanities		X
	ENGL 2220* (met in Outcome 9) or any course in Outcome 13	
Outcome 14 – Social Sciences		3
	GEOG 2210* or any course in Outcome 14	
Outcome 15 - Natural Science		4-5
	PHYS 1101, PHYS 1105, CHEM 1101, CHEM 1105, BIOL 1105, BIOL 1106, GEOL 1101 (required for major)	
Outcome 16 – Cultural Awareness		X
	GEOG 2210* (met in Outcome 14) or any course in Outcome 16	
Additional General Studies hours		X
	MATH 4520 (WIC – satisfied in major)	
	*Starred courses are recommended choices. Choosing a different course may result in more than 120 hours needed to graduate.	
TOTAL GENERAL STUDIES HOURS		**31-32**
TOTAL FREE ELECTIVES		**6**
TOTAL HOURS *(depending on whether a student takes a 4 or 5 hour science course)*		**120-121**

APPENDIX A

Mathematics Teaching Specialization (Grades 5-9)
Current Program

Required Major Courses			HRS
MATH	1430 or 1530	College Algebra	3-4
MATH	1540	Trigonometry & Functions	3
MATH	1561	Introduction to Mathematical Reasoning	3
MATH	1550	Applied Statistics	3
MATH	2501	Calculus I	4
MATH	2551	Structure of the Real Numbers	3
MATH	2552	Data Analysis & Geometry	3
MATH	3553	Elementary Mathematics Methods	3
MATH	4531	Methods & Materials of Teaching Math	3
TOTAL Required Courses			**28-29**

APPENDIX A

Mathematics Teaching Specialization (Grades 5-9)
Proposed Program

Required Major Courses			HRS
MATH	1430 or 1530	College Algebra	3-4
MATH	1540	Trigonometry & Functions	3
MATH	1561	Introduction to Mathematical Reasoning	3
MATH	1550	Applied Statistics	3
MATH	2501	Calculus I	4
MATH	2551	Structure of the Real Numbers	3
MATH	2552	Data Analysis & Geometry	3
MATH	2554	Topics in Math History	2
MATH	3553	Elementary Mathematics Methods	3
MATH	4531	Methods & Materials of Teaching Math	3
TOTAL Required Courses			**30-31**

APPENDIX A
B.S. Degree in Mathematics
Current Program

Required Major Courses		**HRS**	
MATH 1550	Applied Statistics	3	
MATH 1561	Introduction to Mathematical Reasoning	3	
MATH 2501	Calculus I	4	
MATH 2502	Calculus II	4	
MATH 2510	Mathematical Logic	3	
MATH 2563	Transition to Higher Mathematics	4	
MATH 3503	Calculus III	4	
MATH 3520	Linear Algebra	3	
MATH 3550	Probability and Statistics	3	
MATH 4520	Abstract Algebra	3	
COMP 1102	Principles of Programming I	3	
	Any one of the following science courses		
CHEM 1101	General Chemistry I	Counted as General Studies hours XX	
CHEM 1105	Chemical Principles		
PHYS 1101	Introduction to Physics I		
PHYS 1105	Principles of Physics I		
TOTAL Required Major Courses			36
Major Electives			9
Major Electives	Choose three courses from Groups A and B. At least one course must be chosen from Group A.		
	Group A MATH 4580 Topology MATH 4590 Real Analysis **Group B** MATH 2520 Introduction to the Theory of Numbers Math 2562 Introduction to Discrete Mathematics MATH 3540 Numerical Analysis MATH 3570 Modern Geometry MATH 3504 Differential Equations		
Minor Electives			18-24
TOTAL HOURS FOR MAJOR			63-69

Required General Studies Courses		
Outcome 1 – Critical Analysis		3
	ENGL 1102 (Institutional Requirement)	
Outcome 2 – Quantitative Literacy		X
	MATH 1507 or 1407 or higher in Outcome 2 (satisfied in major)	
Outcome 3 – Written Communication		3
	ENGL 1101 (Institutional Requirement)	
Outcome 4 - Teamwork		3
	COMM 2200* or any course in Outcome 4	
Outcome 5 – Information Literacy		X
	ENGL 1102*(Met in Outcome 1) or any course in Outcome 5	
Outcome 6 – Technology Literacy		3
	Any course in Outcome 6	
Outcome 7 – Oral Communication		X
	COMM 2200* (Met in Outcome 4) or any course in Outcome 7	
Outcome 8 - Citizenship		3
	POLI 1103* or any course in Outcome 8	
Outcome 9 - Ethics		3
	ENGL 2220* or any course in Outcome 9	
Outcome 10 - Health		2-3
	PHED 1100* or any course in Outcome 10	
Outcome 11 - Interdisciplinary		X
	POLI 1103* (Met in Outcome 8) or any course in Outcome 11	
Outcome 12 - Arts		3
	Any course in Outcome 12	
Outcome 13 - Humanities		X
	ENGL 2220* (Met in Outcome 9) or any course in Outcome 13	
Outcome 14 – Social Sciences		3
	GEOG 2210* or any course in Outcome 14	
Outcome 15 - Natural Science		4-5
	PHYS 1101, PHYS 1105, CHEM 1101, CHEM 1105 (satisfied in major)	
Outcome 16 – Cultural Awareness		X
	GEOG 2210* (Met in Outcome 14) or any course in Outcome 16	
Additional General Studies hours		X
	MATH 4520 (WIC – satisfied in major)	
	*Starred courses are recommended choices. Choosing a different course may result in more than 120 hours needed to graduate.	
TOTAL GENERAL STUDIES HOURS		**30-32**
TOTAL FREE ELECTIVES		**19-27**
TOTAL HOURS		**120**

APPENDIX A
B.S. Degree in Mathematics
Proposed Program

Required Major Courses			**HRS**	
MATH 1550	Applied Statistics		3	
MATH 1561	Introduction to Mathematical Reasoning		3	
MATH 2501	Calculus I		4	
MATH 2502	Calculus II		4	
MATH 2510	Mathematical Logic		3	
MATH 2563	Transition to Higher Mathematics		3	
MATH 3503	Calculus III		4	
MATH 3520	Linear Algebra		3	
MATH 3550	Probability		3	
MATH 4520	Abstract Algebra		3	
COMP 1102	Principles of Programming I		3	
	Any one of the following science courses			
CHEM 1101	General Chemistry I			
CHEM 1105	Chemical Principles			
PHYS 1101	Introduction to Physics I		Counted	
PHYS 1105	Principles of Physics I		as	
BIOL 1105	Biological Principles I		General	
BIOL 1106	Biological Principles II		Studies	
GEOL 1101	Physical Geology		hours XX	
TOTAL Required Major Courses				36
Major Electives				9
Major Electives	Choose three courses from Groups A and B. At least one course must be chosen from Group A.			
	Group A			
	MATH 4580 Topology			
	MATH 4590 Real Analysis			
	Group B			
	MATH 2520 Introduction to the Theory of Numbers			
	MATH 2562 Introduction to Discrete Mathematics			
	MATH 3540 Numerical Analysis			
	MATH 3570 Modern Geometry			
	MATH 3504 Differential Equations			
Minor Electives				18-24
TOTAL HOURS FOR MAJOR				63-69

Required General Studies Courses		
Outcome 1 – Critical Analysis		3
	ENGL 1102 (Institutional Requirement)	
Outcome 2 – Quantitative Literacy		X
	MATH 2501 (satisfied in major)	
Outcome 3 – Written Communication		3
	ENGL 1101 (Institutional Requirement)	
Outcome 4 - Teamwork		3
	COMM 2200* or any course in Outcome 4	
Outcome 5 – Information Literacy		X
	ENGL 1102*(Met in Outcome 1) or any course in Outcome 5	
Outcome 6 – Technology Literacy		3
	Any course in Outcome 6	
Outcome 7 – Oral Communication		X
	COMM 2200* (Met in Outcome 4) or any course in Outcome 7	
Outcome 8 - Citizenship		3
	POLI 1103* or any course in Outcome 8	
Outcome 9 - Ethics		3
	ENGL 2220* or any course in Outcome 9	
Outcome 10 - Health		2-3
	PHED 1100* or any course in Outcome 10	
Outcome 11 - Interdisciplinary		X
	POLI 1103* (Met in Outcome 8) or any course in Outcome 11	
Outcome 12 - Arts		3
	Any course in Outcome 12	
Outcome 13 - Humanities		X
	ENGL 2220* (Met in Outcome 9) or any course in Outcome 13	
Outcome 14 – Social Sciences		3
	GEOG 2210* or any course in Outcome 14	
Outcome 15 - Natural Science		4-5
	PHYS 1101, PHYS 1105, CHEM 1101, CHEM 1105, BIOL 1105, BIOL 1106, GEOL 1101 (satisfied in major)	
Outcome 16 – Cultural Awareness		X
	GEOG 2210* (Met in Outcome 14) or any course in Outcome 16	
Additional General Studies hours		X
	MATH 4520 (WIC – satisfied in major)	
	*Starred courses are recommended choices. Choosing a different course may result in more than 120 hours needed to graduate.	
TOTAL GENERAL STUDIES HOURS		**30-32**
TOTAL FREE ELECTIVES		**19-27**
TOTAL HOURS		**120**

Minor in Mathematics

Current Program

MINOR IN MATHEMATICS		**24 SEM. HRS**
Required courses		**(12 hours)**
MATH 2501	CALCULUS I	4
MATH 2502	CALCULUS II	4
MATH 3503	CALCULUS III	4

Electives **(12 hours)**

(Choose four courses from the following list with at most one 1000-level course and at least one 3000/4000 course)

MATH 1550	APPLIED STATISTICS	3
MATH 1561	INTRO. TO MATHEMATICAL REASONING	3
MATH 2510	MATHEMATICAL LOGIC	3
MATH 2520	INTRO. TO THE THEORY OF NUMBERS	3
MATH 2562	INTRO. TO DISCRETE MATHEMATICS	3
MATH 2563	TRANSITION TO HIGHER MATHEMATICS	3
MATH 3504	DIFFERENTIAL EQUATIONS	3
MATH 3520	LINEAR ALGEBRA	3
MATH 3540	NUMERICAL ANALYSIS	3
MATH 3550	PROBABILITY AND STATISTICS	3
MATH 3570	MODERN GEOMETRY	3
MATH 4520	ABSTRACT ALGEBRA	3
MATH 4580	TOPOLOGY	3
MATH 4590	REAL ANALYSIS	3

Minor in Mathematics

Proposed Program

MINOR IN MATHEMATICS		**24 SEM. HRS**
Required courses		**(12 hours)**
MATH 2501	CALCULUS I	4
MATH 2502	CALCULUS II	4
MATH 3503	CALCULUS III	4

Electives **(12 hours)**

(Choose four courses from the following list with at most one 1000-level course and at least one 3000/4000 course)

MATH 1550	APPLIED STATISTICS	3
MATH 1561	INTRO. TO MATHEMATICAL REASONING	3
MATH 2510	MATHEMATICAL LOGIC	3
MATH 2520	INTRO. TO THE THEORY OF NUMBERS	3
MATH 2562	INTRO. TO DISCRETE MATHEMATICS	3
MATH 2563	TRANSITION TO HIGHER MATHEMATICS	3
MATH 3504	DIFFERENTIAL EQUATIONS	3
MATH 3520	LINEAR ALGEBRA	3
MATH 3540	NUMERICAL ANALYSIS	3
MATH 3550	PROBABILITY	3
MATH 3570	MODERN GEOMETRY	3
MATH 4520	ABSTRACT ALGEBRA	3
MATH 4580	TOPOLOGY	3
MATH 4590	REAL ANALYSIS	3

APPENDIX B
Course Descriptions

New Course:

MATH 2554 Topics in Math History (2 hrs.)

This course is designed to provide students with an overview of the historical development and perspectives of number, number systems, quantity, algebra, geometry, trigonometry, statistics, probability, calculus, and discrete mathematics, including contributions of significant figures and diverse cultures.

PR: MATH 2562 OR concurrent enrollment in MATH 2562. Fall semester only

Existing Courses:

MATH 3503 Calculus III (4cr)

This course is a continuation of MATH 2502, and covers the calculus of two or more independent variables. Topics include basic vector properties, partial derivatives, double and triple integration, and vector calculus.

PR: MATH 2502. Fall semesters only

MATH 3550 Probability (3cr) (Formerly MATH 3550-Probability and Statistics)

This course will cover undergraduate probability theory from both discrete and calculus perspectives. Topics will include basic combinatorics, the axioms of probability, conditional probability, discrete and continuous random variables (including numerous examples of each), joint distributions, and limit theorems.

PR: MATH 2502 OR concurrent enrollment in MATH 2502. Spring semester only

APPENDIX C
Course Outlines

New Course: Topics in Math History

1. Historical Development of Number, Number Systems, and Quantity
    a. Contributions of significant figures
        i. Thales of Miletus
        ii. Pythagoras of Samos
    b. Contributions of diverse cultures
        i. Egyptian
        ii. Mesopotamian
        iii. Greek

2. Historical Development of Algebra
    a. Contributions of significant figures
        i. Al-Khwarizmi
        ii. Emmy Noether
    b. Contributions of diverse cultures
        i. Arabic
        ii. Egyptian
        iii. German

3. Historical Development of Geometry and Trigonometry
    a. Contributions of significant figures
        i. Euclid
        ii. Archimedes
        iii. Euler
    b. Contributions of diverse cultures
        i. Egyptian
        ii. Greek
        iii. Swiss

4. Historical Development of Statistics and Probability
    a. Contributions of significant figures
        i. Pascal
        ii. Bernoulli
    b. Contributions of diverse cultures
        i. French
        ii. Swiss

5. Historical Development of Calculus
    a. Contributions of significant figures
        i. Newton
        ii. Leibniz
    b. Contributions of diverse cultures
        i. English

ii. German

6. Historical Development of Discrete Mathematics
    a. Contributions of significant figures
        i. De Moivre
        ii. Erdos
    b. Contributions of diverse cultures
        i. Hindu
        ii. Hungarian

Revised Courses:

MATH 3503: CALCULUS III

1. Review of Parametric Equations and Polar coordinates
2. Vectors and the Geometry of space
    a. Vectors in the plane
    b. Vectors in space
    c. The dot product
    d. The cross product
    e. Surfaces in space
    f. Cylindrical and spherical coordinates
3. Vector-valued functions
    a. Definition
    b. Differentiation and integration
    c. Velocity and acceleration
    d. Tangent and normal vectors
    e. Arc length and curvature
4. Functions of several variables
    a. Limits and continuity
    b. Partial derivatives
    c. Differentials
    d. Chain rule
    e. Directional derivatives and the gradient
    f. Tangent planes and normal lines
    g. Extrema and applications
    h. Lagrange Multipliers
5. Multiple integration
    a. Iterated integrals
    b. Double integrals and volume
    c. Change of variables: polar coordinates
    d. Surface area
    e. Triple integrals
    f. Jacobians
6. Vector Calculus
    a. Vector fields
    b. Line integrals
    c. Conservative vector fields and independence of path
    d. Green's theorem

e. Parametric surfaces
f. Surface integrals
g. Divergence Theorem
h. Stoke's Theorem

MATH 3550: Probability

1. Set Theory and Combinatorics
    a. Basic definitions
    b. Set operations
    c. The Fundamental Counting Principle
    d. Permutations
    e. Combinations
2. Probability: Definitions and Axioms
    a. Sample spaces and events
    b. Probability measures
    c. Probability of intersections, unions, and complements
    d. Probability and counting techniques
3. Conditional probability
    a. Definitions
    b. Bayesian probabilities
    c. Independent events
4. Discrete Random Variables
    a. Random variables
    b. Probability mass functions and cumulative distribution functions
    c. Expected value
    d. Variance and standard deviation
5. Common discrete random variables
    a. Bernoulli and Binomial
    b. Poisson
    c. Geometric
    d. Negative Binomial and Hypergeometric
6. Calculus prerequisites
    a. Improper integrals
    b. Iterated double integrals
7. Continuous random variables
    a. Distribution functions
    b. Expectation and variance
    c. The uniform distribution
    d. Normal random variables
    e. Exponential random variables
    f. The Gamma distribution
8. Joint distributions
    a. Jointly distributed random variables
    b. Independent random variables
    c. Convolution
    d. Conditional distributions
9. Limit Theorem
    a. Covariance

b. Conditional expectation
c. Moment generating functions
d. The Law of Large numbers (Weak and Strong)
e. The Central Limit Theorem

APPENDIX D
Course Outcomes and Assessments

MATH 2554: TOPICS IN MATH HISTORY

Outcome	Direct Assessment	Rubric/Satisfactory Performance Standard
Summarize and discuss the historical development of multiple mathematical domains (number, quantity, algebra, geometry, trigonometry, statistics, probability, calculus, and discrete mathematics).	Research papers	*Sample rubric approved by CAEP is below.*
Synthesize mathematically significant historical events from its origin to present day.	Timeline (individual and class)	*Sample rubric approved by CAEP is below.*
Organize mathematical thinking and use the language of mathematics to orally express ideas precisely.	Presentation of assigned period of history to the class	*Sample rubric approved by CAEP is below.*

MATH 3503: CALCULUS III

Outcome	Direct Assessment	Rubric/satisfactory performance standard
1. Graph and apply concepts of calculus using parametric equations and polar coordinates.	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
2. Demonstrate conceptual understanding of and facility with the partial derivative, synthesizing mathematical knowledge to model, interpret and calculate the partial derivative of a function.	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
3. Apply partial derivatives to solve a variety of real world problems using appropriate strategies and symbolic manipulation skills.	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
4. Demonstrate conceptual understanding of and facility with multiple integrals.	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.

MATH 3550: PROBABILITY

Outcome	Direct Assessment	Rubric/satisfactory performance standard
1. Accurately identify the differences between empirical and theoretical probability, and use the appropriate methods from each to solve probabilistic problems	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
2. Solve basic combinatorics problems	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
3. Use discrete probability distributions to model and solve real-world problems	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
4. Use continuous probability distributions to model and solve real-world problems	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.
5. Accurately explain how limit theorems unify probability theory and use limit theorems to solve problems	Exam/quiz question(s)	Class average score of greater than 2.5 on the Arizona Math Rubric.

MATH 2554: Research Paper Rubric (Sample)

	4	**3**	**2**	**1**
Number & Quantity Math Content **(B.1.5.1)**	Paper discusses the historical development of number, number systems, and quantity, as well as how developing mathematical ideas impacted world events and vice versa.	Paper discusses the historical development of number, number systems, and quantity, as well as how developing mathematical ideas were impacted by world events.	Paper discusses the historical development of number, number systems, and quantity.	Paper provides an incomplete picture of the historical development of number, number systems, and quantity.
Number & Quantity Significant Historical Figures **(B.1.5.2)**	Paper includes contributions of significant figures and discusses their implications for the field of mathematics.	Paper includes contributions of significant figures.	Paper includes contributions of one or two significant figures.	Paper does not include contributions of significant figures.
Number & Quantity Diverse Cultures **(B.1.5.3)**	Paper includes contributions of diverse cultures and discusses the implications of those cultures for mathematical developments and vice versa.	Paper includes contributions of diverse cultures.	Paper includes contributions of one particular culture, but does not consider other cultures.	Paper does not include contributions of diverse cultures.

MATH 2554: Timeline Rubric

	4	**3**	**2**	**1**
Historical Information (NCTM CAEP Standards A.1.5, A.2.7, A.3.10, A.4.6, A.5.6, A.6.5)	Timeline is accurate and includes major mathematical "firsts" from diverse cultures, biographical information for mathematicians discussed in your papers, and major historical events.	Timeline is accurate and includes major mathematical "firsts" from diverse cultures, biographical information for ***most*** mathematicians discussed in your papers.	Timeline is accurate and includes major mathematical "firsts" from diverse cultures, but is missing biographical information for mathematicians discussed in your papers.	Timeline is accurate but is missing several mathematical "firsts" ***or*** biographical information for mathematicians discussed in your papers.
Connections among Mathematical Ideas (NCTM CAEP Standard 2e)	Timeline demonstrates the interconnectedness of mathematical ideas and how they built on one another across various	Timeline demonstrates the interconnectedness of mathematical ideas and how they built on one another across various	Timeline demonstrates the interconnectedness of mathematical ideas.	Timeline gives little indication that mathematical ideas are interconnected.

	content areas and real-world contexts.	content areas *or* real-world contexts.		
Organized Thinking and Precise Use of Mathematical Language (NCTM CAEP Standard 2d)	Timeline demonstrates organized mathematical thinking and uses the language of mathematics to express ideas precisely in writing. The timeline is understandable and appealing to classmates, colleagues, as well as secondary mathematics students.	Timeline demonstrates organized mathematical thinking and uses the language of mathematics to express ideas precisely in writing. The timeline is understandable and appealing to classmates, colleagues, *or* secondary mathematics students, but not both.	Timeline demonstrates slightly disorganized mathematical thinking *or* ideas are not expressed precisely using the language of mathematics.	Timeline is disorganized and difficult to understand.

MATH 2554: Presentation Rubric

	4	**3**	**2**	**1**
Connections among Mathematical Ideas (NCTM CAEP Standard 2e)	Presentation demonstrates the interconnectedness of mathematical ideas and how they build on one another across various content areas and real-world contexts.	Presentation demonstrates the interconnectedness of mathematical ideas and how they built on one another across various content areas *or* real-world contexts.	Presentation demonstrates the interconnectedness of mathematical ideas.	Presentation gives little indication that mathematical ideas are interconnected.
Organized Thinking and Precise Use of Mathematical Language (NCTM CAEP Standard 2d)	Presentation demonstrates organized mathematical thinking and uses the language of mathematics to express ideas precisely in writing. The presentation is understandable and interesting to classmates and would be engaging for secondary	Presentation demonstrates organized mathematical thinking and uses the language of mathematics to express ideas precisely in writing. The presentation is understandable and interesting to classmates.	Presentation demonstrates slightly disorganized mathematical thinking *or* ideas are not expressed precisely using the language of mathematics.	Presentation is disorganized and difficult to understand.

	mathematics students as well.			

Arizona Mathematics Rubric for MATH 3503 and 3550

Holistic Scale

4: A4 response represents and effective solution. It shows complete understanding of the problem, thoroughly addresses all points relevant to the solution, shows logical reasoning and valid conclusions, communicates effectively and clearly through writing and/or diagrams, and includes adequate and correct computations and/or setup. It may contain insignificant errors that do not interfere with the completeness or reasonableness of the student's response.

3: A 3 response contains minor flaws. Although it shows an understanding of the problem, communicates adequately through writing and/or diagrams, and generally reaches reasonable conclusions, it shows minor flaws in reasoning and/or computation or neglects to address some aspect of the problem.

2: A 2 response shows gaps in understanding and/or execution. It shows one or some combination of the following flaws: and incomplete understanding of the problem, failure to address some aspects of the problem, faulty reasoning, weak conclusions, unclear communication in writing and/or diagrams, or a poor understanding of relevant mathematical procedures or concepts.

1: A 1 response shows some effort beyond restating the problem or copying given data. It shows some combination of the following flaws: little understanding of the problem, failure to address most aspects of the problem, major flaws in reasoning that lead to invalid conclusions, or a lack of understanding of relevant mathematical procedures or concepts.

0 Response shows no mathematical understanding of the problem or the student has failed to respond to the item.

Curriculum Proposal - New Math History Course

Jones, Stephanie

Fri 10/27/2017 12:53 PM

To: Crislip-Tacy, Carolyn <Carolyn.Crislip-Tacy@fairmontstate.edu>;

1 attachments (101 KB)

CurriculumProposal_Math Hist and prob_DRAFT_10.27.17.docx;

Hi Carolyn,

Just wanted to let you know that I've prepared a proposal to add a math history course for math education students (both 5-adult and 5-9). The full proposal is attached for your review, but in short:

- There are about 6 math history standards students must meet for CAEP
- We currently have no math history course, so data is being collected through multiple classes/professors. It's cumbersome.
- The culmination of the math history work is now in methods, which really isn't the right place for it.
- Since CAEP approved what we are doing, we would like to put it all in a single, 2-hour online course for math education students, which will allow students to get credit for the work and to spend some more focused time on math history.

Note that there are a couple of other more cosmetic items in this proposal as well (dealing with probability and calculus). Feel free to comment on those items as well, if you have concerns, but the biggest change being proposed is the math history course. Also, we may make some slight revisions to the proposal in the next few days. I'll let you know of any pertinent changes, should they occur.

Please let me know if you have any questions or concerns about the proposal.

Have a great weekend,

Stephanie M. Jones
Assistant Professor of Mathematics Education
Fairmont State University
Office: 426 ET
304-367-4307
Stephanie.Jones@fairmontstate.edu

Applied Calculus Curriculum Proposal

Niichel, Robert

Tue 10/31/2017 11:58 AM

To:* FSU Faculty - College of Science & Technology <_FSUFaculty-CollegeofScience&Technology2@fairmontstate.edu>;

2 attachments (137 KB)

Math 2017-18 Proposal 4.docx; CurriculumProposal_Math Hist and prob_DRAFT_10.30.17.docx;

Dear Colleagues,

Attached you will find the Applied Calculus curriculum proposal, as well as another proposal dealing with a new Math History course and some minor changes to Calculus 3 and Probability. They are due Friday, so please let us know as soon as possible if you see any problems.

Thanks,
Bob

From: Niichel, Robert
Sent: Tuesday, October 10, 2017 11:01 AM
To: * FSU Faculty - College of Science & Technology <_FSUFaculty-CollegeofScience&Technology2@fairmontstate.edu>
Subject: RE: Applied Calculus Meeting, round 2

Dear Colleagues,

The last Applied Calculus meeting is scheduled for Thursday, October 12, 12:30-1:30 in ET 311. We received one proposal for changes to regular Calculus 1. If you are interested in the future of either applied calculus or regular calculus, please feel free to attend. After this meeting we will move forward with our curriculum proposal.

Thanks,
Bob

From: Gonzalez, Cheri
Sent: Thursday, January 11, 2018 1:29 PM
To: Jones, Stephanie
Subject: RE: Approval of New Course Number for Curriculum Proposal

Hi Stephanie,

Math 2554 is good.

Thank you
Cheri

Cheri L. Gonzalez
Interim Registrar
Fairmont State University
Pierpont Community & Technical College
304-367-4112
Cheri.Varkonda@fairmontstate.edu

From: Jones, Stephanie
Sent: Tuesday, December 12, 2017 9:23 AM
To: Gonzalez, Cheri <Cheri.Varkonda@fairmontstate.edu>
Subject: Approval of New Course Number for Curriculum Proposal

Hi Cheri,

I'm proposing the addition of a math course in a curriculum proposal. As I understand it, I need a memo from the registrar approving the new course number (MATH 2554). Can you approve this course number for me?

As a bit of background, this course is specific to math education majors, so we chose the number to align with the numbers of other math education courses (2551, 2552, 3553). After

speaking with others in the math department, we are fairly certain that there has never been a course offered with this number in FSU's history.

Please let me know if you need further information. Thank you.

Stephanie M. Jones
Assistant Professor of Mathematics Education
Fairmont State University
Office: 426 ET
304-367-4307
Stephanie.Jones@fairmontstate.edu