FAIRMONT STATE UNIVERSITY™

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MEMORANDUM

TO: Faculty Senate

FROM: Susan Ross

DATE: 1/3/2022

SUBJECT: Curriculum Proposal # 21-22-24

Since the successful implementation of the math support program, many students who would have taken MATH 1510—Applied Technical Mathematics 1 have instead been sent to MATH 1430. To get the trigonometry required by most engineering technology courses, students must then take math 1540. This delays students by a considerable amount and has affected the engineering technology pipeline. We are therefore proposing a new course, MATH 1410, to offer the material from 1510 with more time given to elementary topics and background material. MATH 1510 will be deactivated in Fall 2022.

cc: Dianna Phillips
Lori Schoonmaker
Stephanie Gabor
Laura Ransom
Steve Roof

CURRICULUM PROPOSAL (Submit one electronic copy to the Executive Director of Academic Programs by the second Tuesday of the month.)

Proposal Number: #21-22-24

School/Department/Program: College of Science and Technology/Computer Science and Mathematics/Mathematics

Preparer/Contact Person: Bob Niichel

Title of Degree Program: N/A

Telephone Extension: x4701

Date Originally Submitted: 11/1/2021

Revision (Indicate date and label it Revision #1, #2, etc.): #0

Implementation Date Requested: Fall 2022

I. **PROPOSAL ABSTRACT**. Write a brief abstract, not exceeding 100 words, which describes the proposed changes.

Since the successful implementation of the math support program, many students who would have taken MATH 1510—Applied Technical Mathematics 1 have instead been sent to MATH 1430. To get the trigonometry required by most engineering technology courses, students must then take math 1540. This delays students by a considerable amount and has affected the engineering technology pipeline. We are therefore proposing a new course, MATH 1410, to offer the material from 1510 with more time given to elementary topics and background material. MATH 1510 will be deactivated in Fall 2022.

II. **DESCRIPTION OF THE PROPOSAL**. Provide a response for each letter, A-G, 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) Total hours added: _____4____

C. Provision for interchangeable use of course(s) with program(s):

All courses that previously required MATH 1510 will now instead require MATH 1410. This includes the follow-up course, MATH 1520. MATH 1410 will have the same content with additional student support since there is no prerequisite test score.

D. **Course Description Revision**: Include, as an appendix, a revised course description, written in complete sentences, suitable for use in the university catalog.

Attached as Appendix A

E. **Course Changes:** Identify changes to existing courses such as changes to title, course number, learning outcomes, and elective or required status. N/A

F. **Create a New Course**(s) information (if applicable): For each new course complete the following:

1. **Course Catalog Information:**

a. Course prefix (subject area) and number:	MATH 1410
b. Course title:	**Applied Technical Mathematics I--Enhanced**
c. Course term(s) (e.g., Fall, Summer only):	Fall and Spring
d. Credit hours/Variable credit:	4
e. Repeatability (number of repeat credit hours):	Per University Policy
f. **Prerequisite/Corequisites/Restrictions/Cross-listings:** If none, simply indicate with N/A (Not Applicable):	N/A
g. ***Co-requisite*** (include subject prefix and course number):	N/A
h. ***Cross-listings*** (e.g., PSYC 2230 and SOCY 2230):	N/A
i. **Grade Type:** Indicate whether students will be assigned a standard A-F final grade or Credit/No Credit (CR/NCF) grade:	A-F
j. Required Course or Elective Course: While 1410 will be an elective course in the short term, the Engineering Technology Department plans on placing all first-year students into the course (i.e., replacing MATH 1510). The Engineering Technology Department will make this a change in their curriculum if the course proves to be beneficial.	Elective
k. Course Fees (Indicate amount): No special fees will be collected. Standard College fees will apply.	$0

2. **New Course Supplemental/Supporting Documentation**:

a. **Course Catalog Description**: Include, as an appendix, a course catalog description written in complete sentences that will be published in the university catalog. The word length for a catalog description should be less than 80 words. Do not include any prerequisites, corequisites or any other restrictions in the description.

Attached as Appendix A.

b. **Course Learning Outcomes (CLO's):** These should be stated in terms of what new knowledge and/or skills students should be able to <u>demonstrate</u> upon successful completion of the course. Present course learning

outcomes as a bulleted list predicated with “Upon successful completion of this course, students should be able to…”

- Outcome 1: (Problem Solving Methods) Use problem solving methods to model and solve real world problems using right triangles, the law of sines, and the law of cosines.
- Outcome 2: (Symbolic Manipulation) Demonstrate appropriate symbolic manipulation skills to simplify algebraic expressions.
- Outcome 3: (Language of Mathematics) Use the language of mathematics to describe trigonometric relationships or graphs of functions.
- Outcome 4: (Interpretation of Mathematical Knowledge) Interpret mathematical knowledge to reach logical conclusions about the solution sets of systems of linear equations.
- Outcome 5: Solve problems using vectors.

c. **Course Outline:** Attach a course outline consisting of at least two levels.

A comparative outline showing the material in MATH 1510 and the adjustments proposed for MATH 1410 is attached as Appendix B.

d. **Assessments:** Describe generally how student’s achievement of the course learning outcomes will be assessed

Assessment quizzes are attached as Appendix C.

3. **Shared Course**: If this is a shared course, attach a memo from the Deans of the affected Schools explaining the rationale for course being shared. N/A

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.

This proposal has been developed in tandem with the Engineering Technology Department. It is anticipated that this will become the first gateway mathematics course that Engineering Technology students complete. This course will benefit students to improve their mathematical literacy with the additional support time. A student in Engineering Technology must be able to enroll in the proper mathematics class during their first semester, and when this does not occur, the student is one year off schedule. The addition of one credit will reduce the elective credit hours in a student’s free electives in Engineering Technology.

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 need for change was precipitated by a decline in enrollment in MATH 1510 due to fewer students meeting the SAT requirement. The original goal of MATH 1510 was to provide students with the optimal mathematical information they need in their first semester, allowing them to understand what was happening in their engineering technology courses just-in-time. As a stopgap measure, engineering technology students are taking MATH 1430 (College Algebra) and subsequently MATH 1540 (Trigonometry). However, these two courses together do not cover some of the topics in 1510 (like vectors), and so this leaves a hole in students' knowledge, rendering them unprepared for their engineering classes. The 1430 route essentially puts engineering technology students about a semester behind in terms of their mathematical ability, and about a year behind in terms of coursework.

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?

To fix the problem mentioned above, we need to remove the SAT prerequisite for the course. This cannot be reasonably accomplished without providing additional support to students to help them learn the material. In point of fact, HEPC Series 21 states that students who do not meet the test score requirements for a course must have additional support, hence the additional contact hour. To flesh out what this extra contact hour would look like, the mathematics professors who have been teaching the course for the past few years (Dr. Joe Riesen, Dr. Robert Niichel, and Carol Stewart) were consulted to determine where the most significant weaknesses are among students. We identified basic algebra and geometry skills as presenting the most serious difficulties to students, as well as a few other topics in trigonometry and factoring. We then allocated the additional 14-15 in-class hours gained from the extra credit hour to these topics.

IV. APPROVAL

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
Science and Technology	**Steven Roof**	

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. N/A

Appendix A: Course Description

MATH 1410: Applied Technical Mathematics I—Enhanced 4hrs.

This course is an elementary introduction to fundamental mechanics and techniques for performing operations with algebraic expressions, factoring, solving linear equations and systems of linear equations, graphing functions and relations, as well as using trigonometric functions and applying them to solve triangles and problems involving vectors. The course will provide students with enhanced support to reintroduce and reinforce fundamental concepts from geometry, algebra, arithmetic, and trigonometry.

Appendix B: Comparative Course Outline

The following is the original course outline for MATH 1510, with changes for MATH 1410 indicated by

NEW MATERIAL (+number of in-class hours)
Additional emphasis (+number of extra in-class hours)

I. Demonstrate appropriate symbolic manipulation skills to simplify algebraic expressions and solve equations

1. manipulate signed numbers
2. *solve order-of-operation problems (+1)*
3. use basic graphing calculator functions
4. *solve problems involving exponents (+2)*
5. apply accuracy and precision laws
6. perform basic operations with polynomials (no long division)
7. solve linear equations
8. manipulate formulas
9. solve applied linear equations
10. *REVIEW OF FRACTIONS (+1)*

II. REVIEW OF GEOMETRY (+4)

1. *REVIEW LINES AND ANGLES*
2. *DESCRIBE AND APPLY CHARACTERISTICS OF TRIANGLES*
3. *DESCRIBE AND APPLY CHARACTERISTICS OF QUADRILATERALS*
4. *DESCRIBE AND APPLY CHARACTERISTICS OF CIRCLES*
5. *CALCULATE LENGTHS, AREAS, AND VOLUMES OF GEOMETRIC FIGURES*

III. **Interpret math knowledge to solve and graph functions and relations**

1. use the TI 83/4/5 linear graphing capabilities
2. work with a Cartesian plane
3. find slope
4. graph linear functions
5. apply function definition

IV. **Solve problems using simultaneous equations**

1. solve simultaneous equations
2. solve simultaneous equations using substitution method
3. solve simultaneous equations using addition method
4. apply simultaneous equations

V. **Use the language of mathematics to describe trig relationships**

1. *define trig functions (+2)*
2. use trig functions
3. find inverse trig functions (sin, cos, tan only)
4. using inverse trig functions

VI. Use problem solving methods to model and solve trig functions

1. solve right triangle problems
2. adapt trig functions to all quadrants
3. find trig functions of arbitrary angles
4. use radian measure

VII. **Solve problems using vectors**

1. find a resultant vector graphically

2. reduce a vector to x and y components
3. find a resultant vector algebraically
4. apply vectors

VIII. **Use the law of sines and cosines to solve problems**

1. state law of sines and the law of cosines
2. *solve law of sines problems (+1)*
3. *solve law of cosines problems (+1)*
4. solve applied law of sin and cos problems
5. distinguish between oblique triangle solutions

IX. ***Demonstrate appropriate symbolic manipulation skills to simplify algebraic expressions and solve equations (+2)***

1. perform long binomial multiplication
2. simplify binomial products
3. factor by grouping
4. factor binomials and trinomials
5. multiply and divide polynomial fractions
6. add and subtract polynomial fractions
7. simplify complex fractions
8. clear denominators
9. solve fractional equations

Additional in-class hours: 14

Appendix C: Course Assessments

M1410 Outcomes:

- **Outcome 1:** (Problem Solving Methods) Use problem solving methods to model and solve real world problems using right triangles, the law of sines, and the law of cosines.
- **Outcome 2:** (Symbolic Manipulation) Demonstrate appropriate symbolic manipulation skills to simplify algebraic expressions.
- **Outcome 3:** (Language of Mathematics) Use the language of mathematics to describe trigonometric relationships or graphs of functions.
- **Outcome 4:** (Interpretation of Mathematical Knowledge) Interpret mathematical knowledge to reach logical conclusions about the solution sets of systems of linear equations.
- **Outcome 5:** Solve problems using vectors.

M1410 Quiz §§9.5-9.6 (Outcome 1) Name: *Write your name on back!*

Show your work for full credit!

Average Score: _____/4

(1) Suppose the angle of elevation to the sun is 51°. If the shadow of a tree is 20m long, how tall is the tree? As part of your solution, please draw a picture of the situation.

(2) A surveyor measure the angles and sides of a triangle. Two sides of the triangle measure 15m and 25m. The angle opposite the 25m side measures 75.3°. What is the measure of the third side?

(3) Suppose another triangle has two sides which measure 32in and 50in. The angle between these two sides is 28°. What is the length of the third side?

M1410 Quiz §§1.1-1.8 (Outcome 2) Name: *Write your name on back!*

Show your work for full credit!

Average Score: _____/4

(1) Evaluate: $-7(-3) + \dfrac{6}{-3} - |-5|$

(2) Simplify: $\dfrac{2z^3}{(2z)^3}$

(3) Simplify (eliminate the parentheses): $(2s + 7t)(3s + 5t)$

M1410 Quiz §§8.1-8.3 (Outcome 3) Name: *Write your name on back!*

Show your work for full credit!

Average Score: _____/4

(1) What is the geometric interpretation of $\sin(150°)$? Use a picture to help you explain your answer.

(2) What is the geometric interpretation of sine and cosine for negative angles? Again, use a picture to explain your answer.

(3) Explain the relationship between radians and degrees. Provide an equation that can be used to find radians if the angle is given in degrees.

M1410 Quiz §§5.1-5.4 (Outcome 4) Name: *Write your name on back!*

Show your work for full credit!

Average Score: _____/4

(1) Solve the following system using any method you like:

$$\begin{cases} 2x + y = 5 \\ 5x + 3y = 8 \end{cases}$$

(2) Solve the following system using any method you like:

$$\begin{cases} -2x - 3y = 2 \\ 4y + 2x = 8 \end{cases}$$

(3) What conclusions can be drawn about the geometric interpretations of the solution sets to these systems? Be sure to address both systems.

M1410 Quiz §§9.1-9.4 (Outcome 5) Name: *Write your name on back!*

Show your work for full credit!

Average Score: _____/4

(1) What are the horizontal and vertical components of a 200N force exerted at 37° from the positive x-axis?

(2) A storm front is moving North at 20mph and West at 11mph. What are the front's actual direction and speed?