LSC Use Only Proposal No:	UWUCC Use Only Proposal No: 12-26c.
LSC Action-Date: AP-2/7/13	UWUCC Action-Date: AP-5/7/13 Senate Action Date: APP-9/10/13

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person(s) Francisco Alarcon	Email Address falarcon@iup.edu
Proposing Department/Unit Mathematics	Phone 724-357-2608

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

- [ ] New Course
- [x] Course Revision
- [ ] Course Prefix Change
- [ ] Course Number and/or Title Change
- [ ] Course Deletion
- [ ] Catalog Description Change

Current course prefix, number and full title: MATH 110 Elementary Functions

Proposed course prefix, number and full title, if changing:

2. Liberal Studies Course Designations, as appropriate

This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

- [x] Learning Skills
- [ ] Knowledge Area
- [ ] Global and Multicultural Awareness
- [ ] Writing Across the Curriculum (W Course)
- [ ] Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)
  - [ ] Global Citizenship
  - [ ] Information Literacy
  - [ ] Oral Communication
  - [ ] Quantitative Reasoning
  - [ ] Scientific Literacy
  - [ ] Technological Literacy

3. Other Designations, as appropriate

- [ ] Honors College Course
- [ ] Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

- [ ] Catalog Description Change
- [ ] Program Revision
- [ ] Program Title Change
- [ ] New Track
- [ ] New Degree Program
- [ ] New Minor Program
- [ ] Liberal Studies Requirement Changes
- [ ] Other

Current program name:

Proposed program name, if changing:

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)		4/20/12
Department Chairperson(s)	Edel Reilly	4/20/12
College Curriculum Committee Chair		4/20/12
College Dean		4/20/12
Director of Liberal Studies (as needed)		5/6/13
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs	Gail S Sechrist	8/28/13

Received AUG 28 2013 Liberal Studies

Received MAY 3 2013 Liberal Studies

Received APR 22 2012 Liberal Studies

Part II. Description of Curriculum Change

1. New Syllabus of Record

I. Catalog Description

MATH 110 Elementary Functions

3c-0l-3cr

Prerequisite: MATH 100 or appropriate Placement Test score or permission of the Mathematics Department Chairperson.

Note: Students may not take MATH 110 after successfully completing a calculus course without the written approval of the Mathematics Department Chairperson.

Prepares mathematics and science students for the study of calculus. Topics include detailed study of polynomial, exponential, logarithmic, and trigonometric functions.

II. Course Outcomes and Assessment (Expected Undergraduate Student Learning Outcomes – EUSLO)

The student will:

Objective 1:
Identify and utilize patterns in the study of mathematics.
Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale:
Given a set of data, students will be expected to recognize certain mathematical patterns in order to make informed decisions on how that data is related, if at all. The students will be expected to use these relationships to solve a wide variety of problems. Technology will be used to gain deeper insight into the phenomena and make predictions about future behavior.

Objective 2:
Express relationships between sets using functions and apply functions to solve scientific problems.
Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale:
The study of functions is essential in establishing the mathematical relationship between various sets. Once these relationships are established and formalized, they will enable students to assign mathematical meaning to information related to a variety of real-world situations. Students will model phenomena such as the size of a population, demand for a product, speed of a falling object, as well as many others.

Objective 3:
Interpret functions expressed analytically and graphically.
Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale:
Students will be expected to assess information that is disseminated analytically and/or graphically, and use the tools obtained from their study of functions to gain insight on the relationships exhibited. Technology will be used to gain deeper insight.

Objective 4:
Calculate the rate of change of a function and interpret its meaning.
Expected Student Learning Outcomes 1 and 2
Informed and Empowered Learners
Rationale:
Students will be able to measure how one quantity changes in response to a change in another quantity. The concept of rate of change will be used to solve geometric problems, such as curve sketching, and to convert written applied problems into mathematical models. Students will be able to relate the concept of rate of change to the concept of slope of the graph of a function.

III. Detailed Course Outline

A. Fundamentals (3 hours)
   1. Inequalities (includes nonlinear inequalities)
   2. Coordinate Geometry
   3. Graphing Calculators and Computers
   4. Lines

B. Functions (8 hours)
   1. What is a Function?
   2. Graphs of Functions
   3. Applied Functions
   4. Transformations of Functions
   5. Extreme Values of Functions
   6. Combining Functions
   7. One to One Functions and Their Inverses

C. Polynomials and Rational Functions (5 hours)
   1. Polynomial Functions and Their Graphs
   2. Real Zeros of Polynomials
   3. Remainder and Factor Theorems, and Upper and Lower Bound Theorem only
   4. Rational Functions

   Note : Oblique asymptotes are optional

D. Exponential and Logarithmic Functions (8 hours)
   1. Exponential Functions
   2. The Natural Exponential Function
   3. Logarithmic Functions

4. Laws of Logarithms
5. Exponential and Logarithmic Equations
6. Applications of Exponential/Logarithmic Functions

E. Trigonometric Functions of Real Numbers (5 hours)
1. The Unit Circle
2. Trigonometric Functions of Real Numbers
3. Trigonometric Graphs
4. More Trigonometric Graphs (Optional)

F. Trigonometric Functions of Angles (4 hours)
1. Angle Measure
2. Trigonometry of Right Angles
3. Trigonometric Functions of Angles
4. The Law of Sines (Optional)
5. The Law of Cosines (Optional)

G. Analytic Trigonometry (5 hours)
1. Trigonometric Identities
2. Addition and Subtraction Formulas
3. Double-Angle, Half-Angle and Product-Sum Formulas
4. Inverse Trigonometric Functions
5. Trigonometric Equations

This syllabus covers 38 hours, leaving 4 hours for testing and/or review.

There are also 2 hours for a final exam or concluding activity.

IV. Evaluation Methods

The final grade for the course will be determined as follows:

50% Tests. Tests will include problems on basic competency and critical thinking.
20% Final Examination. The final examination will be comprehensive and cover both basic competency and critical thinking.
30% Homework, Quizzes, and Projects. These will cover textbook assignments and applications to business and economics

V. Grading Scale

90% - 100%	A
80% - 89%	B
70%-79%	C
60% - 69%	D
Below 60%	F

VI. Undergraduate Attendance Policy

Although there is no formal attendance policy for this class, student learning is enhanced by regular attendance and participation in class discussions.

[Note: It is recommended that an attendance policy be developed by individual faculty and included in student syllabi. (See undergraduate catalog for Undergraduate Course Attendance Policy.)]

VII. Required Textbooks, Supplemental Books and Readings

Zill, D., *Essentials of Precalculus with Calculus Previews,* Fifth Edition, Jones & Bartlett, 2010.

Cooney, M., *Celebrating Women in Mathematics,* The National Council of Teachers of Mathematics, 1996

Austin, B., Barry, D., and Berman, D., *The Lengthening Shadow: The Story of Related Rates,* Mathematics Magazine, Vol. 73, No. 1, pp. 3-12, 2000

VIII. Special Resource Requirements

Some instructors may require students to purchase a graphing calculator.

IX. Bibliography

Committee on the Mathematical Sciences in the Year 2000. *Everybody Counts: A Report to the Nation on the Future of Mathematics Education.* National Academy Press, 1989.

Connally, Eric, et al. *Functions Modeling Change.* John Wiley & Sons, 2000.

Edwards, C. H. and Penney, D.E. *Calculus with Analytic Geometry.* Prentice Hall, 1998.

Hughes-Hallet, Deborah, et al. *Applied Calculus.* John Wiley & Sons, 2009.

Stewart, James, et al. *Precalculus: Mathematics for Calculus.* Prentice-Hall, 2011.

2. Summary of the proposed revisions

1. Objectives – the course objectives were revised from the original syllabus of record and aligned with the Expected Undergraduate Student Learning Outcomes (EUSLO) and Common Learning Objectives found in the criteria for a mathematics course.

2. Common Learning Objectives for a mathematics course are met in the content portion of the course (not necessarily a specific revision but it should be noted that the objectives for the new curriculum have been met). These objectives are:

- understand deductive reasoning and apply it in the problem-solving process.
- apply appropriate techniques to solve a variety of problems.
- interpret, understand, and apply mathematical formulas appropriate to the course.
- interpret, analyze, and use numerical data and graphs.
- develop simple mathematical models to solve problems.

3. Updated the required textbook to reflect the textbook currently being used in the course.

4. Objective 5 from the old syllabus of record was removed, as it was determined to be vague and not measurable. The idea behind this objective is already covered by Objectives 1 – 4.

3. Justification/Rationale for the revision

The course is a currently approved Liberal Studies mathematics course and is being revised to meet the new curriculum criteria for this category.

4. Old Syllabus of record

I. Catalog Description

MATH 110 Elementary Functions — 3 credits, 3 lecture hours (3c-0l-3sh)

Prerequisite: MATH 100 or appropriate Placement Test score or permission of the Mathematics Department Chairperson.

Note: Students may not take MATH 110 after successfully completing a calculus course without the written approval of the Mathematics Department Chairperson.

Prepares mathematics and science students for the study of calculus. Topics include detailed study of polynomial, exponential, logarithmic, and trigonometric functions.

II. Course Objectives

1. Students will understand and take advantage of pattern recognition in the study of mathematics.
2. Students will make a careful study of functions and their application to science.
3. Students will understand how to interpret functions expressed analytically and graphically.
4. Students will be able to calculate the rate of change of a function and interpret its meaning

5. Students will leave the course with a solid set of skills and a conceptual framework to equip the students for the future study of calculus and science.

III. Course Outline

A. Fundamentals (3 hours)
   5. Inequalities (includes nonlinear inequalities)
   6. Coordinate Geometry
   7. Graphing Calculators and Computers
   8. Lines

B. Functions (8 hours)
   6. What is a Function?
   7. Graphs of Functions
   8. Applied Functions
   9. Transformations of Functions
   10. Extreme Values of Functions
   11. Combining Functions
   12. One to One Functions and Their Inverses

C. Polynomials and Rational Functions (5 hours)
   13. Polynomial Functions and Their Graphs
   14. Real Zeros of Polynomials
   15. Remainder and Factor Theorems, and Upper and Lower Bound Theorem only
   16. Rational Functions
   Note : Oblique asymptotes are optional

D. Exponential and Logarithmic Functions (8 hours)
   17. Exponential Functions
   18. The Natural Exponential Function
   19. Logarithmic Functions
   20. Laws of Logarithms
   21. Exponential and Logarithmic Equations
   22. Applications of Exponential/Logarithmic Functions

E. Trigonometric Functions of Real Numbers (5 hours)
   23. The Unit Circle
   24. Trigonometric Functions of Real Numbers
   25. Trigonometric Graphs
   26. More Trigonometric Graphs (Optional)

F. Trigonometric Functions of Angles (4 hours)
   27. Angle Measure
   28. Trigonometry of Right Angles
   29. Trigonometric Functions of Angles
   30. The Law of Sines (Optional)

31. The Law of Cosines (Optional)

G. Analytic Trigonometry (5 hours)
   6. Trigonometric Identities
   7. Addition and Subtraction Formulas
   8. Double-Angle, Half-Angle and Product-Sum Formulas
   9. Inverse Trigonometric Functions
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The final grade for the course will be determined as follows:

50% Tests. Tests will include problems on basic competency and critical thinking.
20% Final Examination. The final examination will be comprehensive and cover both basic competency and critical thinking.
30% Homework, Quizzes, and Projects. These will cover textbook assignments and applications to business and economics.
Grades will be assigned as follows:

A: 90%-100%
B: 80%-89%
C: 70%-79%
D: 60-69%
F: 0%-59%

V. Required Textbook

Stewart, James, Lothar Redlin, and Saleem Watson. Precalulus: Mathematics for Calculus. Upper Saddle River, NJ: Prentice-Hall, Inc., 2002.

VI. Special Resource Requirements

Some instructors may require students to purchase a graphing calculator.

VII. Bibliography

Committee on the Mathematical Sciences in the Year 2000. Everybody Counts: A Report to the Nation on the Future of Mathematics Education. Washington, DC : National Academy Press, 1989.

Connally, Eric, et al. Functions Modeling Change. New York: John Wiley & Sons, Inc., 2000.

Edwards, C. Henry and David E. Penney. Calculus with Analytic Geometry. Upper Saddle River, NJ: Prentice Hall, 1998.

Hughes-Hallet, Deborah, et al. Applied Calculus. New York: John Wiley & Sons, Inc., 1999.

5. Assignment instructions for one major course assignment and a grading rubric for that assignment

Major assignments for this course consist of chapter tests and final exams. Although the tests and exams cover the same content from the same chapters, instructors for each section determine their test structures and grading criteria on an individual basis.

6. Answers to Liberal Studies Questions

A. This will be a multiple-section course. There will be a common syllabus that should be covered by each of the instructors. The Mathematics Department Service Courses Committee typically meets each year to discuss the textbook for the following year. Throughout the semester instructors typically meet to compare their pace in the course, check what students are finding difficult, and compare tests.

B. Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to the development of the mathematics involved by women and minorities. These discussions, for instance, can be based on content from the supplemental readings. Also, instructors will be sensitive to gender and ethnic balancing with respect to language in problem construction on homework, quizzes, and tests. The construction of contextual problems will be used to facilitate learning by making the material culturally relevant.

C. In this course we would like to exercise the exception to the use of a work of fiction or non-fiction. The concentration is on developing the foundation of calculus; we will work on quantitative skills.

D. This course is an introductory course, but for a specific audience: mathematics and science students. It does not differ from what is provided to beginning mathematics majors. Knowledge of elementary functions is a core prerequisite for both mathematics and science, and students in these majors benefit from a shared core course. Mathematics majors benefit by understanding the science applications inherent in the course. Science students get an appreciation for mathematics as the language of science. The scientific method is the process by which scientists, collectively and over time, endeavor to construct an accurate, reliable, consistent and non-arbitrary representation of the world. Mathematics is a tool to write, analyze, and convey these representations.

MATH 110-001
Quiz 1

Name: KEY Score: _____ / 25 Points

1. (_____ / **25 points**) Consider the nonlinear inequality

$$(x+5)^2(x-2)(x-7) \geq 0.$$

a. (5 points) Determine the solution of the equation $(x+5)^2(x-2)(x-7) = 0$

It must be that $x+5=0$, $x-2=0$, or $x-7=0$. (3 pts.)
So, the solution set is $\{-5, 2, 7\}$. (2 pts.)

b. (15 points) Use the result of part (a) to partition the real number line into appropriate subintervals. Select and test suitable representatives and test the endpoints.

(7 pts.) subinterval	(1 pt. each) test value	(1 pt. each) $(x+5)^2(x-2)(x-7)$
$(-\infty, -5)$	-6	$+$
$(-5, 2)$	0	$+$
$(2, 7)$	3	$-$
$(7, \infty)$	8	$+$

From part (a), $(x+5)^2(x-2)(x-7)=0$ at the noninfinite endpoints.

c. (5 points) Express the solution of the original inequality using interval notation.

$(-\infty, 2] \cup [7, \infty)$

(1 pt. each for inclusion/exclusion of endpoints)
(1 pt. for union)

(correctness of answer based on student answers to parts (a) and (b))