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Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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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
 Course Prefix Change
 Course Deletion
 Course Revision
 Course Number and/or Title Change
 Catalog Description Change

Current course prefix, number and full title: MATH 101 Foundations of Math

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)

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	Anne Kopas	4/20/12
College Dean	Dean [Signature]	4/20/12
Director of Liberal Studies (as needed)	[Signature]	5/7/13
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs	Gail Sechrist	5/7/13

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 MAY 3 2013 APR 22 2012
 Liberal Studies Liberal Studies

Part II: Description of Curriculum Change

1. New Syllabus of Record

I. Catalog Description

MATH 101 Foundations of Mathematics

3c-01-3cr

Prerequisite: none

Introduces logic and a mathematical way of analyzing problems, develops an appreciation for the nature, breadth, and power of mathematics and its role in a technological society, and introduces useful mathematics or mathematics related to student interests. Possible topics include logic, problem solving, number theory, linear programming, probability, statistics, intuitive calculus, introduction to computers, mathematics of finance, game theory.

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

The student will:

Objective 1:

Use mathematics, inductive and deductive reasoning, and logic to solve real-world problems.

Expected Student Learning Outcomes 1 and 2:

Informed and Empowered Learners

Rationale:

Assignments will require students to solve problems in a logical manner. Students will solve useful real-world problems such as computing area, perimeter, and volume; recognition of patterns; and using prime factorizations.

Objective 2:

Apply techniques from a variety of diverse mathematical fields to solve problems.

Expected Student Learning Outcome 1 and 2:

Informed and Empowered Learners

Rationale:

Students will see that there is much more to mathematics than adding and multiplying numbers. They will be introduced to diverse topics such as non-Euclidean geometry, topology, infinity, valid logical arguments, and modern unsolved problems.

Objective 3:

Use mathematics as a tool to solve problems, a language to communicate ideas, and an art form to express the beauty in nature.

Expected Student Learning Outcome 1 and 2:

Informed and Empowered Learners

Rationale:

Students will learn to use mathematics as an aid to solve problems. Students will learn to accurately and precisely describe sets, statements, arguments, hypotheses, and ideas in the language of mathematics. Students will also appreciate how elegance in a proof is similar to beauty in a work of art.

Objective 4:

Apply mathematical concepts in the area of science, economics, computer technology, and modern society.

Expected Student Learning Outcomes 1 and 2

Informed and Empowered Learners

Rationale:

Through assignments, stories, videos, and class discussions, students will see why math is essential to science, how logic and binary numbers are essential in computer programming, and how mathematics is essential to the functioning of our technological society.

III. Detailed Course Outline

- A. Problem Solving Strategies (3 hours)
 - 1. Inductive/Deductive reasoning
 - 2. Number patterns
 - 3. Solving mathematical puzzles

- B. Sets (6 hours)
 - 1. Basic concepts
 - 2. Sets of numbers
 - 3. Venn diagrams
 - 4. Operations on sets
 - 5. Infinity

- C. Logic (8 hours)
 - 1. Statements and quantifiers
 - 2. Truth tables
 - 3. Analyzing arguments

- D. Geometry (11 hours)
 - 1. Basic terms and concepts
 - 2. Angles
 - 3. Polygons
 - 4. Perimeter, area
 - 5. Polyhedrons, volume, surface area
 - 6. Transformations
 - 7. Non-Euclidean geometry
 - 8. Topology

- E. Numeration (3 hours)
 - 1. Roman numerals

2. Binary numbers
3. Other number systems

F. Number Theory

(6 hours)

1. Divisibility rules
2. Factors
3. Prime numbers
4. Prime factorization
5. Goldbach's Conjecture
6. Fermat's Last Theorem
7. Diophantine equations

This syllabus covers 37 hours, leaving 5 hours for testing and/or review.

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

IV. Evaluation Methods

- 30% Three Test (10% for each test) – Test will be given during the regular semester
- 20% Final Examination. The final examination will be comprehensive and cover both basic competency and critical thinking.
- 50% Homework, Quizzes, and Projects. These will cover textbook assignments and applications.

V. Grading Scale

Grades will be assigned as follows:

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

VI. Undergraduate Course 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 Textbook, Supplemental Books and Readings

Sobecki, Bluman, Matthews. *Math in our World*, Second Edition, McGraw-Hill, 2011.

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

Green, J., *How Many Women Mathematicians Can You Name?*, Math Horizons, Vol. 9, No. 2, p. 9, 2001

VIII. Special Resource Requirements

Some instructors may require students to purchase a graphing calculator.

IX. Bibliography

Angel, Porter. *A Survey of Mathematics, with Applications*, 6th ed. New York: Addison Wesley, 2001.

Garfunkel, Solomon, et al. *For All Practical Purposes*, 2nd ed. New York: Freeman and company, 1988.

Miller, Charles, et al. *Mathematical Ideas*, 11th ed. New York: Addison Wesley, 2008.

Smith, Karl. *Math for Liberal Arts*, 1st ed., New York: Brooks/Cole, 2010.

Smith, Karl. *The Nature of Mathematics*, 12th ed., New York: Brooks/Cole, 2011.

2. Summary of the proposed revisions

1. Objectives – course objectives were added. There were no objectives in the original syllabus of record.
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 inductive/deductive reasoning and logic – apply them in the problem-solving process.
 - apply appropriate techniques and critical-thinking skills to solve a variety of problems.
 - interpret, understand, and apply mathematical formulas appropriate to the course.
 - interpret, analyze, and use numerical data.
 - develop simple mathematical models to solve problems.
3. Updated the required textbook to reflect the textbook currently being used in the course.

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 101 Foundations of Mathematics

**3 credits
3 lecture hours
(3c-0l-3sh)**

Prerequisite: none

Introduces logic and a mathematical way of analyzing problems, develops an appreciation for the nature, breadth, and power of mathematics and its role in a technological society, and introduces useful mathematics or mathematics related to student interests. Possible topics include logic, problem solving, number theory, linear programming, probability, statistics, intuitive calculus, introduction to computers, mathematics of finance, game theory.

II. Course Objectives

none

III. Course Outline

A. Problem Solving Strategies

- 1. George Polya**
- 2. Number patterns**
- 3. Fibonacci Sequence**

B. Sets

- 1. Basic concepts**
- 2. Venn diagrams and subsets**
- 3. Operations on sets**
- 4. Surveys**

C. Logic

- 1. Statements and quantifiers**
- 2. Analyzing arguments**

D. Numeration

- 1. Conversion between number bases**
- 2. Arithmetic in other bases**

E. Number Theory and the Real Number System

1. Primes, composites, factors, and multiples
 2. Ordering, operations, and properties
 3. Rational and irrational numbers
 4. Applications of decimals and percents
 5. Scientific Notation
 6. Ratio and proportion
- F. Geometry and Measurement
1. Conversions within customary and metric systems
 2. Angle measure
 3. Shapes and their properties, special triangles
 4. Perimeter, circumference, and area
 5. Similarity, Pythagorean Theorem
 6. Volume
- G. Probability
1. Basic definitions
 2. "and", "or"
 3. Conditional probability
 4. Expected Value
 5. Odds
- H. Statistics
1. Frequency distributions
 2. Bar, line, circle graphs; stem and leaf plot
 3. Choosing an appropriate graph; dishonest graphs
 4. Measures of Central Tendency
 5. Measures of Dispersion
 6. Measures of Position
 7. Normal Curve
 8. Scatter plot, correlation, regression

This syllabus covers 37 hours, leaving 5 hours for testing and/or review.

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.

Grades will be assigned as follows:

- A: 90%-100%
- B: 80%-89%

C: 70%-79%

D: 60-69%

F: 0%-59%

V. Required Textbook

Miller, Heeren, Hornsby. *Mathematical Ideas*, 9th ed.
New York: Addison Wesley, 2001.

VI. Special Resource Requirements

Some instructors may require students to purchase a graphing calculator.

VII. Bibliography

none

5. Assignment instructions for one of the major course assignments and a grading rubric or grading criteria for that assignment

Major assignments for this course consist of chapter tests and final exam. Although the tests and exam 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 the four questions listed in the Liberal Studies Course Approval General Information

- A. This course will be taught by multiple instructors. The Mathematics Department's Service Course Curriculum Committee selects the textbook and develops the learning objectives. Each instructor is expected to teach the same content from the textbook (or a comparable textbook) and have the same learning objectives.
- B. Whenever appropriate, instructors will introduce into the classroom discussion the contributions in mathematics 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. For this course Mathematics Department would like to exercise the exception to the use of a work of fiction or non-fiction. In this mathematics course, students will develop higher level quantitative skills with advanced perspectives.
- D. This course is not a part of any mathematics degree program. The course is an introductory course intended for a general student audience. Rather than developing students' algebra and calculus concepts, instructors will have ample opportunities to provide students a panorama view of mathematics. In short, the course introduces the discipline to students.

Name: SOLUTIONS

Math 101 - Exam 2
Spring 2012

Score: _____/100

- Make sure that your phone is OFF and PUT AWAY. You may use a calculator that has been approved by the instructor.
- Answer each question in the space provided, and clearly mark the answer you want to be graded. Each of the 10 problems is worth 10 points. Partial credit is possible, if work is shown and/or explained clearly.
- Addition and multiplication tables for bases 2, 8, and 16 are provided. You can detach them if you want, but please return them with the exam when you are done.

1. Convert 577 to base 6.

$$\begin{array}{r} 96 \\ 6 \overline{) 577} \\ \underline{-54} \\ 37 \\ \underline{-36} \\ 1 \end{array}$$

$$\begin{array}{r} 16 \\ 6 \overline{) 96} \\ \underline{-6} \\ 36 \\ \underline{-36} \\ 0 \end{array}$$

$$\begin{array}{r} 2 \\ 6 \overline{) 16} \\ \underline{-12} \\ 4 \end{array}$$

$$\begin{array}{r} 0 \\ 6 \overline{) 2} \\ \underline{-0} \\ 2 \end{array}$$

2 pts - division by 6
 2 pts - use quotients
 2 pts - do last division
 2 pts - correct remainders
 2 pts - answer

read remainders backwards

2401_{six}

2. Convert 1234_{seven} to decimal.

In base 7, the place values are: $\frac{(343)}{7^3}$ $\frac{(49)}{7^2}$ $\frac{(7)}{7^1}$ $\frac{(1)}{7^0}$

So, we have

$$\begin{array}{r} 4 \times 7^0 \\ 3 \times 7^1 \\ 2 \times 7^2 \\ + 1 \times 7^3 \\ \hline \end{array} = \begin{array}{r} 4 \times 1 \\ 3 \times 7 \\ 2 \times 49 \\ + 1 \times 343 \\ \hline \end{array} = \begin{array}{r} 4 \\ 21 \\ 98 \\ + 343 \\ \hline 466 \end{array}$$

466

2 pts - powers of 7
 2 pts - correct placement
 2 pts - value of each
 2 pts - correct amount of each
 2 pts - answer

3. Convert C4AB_{sixteen} to binary.

remember that C=12, A=10, and B=11.

Write a 4-digit binary representation for each

of the hexadecimal digits, using $\frac{\text{eights}}{2^3}$ $\frac{\text{fours}}{2^2}$ $\frac{\text{twos}}{2^1}$ $\frac{\text{ones}}{2^0}$

C	4	A	B
↓	↓	↓	↓
(12)	4	(10)	(11)
↓	↓	↓	↓
1100	0100	1010	1011

1100010010101011_{two}

2 pts - value of A, B, C
 2 pts - 4 digit blocks
 2 pts - place values
 2 pts - conversion to each quadruple
 2 pts - answer

4. Convert 10011110101011_{two} to octal.

Split the binary number into groups of 3, starting from the right:

10 011 110 101 011

Now, write down the base 10 value for each triple,

Using $\frac{\text{fours}}{2^2} \frac{\text{twos}}{2^1} \frac{\text{ones}}{2^0}$:

23653_{eight}

2 pts - groups of 3
2 pts - correct place values
1 pt. each - conversion of triples
1 pt. - answer

5. Perform the addition $1001 + 111$ in base two.

$$\begin{array}{r} 1001 \\ + 111 \\ \hline 10000 \end{array}$$

remember, $1+1=10$ in base 2

2 pts for each column,
2 pts. for " $1+1=10$ "

6. Perform the multiplication $3AD \times 5B$ in hexadecimal.

$$\begin{array}{r} \begin{array}{c} 3 \\ 7 \end{array} \begin{array}{c} 4 \\ 8 \end{array} \\ 3AD \\ \times 5B \\ \hline 286F \\ + 1261 \\ \hline 14E7F \end{array}$$

$$B \times D = 8F$$

$$(B \times A) + 8 = 6E + 8 = 76$$

$$(B \times 3) + 7 = 21 + 7 = 28$$

$$5 \times D = 41$$

$$(5 \times A) + 4 = 32 + 4 = 36$$

$$(5 \times 3) + 3 = E + 3 = 12$$

1 pt each multiplication
1 pt each column addition

7. Perform the subtraction $612 - 531$ in base 8.

$$\begin{array}{r} 11 \\ 5\cancel{6}2 \\ -531 \\ \hline 61 \end{array}$$

$$11 - 3 = 6 \text{ in base 8}$$

2 pts. each column
2 pts. borrow correctly
2 pts. answer

8. The UPC code for a 40 oz. jar of *Jif* peanut butter starts with 0-51500-24090. What is the correct check digit?

add the odd position digits, and multiply by 3:

$$3(0+1+0+2+0+0) = 3(3) = 9$$

add the even position digits:

$$5+5+0+4+9 = 23$$

Now $23+9=32$, and the next multiple of 10 requires us to add the correct check digit,

8

9. The ISBN for the Dr. Seuss book *The Cat in the Hat* starts with 0-3948-0001. What is the correct check digit?

multiply each number by its position:

$$\begin{array}{r} 1 \times 0 = 0 \\ 2 \times 3 = 6 \\ 3 \times 9 = 27 \\ 4 \times 4 = 16 \\ 5 \times 8 = 40 \\ 6 \times 0 = 0 \\ 7 \times 0 = 0 \\ 8 \times 0 = 0 \\ + \quad 9 \times 1 = 9 \end{array}$$

98

7 pts. method
3 pts. determine digit

Now, what's the remainder when we divide by 11?

10

But this has 2 digits, so we use

X

6 pts. correct division
4 pts. answer/interpretation

10. Find the smallest nonnegative integer congruent to each of the following:

(a) $412 \pmod{5}$

$$412 \div 5 \text{ has remainder } \boxed{2}$$

(b) $5667 \pmod{5667}$

$$5667 \div 5667 \text{ has remainder } \boxed{0}$$

(c) $-123 \pmod{7}$

$$123 \div 7 \text{ has remainder } 4.$$

Because it's a negative number, we need to count 4 counterclockwise:

