WINONA STATE UNIVERSITY
GENERAL EDUCATION PROGRAM APPROVAL FORM

Routing form for General Education Program Course approval. Course MATH 117

Department Approval

[signature] 2/12/14 bdeppa@winona.edu

Department Chair Date e-mail address

Dean's Recommendation ✓ Yes ____ No*

Charla S Muntzahn 2/12/14

Dean of College Date

*If the dean does not approve the proposal, a written rationale should be provided to the General Education Program Subcommittee.

GEPS Recommendation ____ Approved ____ Disapproved

Chair, General Education Program Subcommittee Date

A2C2 Recommendation ____ Approved ____ Disapproved

Chair of A2C2 Date

Faculty Senate Recommendation ____ Approved ____ Disapproved

President of Faculty Senate Date

Academic Vice President Recommendation ____ Approved ____ Disapproved

Academic Vice President Date

Decision of President ____ Approved ____ Disapproved

President Date

Please forward to Registrar.

Registrar ____ Please notify department chair via e-mail that curricular change has been recorded.
Date entered

[Revised 10-22-12]

S 2/13/14

WINONA STATE UNIVERSITY
PROPOSAL FOR GENERAL EDUCATION PROGRAM COURSES

Department Mathematics and Statistics Date 1/24/14

MATH 117 | Precalculus with Modeling | 4
Course No. | Course Name | Credits

Prerequisites Qualifying math placement score, or MATH 050

GEP Goal Area(s):*

CORE GOAL AREAS
- [ ] Goal 1: Communication
- [ ] Goal 3: Natural Science
- [x] Goal 4: Mathematics/Logical Reasoning
- [ ] Goal 5: History and the Social and Behavioral Sciences
- [ ] Goal 6: The Humanities and Fine Arts

THEME GOAL AREAS
- [ ] Goal 7: Human Diversity
- [ ] Goal 8: Global Perspective
- [ ] Goal 9: Ethical and Civic Responsibility
- [ ] Goal 10: People and the Environment

* Courses may be submitted for up to two Goal Areas.

Additional Requirement Categories (list number of credits desired in appropriate category):

- [ ] Intensive:
  - [ ] 1. Writing
  - [ ] 2. Oral Communication
  - [ ] 3a. Mathematics/Statistics
  - [ ] 3b. Critical Analysis
- [ ] Physical Development and Wellness

Provide information as specified in the previous directions.

Attach a ***General Education Program Approval Form***.

Department Contact Person for this Proposal:

Jeff Draskoci-Johnson | 457-9372 | jdraskociiohnson@winona.e
Name (please print) | Phone | e-mail address

[Revised 9-6-11]

MATH 117 – Precalculus with Modeling
Proposal for GEP Program -- Goal 4

Course Description:

Credits: 4
Prerequisites: Qualifying score on the mathematics placement exam, or MATH 050
Grading method: Grade and P/NC option

A precalculus course with primary emphasis on introductory mathematical modeling. Topics include modeling using linear and polynomial functions, exponential growth and decay scenarios, logarithmic relationships, sinusoidal functions, and difference equations. In addition, the course includes analysis of these modeling methods. Applications will include population, and physiological models. Meets GOAL 4. Prerequisite: Qualifying score on the math placement exam, or MATH 050

Course Outline

A. Introduction to Modeling

1. Empirical vs. theoretical models
2. Goals, assumptions, and limitations of models
3. Unit analysis

B. Review Topics

1. Natural numbers, whole numbers, integers, rational numbers, irrational numbers
2. Formal rules of algebra, exponents, radicals, polynomials, factoring,
3. Inequalities, absolute value

C. Functions

1. The idea of a function
2. One-to-one functions and their inverses
3. Transformations of functions, combining functions, composition of functions

D. Polynomial and rational functions

1. Basic properties of linear, polynomial, and rational functions
2. Modeling with polynomial functions

E. Validating models

A. Dealing with measurement error
B. Accept, improve, or reject a model?

F. Exponential and logarithmic Functions

1. Basic properties of exponential and logarithmic functions
2. Modeling with exponential and logarithmic functions

G. Trigonometric Functions

1. Unit circle, angle measure, radian measure
2. Trig functions of real numbers, trig functions of angle measure
3. Graphs of all trig functions with transformations of amplitude, phase shift, vertical shift, and time period
4. Modeling with trigonometric functions

H. More Advanced Modeling

1. Modeling with difference equations
2. Modeling with differential equations using Euler's Method
3. Modeling with discrete-time Markov chains
4. Modeling dynamical systems

Distribution of Time in the Course: A substantial portion of time will be spent on, and a significant part of the student's final grade will depend on, modeling important real-world phenomena. Students will be required to solve realistic problems using technology.

Method of Instruction: Lecture-presentation, discussion, question-answer sessions, use of calculators/computers, group work.

Evaluation Procedure: Homework, quizzes, projects, midterm exams, and a final exam.

Possible Textbooks

Functions Modeling Change, current edition by Deborah Hughes-Hallett, *et al.*

Contemporary Precalculus through Applications: Functions, Data Analysis, and Matrices, current edition, by Gloria B. Barrett *et al.*

Functioning in the Real World: A Precalculus Experience, current edition, by Sheldon P. Gordon *et al.*

Precalculus: A View of the World around Us, current edition, by David Wells and Lynn Tilson

Additional Resources

Biomath: Problem Solving for Biology Students, current edition, by Robert W. Keck and Richard R. Patterson

Earth Algebra: College Algebra with Applications to Environmental Issues, current edition, by Christopher Schaufele, *et al.*

Rationale for GEP Goal Area 4:

Mathematical models are increasingly being used in a wide variety of fields. Currently at WSU, a student must work through at least four MATH courses to take a course on modeling, even though many models can be understood, and used intelligently, with much less preparation. This course will introduce students to the unique perspective given by

mathematical models, with only minimal prerequisites, and give them practice using such models to reason about important issues in the real world.

How Student Competencies will be Developed by Learning Activities in MATH 117

Goal 4 Competencies: Students will be able to…	Learning Opportunity	Assessment and Evaluation
Illustrate historical and contemporary applications of mathematical/logical systems	• Ever since, in Pope's words, "God said, Let Newton be! and there was light", mathematical models have had the most profound impact on history. They have helped us conquer disease, and have taken us to the moon, uniquely among all civilizations. It would be impossible NOT to illustrate profound applications of modeling techniques in a modeling course.	Students will be required to create and modify simple mathematical models for important phenomena; necessarily they will, in Newton's words, "Stand upon the shoulders of giants," and they will be graded on their efforts.
Clearly express mathematical/logical ideas in writing	• The distinction between pure math and mathematical modeling is precisely that models are supposed to represent and explain something. Correctly interpreting what a model does, and does not, say will be a major emphasis in the course.	As part of the assessments on modeling, students will be graded on how well they explain their model, including the underlying assumptions, and the limitations of the model.
Explain what constitutes a valid mathematical/logical argument (proof);	• The proofs behind even the simplest mathematical models are well beyond the level of this class. However, students will be taught how to give a solid argument that a given model is, or is not, a useful representation of reality.	Students will be required to create, modify, and compare models; they will also be required to give a solid logical argument justifying the choices they made, and the structure they derived.
Apply higher-order problem-solving and/or modeling strategies	• To create or modify a model, students must necessarily abstract the mathematical essence of a phenomenon. To critique or validate that model, they must make predictions and test those against data. This is all high-order problem solving.	Students will be assessed here concurrently with being assessed in the other three areas.