Minnesota State University, Mankato
Curriculum Proposal

Please type or select the requested information. Print completed forms, add appropriate paper attachments, and route through MSU's curricular process for recommendations and decisions.

(Check all that apply):

College: Science, Engineering and Technology
Department: Mathematics and Statistics
Program: Mathematics
CIP #

Type of Change: COURSE PROPOSALS
Proposed: Change in Credits and Title

Title Current: Finite Mathematics and its Applications
Title Proposed: Finite Mathematics and Introductory Calculus

24-Char. Abbrev: Finite Math & Intro Calc

Include a course or program description for the Bulletin (30-40 words maximum for courses, 100 for programs):

This course develops concepts and skills in algebra and introductory calculus needed to model applications in business, economics, social sciences and life sciences, using polynomials, exponentials, logarithms, linear systems, linear programming, sequences, series, derivatives and integrals.

Rationale or Justification for change:
The College of Business has requested this updated course to be used as the required course in their programs instead of Math 112. In the past years Math 130 has not been offered due to insufficient enrollment. With students majoring in the College of Business required to take this course, there will be significant demand for it. The Department of Mathematics and Statistics is committed to offering a course designed to meet the needs of the College of Business.

***For General Education or Cultural Diversity Courses Only***

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<tr>
<th>GE Category #</th>
<th>GE Category Name (Maximum of 3 Categories)</th>
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<td>4</td>
<td>Mathematical/Logical Reasoning</td>
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For Writing Intensive Courses, attach a description of the kind and quantity of writing.
For Upper Division Courses, include a description of the respects in which it is broad and general rather than narrow and specific, and so suitable as GE.

Attach paper copies of the following:

a. Syllabus or course outline.
b. Course's student learning outcomes associated with each GE competency or CD designation.
c. List of strategies to be used to assess students' achievement of each GE competency or CD designation.

***For New Courses***

(Check all that apply):

Instructional Type: Lecture/Lab

Course will be offered:

Grading Format: Grade

Other courses are being changed or eliminated. (Explain.)

Course content or title is similar to courses in other departments. (Attach copy of letter of agreement with other program(s) contacted. Indicate the nature of the discussions and/or resolution of differences or potential conflicts.)

Attach paper copies of the following:

a. Syllabus or course outline.
b. Course's student learning outcomes.
c. A list of resources required to offer and support this course.
d. A description of how teaching this course will affect department staffing.
e. If 400/500 level course, an explanation of added expectations of graduate students.
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<tr>
<th>Committee</th>
<th>Recommended</th>
<th>Not Recommended</th>
<th>Name</th>
<th>Date</th>
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<tr>
<td>Department Chair</td>
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<td>Ernest Boyd</td>
<td>16 Oct 07</td>
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<tr>
<td>College Curriculum Committee</td>
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<td>Nov 9, 2007</td>
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<td>College Dean</td>
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<td>General Education Subcommittee</td>
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<td>Ronald A. Nelson</td>
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<td>Undergraduate Curriculum and Academic Policy Committee</td>
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<td>Academic Affairs Council</td>
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<td>Senior Vice President and Vice President for Academic Affairs</td>
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November 7, 2007

To Whom It May Concern:

The College of Business Curriculum Committee has voted to replace MATH 112 College Algebra with MATH 130 Finite Mathematics and Introductory Calculus as a required course for all College of Business students. All departments in the College of Business have approved this request.

Sincerely,

[Signature]

Ann Kuzma
Chairperson
College of Business Curriculum Committee
New Syllabus
Math 130 – Finite Mathematics and Introductory Calculus
4 Credits – 3 lectures and 1 computer lab using Excel each week

Prerequisite

Knowledge of college algebra including exponentials and logarithms.
Satisfy one of the following three conditions:
(1) Pass Math 112 or 115 with grade of C or better;
(2) Score 20 or better on the ACT Math Subscore, or
(3) Score 8 or better on the Functions and Graphs Placement Test (algebra functions)

Catalogue Description

This course develops concepts and skills in algebra and introductory calculus needed to model applications in business, economics, social sciences and life sciences, using polynomials, exponentials, logarithms, linear systems, linear programming, sequences, series, derivatives and integrals.

Textbook

Mathematics Alive and Applied for Business, Economics, and Life by Sherman Chottiner,

Content

The course will use technology to model problems with functions (polynomial, exponential and logarithmic), systems of linear equations, linear programming, summation formulae for fundamental sequences in calculating present and future values, derivatives for marginal rates of change and integrals for continuous income streams with finite time horizons and discounted payoffs

Introduction (1 day)

Sequences and series with mathematics of finance
(8 days, Chapters 3 & 4)
Arithmetic and geometric sequences
Summation formulae for fundamental sequences
Intuition on convergence of sequences and series
Computer Lab #1: Plotting graphs and calculating sums using Excel
Mathematics for simple and compound interest
Mathematics for future value of increasing annuities
Mathematics for present value of decreasing annuities for amortization of loans
Computer Lab #2: Calculating with formulae in Excel
Linear Functions and Equations
(4 days, Chapter Sections 6.1-6.3 & 7.1-7.3)
Understanding slope and intercept
Applications using linear models to extrapolate data
Computer Lab #3: Plot lines and find regression lines for scatter plots of data in Excel

Review and Test (2 days)

Polynomial Functions
(4 days, Chapter Sections 6.4-6.5 & 7.7)
Understanding quadratic functions for vertex and concavity via completing the square
Factoring polynomial functions with increasing, decreasing, concave up, and concave down
Applications using quadratic functions for maxima and minima
Computer Lab #4: Plot polynomials and fitting data with polynomials for scatter plots in Excel

Exponential and Logarithmic Functions
(8 days, Chapter Sections 6.6-6.6.12 & 7.4-7.5)
Algebra of exponents and logarithms
Computer Lab #5: Plot exponential and logarithmic functions in Excel plus semi-log and log-log scales
Applications for exponential growth, decay and discounting
Computer Lab #6: Fitting data with power functions or exponential functions for scatter plots in Excel via linear regression on semi-log and log-log plots

Linear Systems
(8 days, Chapters 8-11 omit Cramer’s Rule and matrix inverse)
Systems of two linear equations in two variables by elimination and substitution
Finding the solution set to linear inequalities in two variables
Matrix algebra for 2D and 3D with Gaussian elimination
Leontief Input-Output models
Computer Lab #7: Plot 2D feasible sets in Excel
Solve 2D and 3D linear programming problems via simplex algorithm
Computer Lab #8: Solve linear programming problems with Excel Solver

Review and Test (2 days)

Differential Calculus
(12 days, Chapters 12-15 omit Sections 13.12-13.13, 14.6-14.8, 15.8-15.12)
Concept of rate of change in terms of average rate versus instantaneous rate
Concept of marginal rates
Definition of derivative as limit of difference quotient
Computer Lab #9: Calculating difference quotients and graphing them as Δx → 0
Derivatives of polynomial functions
Basic rules of differentiation
Derivatives of power functions, exponential functions and logarithmic functions
Applications for finding maxima and minima
Computer Lab #10: Solving applications in optimization using Excel

Integral Calculus
(8 days, Chapters 16 & 17)
Concept of antiderivative
Concept of cumulative sums over functions with finite time horizons and discounted payoffs
Definition of integral as limit of Riemann sums
Computer Lab #11: Calculating Riemann sums and graphing them as $\Delta x \to 0$
Basic rules of integration (polynomials, power rule and simple substitutions for exponential and logarithmic functions)
Fundamental Theorem of Calculus
Computer Lab #12: Applications of integrals for continuous income streams and consumer – producer surpluses using Excel

Review and Test (2 days)

Review for Final (1 day)

Grading

Three hour tests each counting 20% of the course grade.
Weekly computer labs and quizzes using Excel and Desire2Learn with graduate assistants providing tutorials. Total of all labs and quizzes counts 20% of the course grade.
Final exam counts 20% of the course grade.
1. Students will be able to apply higher-order problem solving skills and modeling strategies in applications taken from historical and contemporary studies in business, economics, the life sciences and the social sciences.

2. Students will gain knowledge and skill in using mathematical models for analyzing trends in economics, finance, management, marketing, population dynamics, ecosystems and social behavior.

3. Students will gain knowledge and skill in presenting written logical arguments for the validity of the mathematical model.

4. Students will be able to present a valid proof that the mathematical model satisfies the hypotheses and that the conclusion is a consequence of the model.

5. Students will be able to recognize the difference between a mathematical model based on a power function and one based on an exponential function. This includes understanding their rates of change and what assumptions lead to these rates of change.

6. Students will be able to distinguish between average rates of change and instantaneous rates of change. This includes being able to use the slope of the secant line and/or the derivative to analyze trends.

7. Students will gain knowledge and skill in using sequences, series and summation formulae to analyze the accumulative effects of different trends, life cycles and strategies.

8. Students will understand the definition of an integral as a limit of Riemann sums, and the Fundamental Theorem of Calculus.

9. Students will gain knowledge and skill in using linear programming in modeling constrained optimization along with methods for solving such problems.

10. Students will gain knowledge and skill in using derivatives and integrals in modeling unconstrained optimization along with methods to find the extrema.

**Strategies to be used to assess students’ achievement**

Weekly homework, quizzes and computer labs will be graded and used as part of the course grade. Regularly scheduled hour tests and a comprehensive final examination will be part of the course grade. All assignments will require students to present written formal proof of the validity of the argument. All assignments will require higher-order problem solving and modeling.
Math 130 – Finite Mathematics and Introductory Calculus

Resources required to offer and support this course

A large lecture classroom with level 2 multimedia technology will be needed for one hour on three days per week for each section. The computer lab component of this class will be conducted in ACC 116 with 25 students per section for one hour per week. We anticipate 4-5 lab sections for each lecture section. Requests for classrooms will follow the normal procedures. The Department of Mathematics and Statistics already has priority scheduling in ACC 116.

Departmental staffing to teach this course

One instructor and one graduate assistant will be assigned to each section of this course. The course will count as four credit hours as part of the instructor’s normal load. The instructor will handle the three lectures, the preparation of D2L materials, design of assessment tools, and coordination of the computer labs. The graduate assistant will conduct four computer labs and assist in grading the assessment tools. Since this course will be required of students majoring in the College of Business instead of Math 112, the enrollment in Math 112 will drop. Therefore, we will be able to reduce the number of sections in Math 112 and re-assign those instructors and graduate teaching assistants to Math 130.

Bulletin Copy

This course develops concepts and skills in algebra and introductory calculus needed to model applications in business, economics, social sciences and life sciences, using polynomials, exponentials, logarithms, linear systems, linear programming, sequences, series, derivatives and integrals.
Pre: Must achieve a score of 19 or better on the MnSCU Math Readiness Test, or have achieved an ACT Math subscore of 20 or higher, or have passed Math 112 with “C” or better.
Fall, Spring
GE-4
Old Syllabus
Math 130 – Finite Mathematics and its Applications
3 Credits

Prerequisite

Knowledge of college algebra including exponentials and logarithms. Satisfy one of the following three conditions:
1. Pass Math 098;
2. Score 19 or better on the ACT Math Subscore, or
3. Score 18 or better on the Math Readiness Test (algebra functions)

Catalogue Description

This course is an introduction to the mathematical concepts needed in business, the social sciences, and the life sciences including problem solving and linear models, linear algebra, linear programming, consumer mathematics, probability and statistics, and decision making.

Content

The course will solve mathematical problems using functions (polynomial, exponential and logarithmic), systems of linear equations, linear programming, summation formulae for fundamental sequences in calculating present and future values, counting methods and probabilities for independent events. The course will make use of scientific calculators.

Introduction (1 day)

Sequences and series with mathematics of finance (8 days)
- Arithmetic and geometric sequences
- Summation formulae for fundamental sequences
- Intuition on convergence of sequences and series
- Mathematics for simple and compound interest
- Mathematics for future value of increasing annuities
- Mathematics for present value of decreasing annuities for amortization of loans

Linear Functions and Equations (4 days)
- Understanding slope and intercept
- Applications using linear models to extrapolate data

Review and Test (2 days)

Polynomial Functions (4 days)
- Understanding quadratic functions for vertex and concavity via completing the square
Factoring polynomial functions with increasing, decreasing, concave up, and concave down
Applications using quadratic functions for maxima and minima

Exponential and Logarithmic Functions
(8 days)
Algebra of exponents and logarithms
Applications for exponential growth, decay and discounting
Curves of best fit

Review and Test (2 days)

Linear Systems
(8 days)
Systems of two linear equations in two variables by elimination and substitution
Finding the solution set to linear inequalities in two variables
Matrix algebra for 2D and 3D with Gaussian elimination
Leontief Input-Output models
Solve 2D and 3D linear programming problems via simplex algorithm

Counting and Probability
(5 days)
Fundamental Principle of Multiplication
Fundamental Principle of Addition
Permutations and Combinations
Definition of Probability Space
Computing probabilities for simple events

Review and Test (2 days)

Review for Final (1 day)

Grading

Three hour tests each counting 20% of the course grade.
Homework and quizzes counts 20% of the course grade.
Final exam counts 20% of the course grade.

1. Minutes of the August 23, 2007 meeting were approved.

2. Singer moved and Zuiker seconded the following Math 130 motion. Motion passed

Motion: Whereas the College of Business desires to replace its requirement of Math 112 College Algebra (4 credits) by a new course called Finite Mathematics and Introductory Calculus (4 credits) designed in cooperation with the Department of Mathematics and Statistics, we move to change the title and number of credits of Math 130 from Finite Mathematics and Its Applications (3 credits) to Finite Mathematics and Introductory Calculus (4 credits) and submit a course redesign application to the CSET Curriculum Committee.

3. Singer moved and Waters seconded the following Math 470 motion. Motion passed

Motion: Whereas few students who enroll in Math 470 Numerical Analysis I (4 credits) have a programming background, and the course is taught without requiring a programming background, we move to change the description of Math 470 to eliminate the prerequisite for a formal programming language, and submit a course description change application to the CSET Curriculum Committee.

Proposed Bulletin Description

This course provides an introduction to techniques and analysis involved with solving mathematical problems using technology. Topics include errors in computation, solutions of linear and nonlinear equations, numerical differentiation and integration, and interpolation. Pre: Math 122 and Math 247.

4. Singer moved and Herman seconded the following motion changing the prerequisite for Math113 from Math 098 to Math 112. Motion passed.

Motion: Where are currently advising students to take Math 112 before taking Math 113, and whereas the Curriculum Committee feels that Math 112 is better preparation for Math 113 than Math 098, we move to change the wording of the prerequisites for Math 113 Trigonometry (4 credits) from “or successful completion of Math 098” to “or Math 112 with “C” or better.”

5. Singer moved and Zuiker seconded the motion regarding Math 181.
6. Zuiker moved and Singer seconded an amendment to reword the motion. Amendment passed.

7. The following motion passed.

Motion: Whereas the Curriculum Committee was charged with developing a calculus course that will meet the needs of students seeking middle school licensure, we move that the Department of Mathematics and Statistics request that the registrar's office place a note in the Fall course schedule indicating that the 10 am section of Math 181 (3 credits) will admit Elementary Education Majors only.

8. Singer moved and Zuiker seconded the following motion to withdraw Math 184. Motion passed.

Motion: Whereas Math 184 Mathematical Reasoning (3 credits) is no longer offered, we move that it be withdrawn, and an application for withdrawal be submitted to the CSET Curriculum Committee.