MAT 125 Applied Business Mathematics

Department of Mathematics

Southern Connecticut State University

I. Catalog Description

Topics include exponential and logarithmic functions, systems of linear equations and matrices, linear inequalities, linear programming, Leontief models, limits, continuity, derivatives, and extrema of functions. Interest and annuities, break-even, optimization, and other business applications will be emphasized.

II. Purpose

The purpose of this course is to provide students with the skills needed for using quantitative techniques and models in problems arising in a number of fields with emphasis on business. It also will provide students with the quantitative reasoning skills needed to satisfy the mathematics general education requirement for the University Liberal Education Program.

III. Credit

(A) MAT 125 carries three semester-hours of university credit.

(B) MAT 125 fulfills the Quantitative Reasoning requirement for the Liberal Education Program

IV. Liberal Education Program

This course satisfies the University's Liberal Education Program (LEP) requirement in Quantitative Reasoning (QR). It addresses the key elements of the QR requirement as indicated in Section VIII: Course Objectives. Further, as a Tier 1 LEP course, it will do the following:

(A) Address at least one *Area of Knowledge and Experience* through the choice of data sets or word problems that are applied to business or the social sciences, *Global Awareness* (for example, data measuring poverty levels in different countries) or *Social Conflict and Consensus* (for example, application problems involving business such as break-even analysis or communication networks). Examples of data could also be chosen to introduce other *Areas of Knowledge* such as *American Experience* (for example, data measuring population changes in America). **[GA, SS, AE]**

(B) Incorporate at least one *Discussion of Values*. For example, *Rational Thought* can be emphasized by asking students to interpret and make predictions from a given mathematical

model. For example, students might be asked to interpret the meaning of the parameters in an exponential model of an annuity or they might be asked about the limitations of the model. *Civic Engagement* is another area that could be discussed by choosing to model data or applications that involve business decisions that directly affect students' local communities. **[RT, CE]**

(C) Address at least one *Embedded Competency* in a significant manner. Instructors may choose to address this requirement by incorporating one of the following requirements into their course: *Oral Communication* by requiring students to present the results of their work through oral presentations, *Interpersonal Effectiveness* by requiring students to work in group settings, *Information Literacy* by requiring students to locate and evaluate their own information and/or data for a project, or *Creative Thinking* by requiring students to create a model for a set of data or scenario in which they have not already been told what type of model is most appropriate. **[OC, IE, IL, CT]**

(D) Present the Quantitative Reasoning aspects of Finite Mathematics in context. The key elements QR1–Quantitative Situations, QR2–Quantitative Data, QR3–Methods, QR4–Reliability of Data and Solutions, and QR5–Mathematical Process are addressed in the course objectives listed below.

V. Prerequisites

The student must satisfy one of the following three prerequisites:

(A) pass MAT 112 with a grade of C- or better;

(B) pass MAT 120, 122, or 124 with a grade of C- or better;

(C) establish a placement level appropriate for the course.

VI. Format

MAT 125 meets for 3 contact hours per week throughout a standard academic semester and is conducted primarily in a lecture and discussion format. Graphing will be included and technology-assisted in this course.

VII. Quantitative Reasoning Key Elements

(A) **QR1**: Quantitative Situations - Identifying the essential quantitative elements in both routine and novel situations and understanding the relationships between those quantitative elements, and producing mathematical models appropriate for the intended analysis (e.g., writing equation(s) to represent the situation).

(B) **QR2**: Quantitative Data - Representing quantitative information in both technical and common language by using symbolic, graphical, and tabular formats, and drawing correct inferences from quantitative information through the interpretations of such representations.

(C) **QR3**: Methods - Acquiring the tools and methods necessary to resolve both routine and novel quantitative questions, including a correct sequencing of procedures, and using them appropriately, given the nature and constraints of a situation. In addition to using knowledge previously acquired in intermediate algebra, students will demonstrate proficiency with information presented in numerical or statistical form and mathematical concepts of growth and decay with their applications (e.g., linear, quadratic, exponential, etc.).

(D) **QR4**: Reliability of Data and Solutions - Correctly evaluating the level of accuracy stated or implied for given data, and assessing the correctness and accuracy of an analysis, including the assessment of the method and model used and the reasonableness of the solution.

(E) **QR5**: Mathematical Process - Using discovery (e.g., exploration and pattern-recognition), conjecture, and testing to develop mathematical formulas, theorems, and then giving persuasive mathematical arguments to establish their validity.

VIII. Course Objectives

In addition to satisfying LEP Tier 1 requirements, MAT 125 has specific course objectives. By the end of the course, a successful student should be able to do the following:

(A) Sketch the basic shape and behavior of the graphs of exponential and logarithmic functions without using a graphing calculator. Sketch basic transformations of these graphs without a calculator. (QR1, QR2, QR3)

(B) Construct and use appropriate functions to model applications. In particular, the exponential function and logarithmic functions should be used to model and solve problems involving business and finance applications. (QR1, QR2, QR3, QR4, QR5)

(C) Use systems of linear equations and matrix models to model business applications. Algebraically solve systems of two equations and use row-reduction to solve larger systems of equations. In particular, solve problems using the Leontief input-output model. (QR1, QR2, QR3, QR4, QR5)

(D) Use systems of linear inequalities to model optimization problems in business, both algebraically and geometrically. (QR1, QR2, QR3, QR4, QR5)

(E) Differentiate polynomial, exponential, and logarithmic functions and interpret the derivative in context. (QR1, QR2, QR3)

(F) Use calculus to model optimization problems in business, both algebraically and geometrically. (QR1, QR2, QR3, QR4, QR5)

IX. Outline

(A) Review of Elementary Functions. (5 %)

1. Review of function notation.
2. Review of the graphs of linear and quadratic functions.
3. Review of the graphs of basic functions (x^2, x^3, $\sqrt{x}$, $\sqrt[3]{x}$, $|x|$) with transformations of these graphs.

(B) Exponential and Logarithmic Functions. (20 %) **[QR3]**

1. The basic exponential functions (including the natural exponential function) and their graphs.
2. The basic logarithmic functions and their graphs.
3. The laws of exponents and the properties of logarithms.
4. Analytical and graphical solution of exponential and logarithmic equations.
5. Applications of exponential functions to the mathematics of finance (simple and compound interest, annuities) **[QR1, QR2, QR4, QR5]**

(C) Systems of Linear Equations; Matrices (25 %) **[QR3]**

1. Applications of linear systems to break-even analysis and market price equilibrium (supply/demand equations). **[QR1, QR2, QR4, QR5]**
2. Systems of linear equations and augmented matrices.
3. Gauss-Jordan Elimination.
4. Basic matrix operations.
5. Leontief input-output models. **[QR1, QR2, QR4, QR5]**

(D) Systems of Linear Inequalities and Linear Programming (20 %) **[QR3]**

1. Review of solving systems of linear inequalities in two variables.
2. Linear programming in two dimensions (geometric approach).
3. The Simplex Method–maximization with problem constraints of the form $\leq$. **[QR1, QR2, QR4, QR5]**
4. The Dual–minimization with problem constraints of the form $\geq$. **[QR1, QR2, QR4, QR5]**

(E) Calculus (30 %) **[QR3]**

1. Limits
2. Continuity.
3. Derivatives.

4. Rules for differentiation.
5. The second derivative.
6. Optimization. **[QR1, QR2, QR4, QR5]**

X. Assessment

Individual instructors may vary assessment modes, but typically grades will be based on a combination of homework assignments, quizzes, and exams.

	QR 1 Quantitative Situations	QR 2 Quantitative Data	QR 3 Methods	QR 4 Reliability of Data and Solutions	QR 5 Mathematical Process
Homework	Individual instructors decide which QR will be assessed appropriately.				
Quizzes	Individual instructors decide which QR will be assessed appropriately.				
Tests	✓	✓	✓	✓	✓
Final Exam	✓	✓	✓	✓	✓

XI. Recommended Texts

(A) OpenStax College, *College Algebra*, `https://openstax.org/details/books/college-algebra`

(B) Calaway, Hoffman, and Lippman, *Applied Calculus*, `http://www.opentextbookstore.com/details.php?id=14`

(C) Sekhon, *Applied Finite Mathematics*, `http://cnx.org/contents/f1cfb58e-3118-435e-b41d-0bff4ec66d25.1/Applied-Finite-Mathematics`.

XII. Waiver Policy

This course may be waived.

XIII. Bibliography

(A) OpenStax College, *College Algebra*, `https://openstax.org/details/books/college-algebra`

(B) Calaway, Hoffman, and Lippman, *Applied Calculus*, `http://www.opentextbookstore.com/details.php?id=14`

(C) Sekhon, *Applied Finite Mathematics*, http://cnx.org/contents/f1cfb58e-3118-435e-b41d-0bff4ec66d25.1/Applied-Finite-Mathematics.

(D) Barnett, Ziegler, and Byleen, *Finite Mathematics.*

(E) Goldstein, Schneider, and Siegel, *Finite Mathematics and Its Applications.*

(F) Tomastik and Epstein, *Applied Finite Mathematics.*

XIV. Preparation

Updated outline prepared by L. Brin, October 2018.

Approved by the MDCC, 2018.
Approved by the Mathematics Department, 13-0-0 2018.