

ILLINOIS VALLEY COMMUNITY COLLEGE



Course Syllabus

DIVISION: English, Mathematics, Education

Course: MTH 1006 Finite Mathematics

Date: September, 2015

Semester Hours: 4

Prerequisite(s): MTH 1003 or the equivalent with a grade of C or better.
Appropriate score on the placement exam

Delivery Method: **Lecture** **4 Credit Hours**
 Seminar **0 Credit Hours**
 Lab **0 Credit Hours**
 Clinical **0 Credit Hours**
 Online
 Blended

Offered: X **Fall** X **Spring** X **Summer**

IAI Equivalent –*Only for Transfer Courses*–go to <http://www.itransfer.org>:
M1 906

CATALOG DESCRIPTION:

This course is intended for students in business, social sciences, and other areas in which knowledge of the mathematics of probability, matrices, linear programming and their applications is used.

GENERAL EDUCATION GOALS ADDRESSED

[See the last page for Course competency/Assessment Methods Matrix.]

Upon completion of the course, the student will be able:

[Choose up to three goals that will be formally assessed in this course.]

- To apply analytical and problem solving skills to personal, social, and professional issues and situations.
- To communicate successfully, both orally and in writing, to a variety of audiences.
- To construct a critical awareness of and appreciation for diversity.
- To understand and use technology effectively and to understand its impact on the individual and society.
- To develop interpersonal capacity.
- To recognize what it means to act ethically and responsibly as an individual and as a member of society.
- To recognize what it means to develop and maintain a healthy lifestyle in terms of mind, body, and spirit.
- To connect learning to life.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals. See last page for more information.]

Upon completion of the course, the student will be able to:

1. Demonstrate knowledge of Linear Models.
2. Demonstrate knowledge of Matrices and Applications.
3. Demonstrate knowledge of Linear Programming.
4. Demonstrate knowledge of Elementary Combinatorial Analysis and Probability.
5. Demonstrate knowledge of Statistics.
6. Demonstrate knowledge of Decision Theory.
7. Demonstrate knowledge of Mathematics of Finance.

Outcome 1. Students will demonstrate knowledge of Linear Models

Competency 1.1 – Students will be able to discuss the meaning of a mathematical model.

Competency 1.2– Students will be able to differentiate between a deterministic model and a probabilistic model.

Competency 1.3– Students will be able to determine whether a given number is a natural, number, whole number, integer, rational number, or an irrational number.

Competency 1.4– Students will be able to determine linear relationships between two numbers.

Competency 1.5– Students will be able to graph linear equations in two variables.

Competency 1.6– Students will be able to find the equations of lines.

Competency 1.7– Students will be able to solve systems of linear equations by algebraic or graphic methods.

Outcome 2. Students will demonstrate knowledge of Matrices and Applications

Competency 2.1 – Students will be able to determine if a matrix is square.

Competency 2.2 – Students will be able to determine if a matrix is the zero matrix.

Competency 2.3– Students will be able to determine the elements that form the main diagonal in a square matrix.

Competency 2.4 – Students will be able to determine if two matrices are equal.

Competency 2.5 – Students will be able to find the sum, scalar product, and product of two or more matrices.

Competency 2.6 – Students will be able to solve a system of linear equations using Gaussian elimination.

Competency 2.7 – Students will be able to find the inverse of a given matrix.

Competency 2.8 – Students will be able to solve a system of linear equations using the inverse of the augmented matrix.

Competency 2.9 – Students will be able to determine whether a given matrix is a stochastic matrix.

Competency 2.10 – Students will be able to find $p(k)$ for a Markov chain determined by a given matrix.

Competency 2.11– Students will be able to determine if a vector is a probability vector.

Competency 2.12 – Students will be able to determine if a given matrix is a regular transition matrix.

Competency 2.13 – Students will be able to solve word problems involving the Markov chain process.

Competency 2.14 – Students will be able to state whether a matrix is a matrix for absorbing Markov chains.

Competency 2.15 – Students will be able to write an absorbing matrix in canonical form.

Competency 2.16 – Students will be able to compute F and Q for an absorbing matrix.

Competency 2.17 – Students will be able to solve word problems using the theory of absorbing Markov chains.

Outcome 3. Students will demonstrate knowledge of Linear Programming

Competency 3.1 – Students will be able to sketch the graph of linear inequalities.

Competency 3.2 – Students will be able to find the graphical solution of a system of linear inequalities.

Competency 3.3 – Students will be able to formulate word problems mathematically and then solve by graphing.

Competency 3.4 – Students will be able to classify a problem as a standard or a nonstandard linear programming problem.

Competency 3.5 – Students will be able to convert a given problem to a standard linear programming problem.

Competency 3.6 – Students will be able to solve a given system of equations for X and Y in terms of these variables.

Competency 3.7 – Students will be able to read the first basic solution, then perform the complete elimination process.

Competency 3.8 – Students will be able to find the pivot element in a given matrix.

Competency 3.9 – Students will be able to solve a standard linear programming problem using the simplex method.

Competency 3.10 – Students will be able to solve nonstandard linear programming problems

Competency 3.11 – Students will be able to solve the dual problem

Outcome 4. Students will demonstrate knowledge of Elementary Combinatorial Analysis and Probability

Competency 4.1 – Students will be able to determine whether a counting problem is a permutation or combination.

Competency 4.2 – Students will be able to compute $p(n,k)$ and $C(n,k)$.

Competency 4.3 – Students will be able to simplify expressions involving factorial notation.

Competency 4.4 – Students will be able to solve word problems that can be classified as permutation or combination problems.

Competency 4.5 – Students will be able to compute expressions that contain the notation.

Competency 4.6 – Students will be able to compute expressions that contain notation.

Competency 4.7 – Students will be able to write the terms in the expansion of $(a + b)^n$.

Competency 4.8 – Students will be able to find the coefficient of the specified term in the expansion of $(a + b)^n$.

Competency 4.9 – Students will be able to determine whether a problem can be classified as a partition or ordered partition problem.

Competency 4.10 – Students will be able to solve word problems that can be classified as partition or ordered partition problems.

Competency 4.11 – Students will be able to write the definition of probability.

Competency 4.12 – Students will be able to use the definition to evaluate the probability of finite events.

Competency 4.13 – Students will be able to describe an associated sample space for an experiment and find how many points are in it.
Competency 4.14 – Students will be able to prove elementary assertions involving probability functions.
Competency 4.15 – Students will be able to use the definition of conditional probability to calculate the probability of certain events.
Competency 4.16 – Students will be able to determine whether two or more events are independent.
Competency 4.17 – Students will be able to find the probability of events using properties of independent events.
Competency 4.18 – Students will be able to use Bayes' Theorem to find the probability of an event.
Competency 4.19 – Students will be able to determine if an experiment is a sequence of Bernoulli trials.
Competency 4.20 – Students will be able to find the probability of k success in a sequence of n Bernoulli trials.
Competency 4.21 – Students will be able to calculate the expected value of an experiment.

Outcome 5. Students will demonstrate knowledge of Statistics

Competency 5.1 – Students will be able to define the random variables for a given problem.
Competency 5.2 – Students will be able to construct a histogram for a given probability distribution
Competency 5.3 – Students will be able to calculate the mean, median, mode, range, variance, and standard deviation for a set of data.
Competency 5.4 – Students will be able to find the probability distribution for a binomial experiment.
Competency 5.5 – Students will be able to find the probability of an event where the distribution is normal.
Competency 5.6 – Students will be able to use the normal curve to approximate the binomial distribution.
Competency 5.7 – Students will be able to use least square to find the line of best fit.
Competency 5.8 – Students will be able to determine whether there is a significant linear correlation.

Outcome 6. Students will demonstrate knowledge of Decision Theory

Competency 6.1 – Students will be able to find the expected value of a given probability function.
Competency 6.2 – Students will be able to determine the optimal strategies and value of the game.
Competency 6.3 – Students will be able to use game theory to solve problems.

Outcome 7. Students will demonstrate knowledge of Mathematics of Finance

Competency 7.1 – Students will be able to compute the first k terms of the solution to a linear difference equation.

Competency 7.2 – Students will be able to compute and compare interest on investments.

Competency 7.3 – Students will be able to find the value of an annuity.

Competency 7.4 – Students will be able to find the present value of an ordinary annuity.

Competency 7.5 – Students will be able to find monthly payments for loans.

MAPPING LEARNING OUTCOMES TO GENERAL EDUCATION GOALS

[For each of the goals selected above, indicate which outcomes align with the goal.]

Goals	Outcomes
First Goal	
Goal #1: To apply analytical and problem solving skills to personal, social and professional issues and situations.	<ul style="list-style-type: none"> • Outcome 2: Students will demonstrate knowledge of Matrices and Applications • Outcome 3: Students will demonstrate knowledge of Linear Programming • Outcome 4: Students will demonstrate knowledge of Elementary Combinatorial Analysis and Probability • Outcome 5: Students will demonstrate knowledge of Statistics • Outcome 6: Students will demonstrate knowledge of Decision Theory • Outcome 7: Students will demonstrate knowledge of Mathematics of Finance
Second Goal	
Goal #5: To develop interpersonal capacity.	<ul style="list-style-type: none"> • Outcome 1. Students will demonstrate knowledge of Linear Models <ul style="list-style-type: none"> ○ Competency 1.1 – Students will be able to discuss the meaning of a mathematical model.
Third Goal	
Goal #8: To connect learning to life.	<ul style="list-style-type: none"> • Outcome 2: Students will demonstrate knowledge of Matrices and Applications • Outcome 3: Students will demonstrate knowledge of Linear Programming • Outcome 4: Students will demonstrate knowledge of Elementary Combinatorial

	<p>Analysis and Probability</p> <ul style="list-style-type: none"> • Outcome 6: Students will demonstrate knowledge of Decision Theory • Outcome 7: Students will demonstrate knowledge of Mathematics of Finance
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COURSE TOPICS AND CONTENT REQUIREMENTS:

- I. Linear Equation
 - A. Mathematical models
 - B. Cartesian coordinates and graphs
 - C. Lines
 - D. Systems of linear equations

- II. Matrices and Vectors
 - A. Properties and operations
 - B. Inverse
 - C. Systems of equations
 - D. Applications

- III. Linear Programming
 - A. Systems of inequalities
 - B. Graphical methods
 - C. Simplex method
 - D. Applications

- IV. Probability
 - A. Sample space and events
 - B. Permutations and combinations
 - C. Probability of events
 - D. Conditional probability
 - E. Binomial theorem and binomial probability
 - F. Decision making
 - G. Stochastic processes
 - H. Markov chains

- V. Statistics
 - A. Analysis of data
 - B. The Binomial Distribution
 - C. The Normal Distribution
 - D. Application
 - E. Correlation and Regression

- VI. Decision Theory

- A. Expectation
 - B. Game Theory
- VII. Mathematics of Finance
- A. Difference Equations
 - B. Interest
 - C. Annuities
 - D. Amortization

INSTRUCTIONAL METHODS:

1. Lecture
2. Class discussion
3. Audio-visual aids
4. Written assignments
5. Quizzes and examinations

INSTRUCTIONAL MATERIALS:

TEXT: Finite Mathematics, 12th edition, Barnett, Pearson Publishing 2011

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

1. Tests
2. Quizzes
3. Homework quizzes
4. Projects
5. Class Participation

OTHER REFERENCES

Applied Finite Mathematics, 8th Edition, Tan, Brooks/Cole, 2006

Finite Mathematics for the Managerial, Life, and Social Sciences, 11th Edition, Tan, Brooks/Cole, 2014

Form Revised: 5/24/16