



# ILLINOIS VALLEY COMMUNITY COLLEGE

## COURSE OUTLINE

**DIVISION: Natural Sciences and Business**

**COURSE: MTH 1006 Finite Mathematics**

Date: Spring 2022

Credit Hours: 4

*Complete all that apply or mark "None" where appropriate:*

Prerequisite(s): MTH 1003 with a grade of C or better.

Enrollment by assessment or other measure?  Yes  No

If yes, please describe: By appropriate assessment

Corequisite(s): None

Pre- or Corequisite(s): None

Consent of Instructor:  Yes  No

Delivery Method:  **Lecture**      **4 Contact Hours** (1 contact = 1 credit hour)  
 **Seminar**      **0 Contact Hours** (1 contact = 1 credit hour)  
 **Lab**      **0 Contact Hours** (2-3 contact = 1 credit hour)  
 **Clinical**      **0 Contact Hours** (3 contact = 1 credit hour)  
 **Online**  
 **Blended**  
 **Virtual Class Meeting (VCM)**

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

### **CATALOG DESCRIPTION and IAI NUMBER (if applicable):**

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. IAI equivalent: M1906

## **ACCREDITATION STATEMENTS AND COURSE NOTES:**

None

## **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

## **EVALUATION OF STUDENT ACHIEVEMENT:**

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

## **INSTRUCTIONAL MATERIALS:**

### **Textbooks**

Finite Mathematics for Business, Economics, Life Sciences, and Social Sciences  
(Barnett, Ziegler, Byleen, & Socker 14th Edition, Pearson, 2019)

### **Resources**

MyMathLab

## **LEARNING OUTCOMES AND GOALS:**

### **Institutional Learning Outcomes**

- 1) Communication – to communicate effectively;
- 2) Inquiry – to apply critical, logical, creative, aesthetic, or quantitative analytical reasoning to formulate a judgement or conclusion;
- 3) Social Consciousness – to understand what it means to be a socially conscious person, locally and globally;
- 4) Responsibility – to recognize how personal choices affect self and society.

### **Course Outcomes and Competencies**

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 their 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.