SYLLABUS

Code: MATH 146  Title: ADVANCED TOPICS IN MATHEMATICS FOR THE LIBERAL ARTS

Institute: STEM  Department: MATHEMATICS

Course Description: This is a survey course with topics chosen from the mathematics of voting, fair division, apportionment, Euler circuits, the Traveling Salesman Problem, networks, scheduling, finance, and fractal geometry.

Prerequisites: A grade of C or higher in MATH 145 or MATH 025 or satisfactory completion of the college’s foundational studies requirement in algebra.

Credits: 4  Lecture Hours: 4  Lab: 0

REQUIRED TEXTBOOK/MATERIALS:


2. Calculator: You will need a scientific calculator for this course, such as the TI-30 XIIS.

OTHER TIME COMMITMENTS:

- In addition to the regular class hours, you will need to set aside time each week for homework. The weekly time will vary by topic and level of difficulty, but as an estimate, you should expect two homework hours for each class hour per week. For example, if your class meets for four hours per week, you should expect to spend about eight hours per week on homework.
- If you are having any difficulty with the course material, you may need to allow time to see your instructor during office hours or to get help in the Math Lab.

COURSE LEARNING OUTCOMES:

Upon completion of this course, students will be able to:

- Demonstrate the mathematical skills appropriate to this course. (M)
- Analyze and solve application problems. (M)
- Explain how mathematical knowledge can be used in an applied situation and interpret solutions in the context of the situation. (M)

Learning Outcome(s) support the following General Education Knowledge Area:

➢ (M) Mathematics
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**Grading Standard:** In this course, you will be evaluated by means of tests, labs, and quizzes (and possibly homework).

**A. Tests**

There will be three tests, one after each unit. All supporting work must be shown on tests in order for your instructor to properly assess your understanding of the material. The tests will be given in class and it is expected that you will be in class to take the test on the day it is given. If you are very ill (verifiable with a doctor’s note) or you have some other emergency, you must contact your instructor immediately.

**B. Quizzes/Labs/Homework/Other Assignments**

There are daily labs in this course. They are done in groups but handed in individually. The labs contain problems that reinforce the concepts and skills learned in class. There are also periodic quizzes and your instructor may also choose to use certain homework assignments for evaluation.

**Grading**

Each test is graded on the basis of 100 points. The labs are averaged to form your “lab grade,” and the quizzes are averaged to form your “quiz grade.”

Your final course average is determined by a weighted average as follows:

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**Final Grade**

Your final grade is determined as follows:

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<td>F</td>
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**To use this course as a prerequisite for another mathematics course, you must have a grade of C or better.**
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Incomplete

INC is only given at the discretion of your instructor. This may occur in documented cases of hardship or emergency. In this case, you must meet with the instructor to discuss the work that must be completed to earn a grade in the course. All work must be completed within 21 days after the end of the term, exclusive of official college closings.

Withdrawal

You may withdraw from the course, without penalty, up to a date set by the College. If you do not withdraw from the course but stop attending, your grade at the end of the semester will be F.

COURSE CONTENT: (TEXT SECTION)

Unit 1: The Mathematics of Social Choices. In this unit, you will study mathematical applications from social science, such as the mathematics of voting, weighted voting systems, fair division and the mathematics of apportionment.

Unit 1 Outcomes: You will:
  o Use preference ballots and preference schedules to summarize the voting in an election (1.1)
  o Use the plurality method and the Borda count method to find a winner (1.2, 1.3)
  o Use the plurality-with-elimination method and the pairwise comparisons method to find a winner (1.4, 1.5)
  o Determine a weighted voting system and how to find the Banzhaf power index (2.1, 2.2)
  o Use Banzhaf Power and Shapley-Shubik Power Index to find the power distribution of the weighted voting system (2.3, 2.4)
  o Explain and apply the basic concepts of fair division (3.1, 3.2)
  o Define and apply the lone-divider method for three or more players (3.3)
  o Use the discrete fair-division method, the method of sealed bids, and method of Markers to demonstrate fair division (3.6, 3.7)
  o Interpret the basic concepts of the mathematics of apportionment (4.1)
  o Solve apportionment problems using Hamilton’s method, Jefferson’s method, Adams’s method and Webster’s method. (4.2, 4.4, 4.5, 4.6)
  o Compare and contrast the fairness and the paradoxes of different methods of apportionment (4.3)

Unit 2: Management Science. In this unit, you will use various methods for solving problems involving the organization and management of activities with a large number of steps or variables.

Unit 2 Outcomes: You will:
  o Use graphs to model real-world problems (5.1, 5.2, 5.3, 5.4)
  o Use Euler’s theorems to eulerize a graph (5.5, 5.7)
  o Explain the difference between a Hamilton circuit, Hamilton path, Euler circuit and Euler path (6.1, 6.2)
  o Find an optimal solution for a traveling-salesman problem (6.3, 6.4)
  o Use the brute-force algorithm, the nearest neighbor algorithm, the repetitive nearest-neighbor algorithm, and the cheapest-link algorithm to find an optimal or approximate optimal solution (6.5, 6.6, 6.7, 6.8)
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- Interpret an optimal solution in the context of a traveling-salesman problem (6.5, 6.6, 6.7, 6.8)
- Define a tree and use the properties of a tree (7.1, 7.2)
- Use Kruskal’s algorithm to find an optimal (minimum expense or shortest distance) solution of a minimum spanning tree (7.3)
- Find and interpret the shortest distance between three points and the shortest network linking more than three points (7.4, 7.5)

Unit 3: Shape, Growth and Form. In this unit, you will create and analyze schedules when given a set of tasks. You will use finance formulas to make decisions about investments. You will recognize fractals and create diagrams from fractals.

Unit 3 Outcomes: You will:
- Create a project digraph based on a schedule model (8.1, 8.2, 8.3)
- Use the decreasing-time algorithm or critical-path algorithm to create a schedule which would have an efficient optimal solution (8.4, 8.5, 8.6)
- Understand that there are no efficient optimal algorithms known for scheduling, even when the tasks are all independent (8.7)
- Compare future value of money invested in accounts with simple and compound interest (10.2, 10.3)
- Apply the fixed deferred annuity formula (10.5)
- Apply the amortization formula to compare terms of a loan and/or whether to refinance (10.6)
- Define a fractal and construct a fractal, such as a Koch snowflake and the Sierpinski Gasket (12.1, 12.2)
- Find the perimeter of a fractal, such as a Koch snowflake, after a few iterations (12.1, 12.2)
- Introduce the Chaos Game (12.3)

DEPARTMENT POLICIES:

The Math Department wants you to be successful in this course. Because of this, we have compiled a list of strategies and behaviors.

Attendance and class participation
- If you want to be successful in this course, attend every class.
- Come to class on time, and stay for the entire class period. If you are late or leave during class, you will miss important class material and you will also distract your classmates and your instructor. (See the Student Conduct Code)
- Turn off your cell phone during class. You and your classmates need to be free from distractions. (See the Student Conduct Code)
- Bring your book and calculator to every class.
- Respect your classmates and your instructor. Listen carefully to questions asked and answers given. Treat all questions with respect.
- Participate fully in class. Volunteer answers, work problems, take careful notes, and engage in discussions about the material. Above all, stay on task.
- Contribute your share to your in-class lab work and do your best to make the group experience a positive one for all members.
- Do your own work on tests and quizzes. Cheating will not be tolerated. (See the Academic Integrity Code.)
Homework

- Homework is the way you practice the ideas and skills that are introduced in class. To be successful on the tests, you must do the homework. Homework may be collected and homework questions may be included on quizzes or tests.
- When you do the homework, write down all supporting work. Using the correct process is at least as important as getting the correct answer, so your work and steps are very important.
- Remember to check your answers. Answers will be in the back of the text or in the student’s solutions manual. There is a Student's Solution Manual in the Math Lab.
- If there are questions you can’t get or don’t understand, ask about them at the beginning of the next class. If you have trouble with more than a few problems, try starting your homework in the Math Lab, where help is available.

Absence

- If you are sick and an absence is unavoidable, please call or email your instructor. You are still expected to read the course material and to try to do the homework.
- Make time to see your instructor when you return so that you can get any papers you missed.
- You will not be able to make up quizzes or labs.
- Remember that you are expected to be in class for the tests and quizzes.

Getting Help

After you have tried the homework, there are ways to get help:

- Look in your text and your class notes for examples similar to the problems you are finding difficult.
- See your instructor during office hours or make an appointment. Bring the work you have done.
- Go to the Math Lab to get extra help on your homework or simply go and do your homework there. Someone will be there if you get stuck. You don’t need an appointment to use the Math Lab.
- Form a study group with other class members. Working with other students can be a great way to learn. If you have a group to work with, consider meeting and working together in the Math Lab.
- Your textbook may have a complete solutions manual available in the Math Lab, which can be used in the Math Lab.
- You can use the computers in the computer lab within the Math Lab to do work related to your math course.
- In the Math Lab, you can get help on how to use your calculator.

Visit the Math Lab website to view hours and other useful information about the Math Lab.
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COLLEGE POLICIES:
For information regarding:
♦ Brookdale’s Academic Integrity Code
♦ Student Conduct Code
♦ Student Grade Appeal Process

Please refer to the BCC STUDENT HANDBOOK and BCC CATALOG.

NOTIFICATION FOR STUDENTS WITH DISABILITIES:
Brookdale Community College offers reasonable accommodations and/or services to persons with disabilities. Students with disabilities who wish to self-identify must contact the Disabilities Services Office at 732-224-2730 (voice) or 732-842-4211 (TTY) to provide appropriate documentation of the disability, and request specific accommodations or services. If a student qualifies, reasonable accommodations and/or services, which are appropriate for the college level and are recommended in the documentation, can be approved.