

# SYLLABUS

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**Code: MATH 226**

**Title: DISCRETE MATHEMATICS**

**Institute: STEM**

**Department: MATHEMATICS**

**Course Description:** This course is intended for students of mathematics or computer science. The course examines the theoretical and applied mathematical foundations for the discipline of computer science. Topics include sets, logic, methods of proof, functions, number theory, counting techniques, discrete probability, graphs and trees, relations, and Boolean functions. Mathematical reasoning and proofs will be stressed. Applications are drawn from the field of computer science. A prior programming course, while recommended, is not necessary.

**Prerequisites:** A grade of C or higher in MATH 172.

**Credits: 4**

**Lecture Hours: 4**

**Lab: 0**

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**REQUIRED TEXTBOOK/MATERIALS:**

**Textbook:** Rosen, Kenneth H., Discrete Mathematics and its Applications, sixth edition, McGraw-Hill, Inc, 2007.

**RECOMMENDED MATERIALS:**

1. Rosen, Kenneth H., Student Solutions Manual, McGraw-Hill, Inc, 2007.
2. Calculator –The calculator for this course is the TI-83 (any version) or TI-84 (any version). .

**ADDITIONAL TIME REQUIREMENTS:**

**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)
- Model and solve application problems appropriate to this course. (M)
- Construct a logical proof. (M)

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

- (M) Mathematics

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**GRADING STANDARD:** In this course, you will be evaluated by means of tests, quizzes, and possibly homework and projects.

## 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 and you are going to miss a test, you *must* call your instructor before the test to discuss both the reason for the absence and the process for taking the missed test.

## B. QUIZZES

Your instructor will give periodic quizzes as in-class and/or as take-home assignments.

## C. HOMEWORK/PROJECTS

Your instructor may assign individual homework and/or group projects to be done outside of class for evaluation. In these assignments, you will apply the concepts and skills learned in class to a problem situation, present the mathematics, write careful explanations, and interpret your results.

## GRADING STANDARD

Each test is graded on the basis of 100 points and is worth between 25% and 30% of your grade. Quizzes (and possibly homework and projects) result in a combined grade worth between 15% and 25% of your grade. Your instructor's addendum will state the exact percentages.

## FINAL GRADE

Your final grade is determined as follows:

If your final course average is	Your final grade is
90 – 100	A
88 – 89	A-
86 – 87	B+
80 – 85	B
78 – 79	B-
76 – 77	C+
70 – 75	C
60 – 69	D**
Below 60	F

\*\* 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:** In this unit, you will study logic, sets, functions, methods of constructing a proof, and Boolean expressions and functions.

**Unit 1 Outcomes:** You will:

- Determine the precedence of logical operators in a compound logical statement. (1.1)
- Create logic tables using T/F and 0/1. (1.1)
- Translate between logical expressions and English statements. (1.1)
- Distinguish among a tautology, contradiction, and contingency. (1.2)
- Determine when two propositions are logically equivalent. (1.2)
- Distinguish between a universal quantifier and existential quantifier. (1.3)
- Translate between predicates and English statements. (1.3)
- Translate between predicates with nested quantifiers and English statements. (1.4)
- Determine the order of nested quantifiers. (1.4)
- Define the following terms: theorem, proof, axiom (postulate), fallacy, lemma, corollary, and conjecture. (1.6)
- Construct a direct proof and a proof by contradiction. (1.6)
- List specific elements (members) of a set. (2.1)
- Distinguish among the following: universal set, empty set (null set), singleton, subset, and proper subset. (2.1)
- List the power set of S, given S. (2.1)
- Form the Cartesian product of A and B, given sets A and B. (2.1)
- Distinguish among the following terms: union, intersection, disjoint, set difference, and complement. (2.2)
- Prove equality of set unions and/or intersections using DeMorgan's Laws. (2.2)
- Know the definitions of one to one and onto functions. (2.3)
- Perform Boolean arithmetic. (11.1)
- Use Boolean identities to verify various laws. (11.1)
- Represent a Boolean function as a sum of products. (11.2)
- Construct circuits using gates that implement a Boolean operation. (11.3)

**Unit 2:** In this unit, you will study number theory, the principle of counting, and probability theory.

**Unit 2 Outcomes:** You will:

- Prove laws of integer divisibility. (3.4)
- Use the Division Algorithm, to construct proofs. (3.4)
- Use the Fundamental Theorem of Arithmetic, to construct proofs. (3.5)
- Employ modular arithmetic to the application of public key cryptography. (3.6,3.7)

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- Construct proofs using Induction (4.1)
- Apply the Product Rule. (5.1)
- Apply the Sum Rule. (5.1)
- Apply the Inclusion-Exclusion Principle. (5.1)
- Apply the Inclusion-Exclusion Principle to more generalized applications. (7.5)
- Construct a permutation or  $r$ -permutation of  $n > r$  objects. (5.3)
- Construct an  $r$ -combination of  $n \geq r$  objects. (5.3)
- Apply knowledge of permutations and combinations to applicable situations. (5.3)
- Use the binomial theorem to find coefficients in binomial expansions (5.4)
- Solve permutation and combination problems with repetition (5.5)
- Determine the probability of an event. (6.1)
- Determine the probability of the complement of an event. (6.1)
- Determine the probability of the union of events. (6.1)
- Define a probability distribution. (6.2)
- Determine the conditional probability of an event. (6.2)
- Determine if two given events are independent or dependent. (6.2)

**Unit 3:** In this unit, you will study graph theory, Euler and Hamilton Paths and Circuits, trees, and relations.

**Unit 3 Outcomes:** You will:

- Determine if a relation is reflexive, symmetric, antisymmetric, or transitive. (8.1)
- Combine relations using union, intersection, and subtraction. (8.1)
- Draw graph models, noting vertices and edges. (9.1)
- Determine if a given graph is a simple graph, a multigraph, a pseudograph, or a directed graph. (9.1)
- Use basic vocabulary of graph theory (e.g. adjacent vertices, incident, endpoint, vertex degree, isolated vertex, pendant, initial vertex, terminal vertex, in-degree, out-degree, isolated vertex) to solve problems. (9.2)
- Determine if a simple graph is bipartite. (9.2)
- Create subgraphs and unions of graphs. (9.2)
- Prove any subgraph of a complete graph is also complete. (9.2)
- Distinguish among a path, circuit, simple path, and simple circuit. (9.4)
- Determine if a graph is a connected graph. (9.4)
- Find the strongly connected components of graphs. (9.4)
- Determine if a path or circuit is Eulerian or Hamiltonian. (9.5)
- Describe a weighted graph model to solve problems. (9.6)
- Apply algorithms to solve shortest-path problems, including the traveling salesman problem. (9.6)
- Identify graphs as trees. (10.1)
- Prove every tree is a bipartite graph. (10.1)
- For rooted trees, identify parent, child, sibling, ancestor, descendant, leaf, internal vertex. (10.1)
- Draw a subtree of a given tree. (10.1)
- Construct proofs for an  $m$ -ary tree, full  $m$ -ary tree, and binary tree. (10.1)

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## **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 any group 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. They will be in the back of the text or in the student's solutions manual.
- 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.
- Remember that you are expected to be in class for the tests and quizzes.

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## 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.

## COLLEGE POLICIES:

As an academic institution, Brookdale facilitates the free exchange of ideas, upholds the virtues of civil discourse, and honors diverse perspectives informed by credible sources. Our College values all students and strives for inclusion and safety regardless of a student's disability, age, sex, gender identity, sexual orientation, race, ethnicity, country of origin, immigration status, religious affiliation, political orientation, socioeconomic standing, and veteran status. For additional information, support services, and engagement opportunities, please visit [www.brookdalecc.edu/support](http://www.brookdalecc.edu/support).

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.

## MENTAL HEALTH:

- Mental Health Crisis Support: From a campus phone, dial 5555 or 732-224-2329 from an external line; off-hours calls will be forwarded to BCC police (2222 from a campus phone)
- Psychological Counseling Services: 732-224-2986 (to schedule an appointment during regular hours)

# **SYLLABUS**

*The syllabus is intended to give student guidance in what may be covered during the semester and will be followed as closely as possible. However, the faculty member reserves the right to modify, supplement, and make changes as the need arises.*