# Georgia Perimeter College
## Common Course Course Outline

<table>
<thead>
<tr>
<th>Course Abbreviation &amp; Number:</th>
<th>Math 2420</th>
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<tbody>
<tr>
<td>Course Title:</td>
<td>Discrete Mathematics</td>
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<tr>
<td>Credit Hours:</td>
<td>3</td>
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</tbody>
</table>

**Prerequisites:**

- MATH 1113 or MATH 1433 with a "C" or better

**Co-requisites:**

- None

**Course Description:**

This course introduces the concepts of finite mathematical structures. Topics include set theory, logic, proof techniques, functions and relations, graphs, trees, and combinatorics.

**Expected Educational Results:**

As a result of completing this course, the student will be able to:

1. Identify logical form; form compound statements; determine truth tables; determine logically equivalent statement forms; apply De Morgan’s laws; determine a tautology vs. a contradiction; and use logical equivalences.
2. Determine truth tables for statements containing conditional and biconditional connectives; represent if-then as or; negate an if-then statement; determine the negation, contrapositive, converse and inverse of a conditional statement; rewrite conditional statements.
3. Determine whether an argument is valid; use valid argument forms to do complex deductions.
4. Give the input/output table for the following gates: OR, AND and NOT; find a Boolean expression of a circuit; find a circuit corresponding to a Boolean circuit; determine whether two logical circuits are equivalent; and simplify a combinatorial circuit.
5. Represent a decimal/binary/hexadecimal/octal number from one notation system to another; and add and subtract binary numbers.
6. Determine the domain and the truth set of a predicate variable; identify universal and existential statements; write statements in formal and informal language; identify universal conditional statements; negate universal and existential statements.
7. Define an even/odd integer; prove an existential statement; use a direct proof to prove universal statements; disprove a universal statement by an example; follow the directions for writing proofs of universal statements; and identify common mistakes.
8. Use direct proofs or counterexamples to prove or disprove statements involving the rational numbers.
9. Use direct proofs or counterexamples to prove or disprove statements involving the divisibility of integers, and use the quotient-remainder theorem to illustrate a proof by division into cases.
10. Use methods of proofs by contradiction and contraposition.
11. Find the explicit formula for a sequence, and be able to do calculations involving factorial, summation and product notations.
13. Be able to prove statements using mathematical induction.
14. Understand and solve problems in set theory; use Venn diagrams; determine the Cartesian product of two or more sets; prove set identities; use set identities to derive new set properties; determine a partition of a set, and the power set of a set.
15. Determine whether a relation is a function; determine the domain, co-domain, range of a function, and the inverse image of $x$; prove or disprove one-to-one-ness and onto-ness; determine the inverse of a one-to-one correspondence; determine the composition of two functions.
16. Determine the arrow diagram of a relation; determine the inverse of a relation, whether a relation is reflexive, symmetric or transitive; determine the transitive closure of a relation; determine an equivalence relation.
17. Identify loops, parallel edges, etc. in a graph; draw complete graphs and complete bipartite graphs; determine a bipartite graph; list all the subgraphs of a graph; determine the degree of a vertex; prove and apply properties on the degrees of the vertices and the number of edges of a graph.
18. Determine whether a walk is a path, simple path, closed walk, circuit or a simple circuit; determine a connected graph and an Euler circuit and prove properties about them; determine an Euler path and a Hamiltonian circuit.
19. Determine whether a graph is a tree; show properties of trees on vertices, leaves, and edges; determine the root, level of a given vertex, height of the tree, children, parent, siblings, ancestors and descendants of a vertex; determine binary/full binary tree.

General Educational Outcomes:

1. Students produce well-organized communication that exhibit logical thinking and organization, use appropriate style for audience and meet conventional standards of usage.
   A. Students develop their listening skills through lecture and through group problem solving.
   B. Students develop their reading comprehension skills by reading the text and by reading the instructions for text exercises, problems on tests, or on projects. Reading mathematics text requires recognizing symbolic notation as well as analyzing problems written in prose.
   C. Students develop their writing skills through the use of problems that require written explanations of concepts.
II. Students demonstrate effective problem-solving and critical thinking skills through interpreting, presenting or evaluating ideas.
   A. Students must apply mathematical concepts previously mastered to new problems and situations.
   B. In applications, students must analyze problems and describe problems through pictures, diagrams, or graphs, then determine the appropriate strategy for solving the problem.

III. Students demonstrate the ability to interpret and analyze quantitative information; apply mathematical principles and techniques; and to use mathematical models to solve applied problems.
   A. Students must demonstrate proficiency in problem-solving skills including applications of finite mathematical structures, functions and relations, graphs, combinatorics and logic.
   B. Students must write functions to describe real-world situations and interpret information from both the function (relation) rule and the graph of the function (relation).
   C. Students must solve problems in combinatorics, graph theory and logic that often arise in modeling numerical relationships.

Course Content:

1. Sets and Logic
2. Proof Techniques
3. Relations and Functions
4. Combinatorics
5. Graphs and Trees

Assessment of Outcome Objectives

Course Grade:

The course grade will be determined by the individual instructor using a variety of evaluation methods. A portion of the course grade will be determined through the use of frequent assessment using such means as tests, quizzes, projects, or homework as developed by the instructor. Some of these methods will require the student to demonstrate ability in problem solving and critical thinking as evidenced by explaining and interpreting solutions. A comprehensive final examination is required which must count at least one-fifth and no more than one-third of the course grade.
## Course Assessment:

A. This course will be assessed in the fall semester on a three-year assessment cycle. Objective questions assessing student mastery of outcomes for this course will be included in either the final exam or unit tests for this course. Each instructor must include these questions in the appropriate exam. Each instructor is responsible for reviewing and tabulating the results of these outcome assessment questions and transmitting them to the course or curriculum committee responsible for this course. Individual instructors should use feedback from assessment in their classes to review and evaluate their own teaching practices.

B. The construction of the outcome assessment questions will be the responsibility of the college-wide Math 2420/2641/2652 Curriculum Committee.

## Use of Assessment Findings:

The Math 2420/2641/2652 Curriculum Committee will meet in the spring term after the fall assessment to review the course and to evaluate the results. The review of the course outcome assessment findings will provide information on success in achieving the desired outcomes for this course on a college-wide basis. If fewer than 70% of the students perform successfully on questions measuring any particular educational outcome, the committee will examine teaching practices related to that outcome, the assessment instrument, and the desired learning outcomes to determine which, if any, of these need modifying. The committee will share its findings and recommendations with all faculty teaching this course, and may make changes to the desired educational outcomes, teaching practices, or assessment instrument as appropriate.

## Last Revised:

February 2012