Ramapo College of New Jersey
School of Theoretical and Applied Sciences

Instructor:	Dr. Atul Anurag
Office:	G128H
Phone:	(201) 684-7159
Email:	aanurag@ramapo.edu
Office Hours:	Mondays and Thursdays, 10:00 AM –1:00 PM (in-person or virtual, or by appointment)
Class Time & Room:	Mondays and Thursdays, 4:10 PM –5:50 PM Anisfield School of Business, Room 524 (Main Campus)

General Education Program Course

This course fulfills the Quantitative Reasoning category in the general education program.

In-Person Course

This course is scheduled as a fully in-person class. All instructional time, which amounts to 200 minutes per week for a 4-credit course, will take place during regularly scheduled class meetings.

As with any college course, you are expected to dedicate approximately two hours of work outside of class for every hour spent in class. This totals about 400 minutes of out-of-class work per week, which includes completing assignments, reviewing material, preparing for assessments, and engaging with supplemental resources.

Attendance, active participation, and consistent engagement with the course materials are critical to your success. Please arrive to class on time, prepared, and ready to contribute to a collaborative learning environment.

All course materials and information will be posted to Canvas. The homepage will be organized with key resources, important documents, and announcements. I also use the weekly calendar to keep you on pace with assignments, deadlines, and upcoming topics.

If you have any concerns about attendance, technology access, or coursework expectations, please reach out early so that we can work together on a solution.

Text The required texts are posted to Canvas and free at the links below. If you prefer a printed and bound copy, then it can be ordered at the SIAM bookstore for $15 each.

- *Society for Industrial and Applied Mathematics (SIAM)* "Math Modeling: Getting Started and Getting Solutions." available for download here.
  Bookstore: Bookstore Link
- *Society for Industrial and Applied Mathematics (SIAM)* "Math Modeling: Computing and Communicating." available for download here.
  Bookstore: Bookstore Link
- (optional) COMAP, For All Practical Purposes: An Introduction to Contemporary Mathematics, 9th edition, W. H. Freeman and Co. ISBN: 978-1429254823

Course Description This is a Quantitative Reasoning keystone course meant for non-science majors. The course is intended to provide insight into the importance of mathematics to the world outside academia, and to improve students reasoning and problem-solving skills. It will introduce to students applications by way of management decision making, social choice, and population studies. Typical among problems to be studied are: scheduling of projects with precedence restrictions; linear programming problems; manipulability of voting systems; weighted voting systems (coalitions and relative power, paradoxes in voting systems); apportionment; fair division in presence of individual preferences; detection and/or correction of data transmission errors.

Course Goals

The goals of this course are to:

1. Apply mathematical concepts effectively.
   Mathematical modeling is the art of applying mathematics effectively to problems that may not naturally appear to be mathematical in nature. We highlight the uses of mathematics to these problems and then ask students to use those skills to understand, solve, and explain their solutions from the context of the problem. Students could not be successful in this course without successfully achieving this objective as it is embedded in every assignment of the course.
2. Demonstrate logic and reasoning skills.
   Mathematical modeling requires these skills to convert the problem to mathematics, to solve the mathematical problem, and then to convert the solution back in terms of the original problem. Students could not be successful in this course without successfully achieving this objective as it is embedded in every assignment of the course.
3. Use technology to communicate, manage, or solve problems.
   Students often lack the skills to solve linear programming problems involving more than two variables by hand. To address this, we incorporate technology tools such as Excel or Google Sheets to assist in solving these more complex problems efficiently and accurately. The unit on data modeling specifically requires the use of Excel or Google Sheets, introducing students to spreadsheet manipulation, basic computational functions, and graphical data visualization. These are essential tools commonly used in business and professional settings to analyze and present data. This objective is assessed through group work, homework assignments, and class discussions.
4. Apply disciplinary and interdisciplinary knowledge and skills to address complex problems.
   Mathematical modeling is used to solve complex problems that often come from other disciplines. In this course, we explore topics rooted in decision theory, business, environmental science, engineering, and computer science. The variety of approaches students use to solve these problems must be based in mathematics as well as the discipline from the problem. Students could not be successful in this course without successfully achieving this objective as it is embedded in every assignment of the course.

This is achieved by:

- Using decision making procedures to solve real-life problems.
- Modeling data with functions and visualizing it in Excel.
- Understanding the important of context in modeling data.
- Understanding the impact of model selection, assumptions, and problem formulation in the results we achieve.
- Communicating results in a variety of contexts.
- Linear programming as a model of optimization problems, and the use of the software package Mathematica to solve these problems.
- The use of graphs and networks to model scheduling, traffic, and other problems in modern society.

Respect the learning environment! To help create a positive and productive classroom experience, please:

- Be on time to class each day. Coming in late or leaving early can be distracting to others. Your full presence is welcome and important for the entire 100-minute class.
- Silence your cell phones. Phone noises interrupt both your classmates and your instructor.
- Take part in all class activities, especially group work and problem solving. Give it a try—even when it's hard. We often learn the most by making mistakes.

Student Learning Outcomes

Students will be able to:

Objective	Outcome	HW	Group Work	Quizzes	Exams	Final Presentation
Apply mathematical concepts effectively.	1. Effectively communicate quantitative evidence in support of an argument.	X	X	X	X	X
	2. Explain information in mathematical forms (e.g., equations, graphs, diagrams, tables, words).	X	X	X	X	X
	3. Use appropriate computational method(s) to solve a problem.	X	X	X	X	X
Demonstrate logic and reasoning skills.	1. Demonstrate logic and reasoning skills.	X	X	X	X	X
Use technology to communicate, manage, or solve problems.	1. Use technology to solve problems.	X	X			X
Apply disciplinary and interdisciplinary knowledge and skills to address complex problems.	1. Apply disciplinary and interdisciplinary knowledge to identify key resources or steps required to solve a complex problem.	X	X	X	X	X
	2. Utilize disciplinary or interdisciplinary skills to solve problems appropriately.	X	X	X	X	X

Grading The distribution of points for the course is

Requirement	Weight (%)
Homework & Quizzes	30%
Exam I (Oct 13)	20%
Exam II (Nov 6)	20%
Final Exam (Dec 11)	30%
Total	100%

Homework Homework problems will generally be assigned for each lesson. There is a combination of content and skills questions requiring you to use ideas from class and/or group work and reflective assignments to analyze your own understanding based on the work completed in your group. At times homework will be an individual write up of group work, thus you are responsible for communicating in your own words the answers to the questions based on work created as a group. Despite using shared data or information, the submissions must be unique and reflective of your own understanding. Copied work will not be accepted and violates Ramapo's academic integrity policy. These problems are assigned to aid in your understanding of the material.

Quizzes Quizzes will generally be given each week, typically in person or online depending on the week's schedule. They will be based on the material covered during in-person class sessions. This content is best learned through lecture,

discussion, reading, and in-class activities. The quizzes are intended to help focus your learning and ensure you are retaining the key points from each lesson. The lowest two quiz scores will be dropped from your final quiz grade.

Exams Exams will be given on **Monday, Oct 13th**, **Thursday, Nov 6th** and **Thursday, Dec 11th** unless the College is closed that day. Only a writing implement and a drink may be around your test taking area and all other materials, especially math related or web capable, must be left in the front of the room. NO CHEATING! No make up will be given without a documented pre-approved excuse.

Class Discussion In addition to comparing and contrasting the results of group work in class, we will also discuss the material and topics as a group. Many of the applications are familiar to you, so we build on previous knowledge to understand how the mathematics is used to address these topics.

Course Grading Scale 100%-93% A, 92%-90% A-, 89%-87% B+, 86%-83% B, 82%-80% B-, 79%-77% C+, 76%-73% C, 72%-70% C-, 69%-67% D+, 66%-60% D, 59%-0% F.

Attendance Policy Students are expected to attend all classes. If a class is missed, students are still responsible for the material covered or any announcements. I will post all course documents on Canvas. Students who miss more than **3 classes** will not receive a passing grade.

A student who plans to miss one or more class sessions for religious observance, whether the religious holiday is recognized by the State of New Jersey or not, must notify the course instructor as soon as possible but no later than prior to the date of the religious holiday or the 50% refund date of the term in which the student is enrolled in the course (whichever comes first). The course instructor will not penalize the student for the absence and will allow the student to make up any work missed while absent for religious observance. Ultimately, it is the student's responsibility to complete the work by the dated agreed upon by the instructor and the student.

Communication I will email the class with any important information that cannot wait until the next class. In accordance with College policy, I will use your Ramapo College email address (@ramapo.edu) to communicate with you about all course-related matters. Since I cannot authenticate the sender using personal accounts, I am unable to discuss course materials or possibly sensitive materials, like grades, from an alternate electronic source. I will post all course documents on Canvas.

Policy on Academic Integrity Students are expected to read and understand Ramapo College's Academic Integrity Policy, which can be found online in the College Catalog, which can be downloaded here. Members of the Ramapo College community are expected to be honest and forthright in their academic endeavors. Students who are suspected of violating this policy will be either required to meet with the faculty member (and in the event of a 'responsible' finding, reported to the Office of the Provost), or be referred directly to the Office of the Provost, which will adjudicate the matter.

Students with Disabilities If you need course adaptation or accommodations because of a disability that has been documented with the Office of Specialized Services, please make an appointment with me.

Important Dates

- Last day to add/drop classes: Tuesday, September 9th
- Last day to withdraw: Friday, November 7th

Course Lecture Schedule

Lecture #	Sections / Topics Covered
1	Introduction to Mathematical Modeling *(by Prof. Harold)*
2	Introduction to the Modeling Process & Applications to Certain Mathematical Models
3	Introduction to Graph Theory; Euler Circuits; Eulerizing a Graph; Handshaking Lemma; Adjacency Matrix
4	Hamiltonian Path; Hamiltonian Circuit; Traveling Salesman Problem; Complete Graphs; Greedy Algorithms; Nearest Neighbor Algorithm; Sorted Edges Algorithm
5	Trees; Spanning Trees; Minimal Spanning Tree; Kruskal's Algorithm; Order Requirement Digraph; Critical Path Analysis (CPA)
6	Planning and Scheduling; Priority List; Gantt Chart; List Processing Algorithm; Creating a Priority List for Critical Path Scheduling
7	Linear Programming; Maximization and Minimization Problems in two Variables
8	Linear Programming (continued)
9	Introduction to Elementary Statistics; Data Distributions; Histograms; Mean; Median; Mode
10	Introduction to Elementary Statistics (continued); Outliers; Normal Distribution
11	*Review Class for Exam I*
12	UPC Codes and Check Digits; Modular Arithmetic and Congruences; Types of Identification Errors
13	Encoding Data in Driver's License Numbers
14	
15	

Syllabus is subject to change.