MATH 370: Introduction to Mathematical Modeling

Spring 2020 Section 001 3 credit hours

Instructor: **Dr. Zach Abernathy**
Office: Bancroft 161
Office Phone: 803-323-4605
Math Department: 803-323-2175
Campus Email: abernathyz@winthrop.edu
Instructor Website: faculty.winthrop.edu/abernathyz

Course Meeting Schedule: TR 12:30 – 1:45 Owens 103

Office Hours: MW: 1:00-2:00pm and by appointment

The instructor reserves the right to make modifications to this syllabus. Students will be notified in class & by email.

Students with Disabilities/Need of Accommodations for Access

Winthrop University is committed to providing accessible learning experiences and equal access to education for all students. The syllabus is available in alternate formats upon request. If you are a student with a disability (including mental health concerns, chronic or temporary medical conditions, learning disabilities, etc.) and you anticipate or experience academic barriers due to the condition, please contact The Office of Accessibility (OA) for information on accommodations, registration, and procedures. After receiving approval for accommodations through OA, please make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely manner. OA contact information: accessibility@winthrop.edu; 803-323-3290; 307 Bancroft Hall Annex.

Texts, Materials, and Resources

- A First Course in Mathematical Modeling by Frank Giordano, William Fox, and Steven Horton (5th edition).
- The Mathematics Tutorial Center information is available at: www.winthrop.edu/mtc.
- Winthrop's Academic Success Center (ASC) is a free resource for all undergraduate students seeking to perform their best academically. Information is available at www.winthrop.edu/success.

Determination of Grade

Homework (30%) Regular homework will be assigned for each section and turned-in on a weekly basis.

Projects (30%) For each chapter, we will have an associated project packet to supplement the material and techniques learned in that chapter. These projects are equivalent to short/medium-length papers, and will often require research (both deep thought about the problem, and library work and reading that goes beyond a superficial reading of the text). In general, projects will be due about one week after the completion of the chapter. You are allowed to work in groups of two or three and each group will turn-in a single report.

Midterm (20%) There will be an in-class midterm. You are expected to take the midterm at the scheduled time. A make-up midterm will not be given. An unexcused absence will result in the grade of zero. Excused absences will be dealt with at the end of the term and may depend on individual circumstances. Anticipated absences should be reported and verified in advance; emergency absences must be verified within one week after returning to class. Any questions concerning grading of the midterm must also be resolved within one week after the midterm is returned.

Final Exam (20%) The cumulative final exam is scheduled for Thursday, April 30th at 11:30am.

Letter Grade Determination:

92-100 A	90-91.99 A-	87-89.99 B+	82-86.99 B	80-81.99 B-	77-79.99 C+
72-76.99 C	70-71.99 C-	67-69.99 D+	62-66.99 D	60-61.99 D-	

Add/Drop:	Through F 1/17	**SU and Course Withdraw Date:**	W 3/11
Spring Break:	M 3/16 - F 3/20	**Final Exam:**	R 4/30, 11:30am

Policies

1. Review the student code of conduct for university polices on academic misconduct. Academic misconduct will not be tolerated and will result in a failing grade on the assignment and/or in the course. The full handbook is available online at: (https://www.winthrop.edu/studentconduct/winthrop-university-student-handbook.aspx)
2. All electronic devices (including cell phones) other than a calculator should be on silent and kept in your book bag or purse throughout class time unless otherwise instructed. (Note if you have some educational, health, or physical reason for an electronic device you must work with your professor to inform them of the accommodation.)

Attendance Policy

The University Attendance policy as stated in the current catalog (https://www.winthrop.edu/recandreg/undergraduate-catalogs.aspx): if a student's absences in a course total 25 percent or more of the class meetings for the course, the student will receive a grade of N if the student withdraws from the course before the withdrawal deadline; after that date, unless warranted by documented extenuating circumstances as described in the previous section, a grade of F or U shall be assigned.

Course Content

Mathematical modeling is an area of applied mathematics that uses mathematical tools for exploring and studying "real world" problems. The overall objective of this course is to provide an introduction to the process of mathematical modeling while giving students an opportunity to

1. develop and construct appropriate models for various problem situations,
2. analyze given models to uncover underlying assumptions, and
3. investigate particular problems to find out what has already been done toward developing solutions.

Prerequisites: A grade of C- or better in MATH 201.

Course Goals and Student Learning Outcomes:

Being exposed to mathematical modeling, students will meet the following three departmental objectives.

1. Students are able to communicate mathematical ideas, demonstrate mathematical reasoning skills, and create and evaluate mathematical conjectures at various levels of formality.
2. Students apply fundamental mathematical concepts and techniques to solve problems and evaluate results.
3. Students demonstrate the ability to apply appropriate technologies to the study of mathematics and effectively use such technologies to investigate and develop an understanding of mathematical ideas.

Tentative Course Schedule

T 1/14	1.1	Modeling Change with Difference Equations
R 1/16	1.2	Approximating Change with Difference Equations
T 1/21	1.3	Solutions to Dynamical Systems
R 1/23	1.4	Systems of Difference Equations
T 1/28	2.1	Mathematical Models
R 1/30	2.2	Modeling Using Proportionality
T 2/4	2.3	Modeling Using Geometric Similarity
R 2/6	3.1	Fitting Models to Data Graphically
T 2/11	3.2	Analytic Methods to Model Fitting
R 2/13	3.3	Applying the Least-Squares Criterion
T 2/18	3.4	Choosing a Best Model
R 2/20		Midterm
T 2/25	7.1	An Overview of Optimization Modeling
R 2/27	7.2	Linear Programming I: Geometric Solutions
T 3/3	7.3	Linear Programming II: Algebraic Solutions
R 3/5	7.4	Linear Programming III: The Simplex Method
T 3/10	7.5	Linear Programming IV: Sensitivity Analysis
R 3/12	7.6	Numerical Search Methods
T 3/24		3D Printing I: 3D Modeling
R 3/26		3D Printing II: 3D Printing Software
T 3/31		Introduction to Mathematical Careers
R 4/2		Data Mining I: Data Preprocessing and Exploratory Data Analysis
T 4/7		Data Mining II: Classification Methods
R 4/9		Data Mining II: Classification Methods
T 4/14		Data Mining III: Association Rules
R 4/16		Data Mining III: Association Rules
T 4/21		Group Presentations
R 4/23		Course Wrap-up and Evaluations