

MATH 341 Mathematical Modeling Fall 2009

Meeting Place: Frey 141 11:00 – 11:50 MWF

Instructor: Marvin L. Brubaker
Phone: 3790
Office: Frey 237
Office Hours - MWF (9-10:00 a.m.) T (8:15-9:15)

Required Course Material: Giordano, Weir, and Fox, *A First Course in Mathematical Modeling*, 4th edition, Brooks/Cole—Thomson Learning, 2009.

Course Objectives: A course in mathematical modeling differs from a course in applied mathematics in one important way. Applied mathematics courses are typically taught as mathematics in search of an application. A mathematical modeling course is centered on real world situations in search of some appropriate mathematics. Thus the following objectives distinguish this course from other mathematics courses in the curriculum:

1. To change the student's world view, so as to see the pervasiveness of mathematics in the natural sciences.
2. To give teams of two or three students an opportunity to work together to solve real-world problems of the kind that professional applied mathematicians are paid to do.
3. To discover the usefulness of discrete deterministic models in areas such as social choice, finance, and population growth.
4. To learn powerful ideas of mathematics like "transform-solve-invert" and Polya-like strategies for attacking problems like looking for analogies and solving just a useful part of a problem.
5. To learn to explain the mathematics that one has used to solve a problem both in formal writing and in oral presentation.

Prerequisites:

Mathematical modeling can be taught in elementary school, yet so as to have a collection of techniques on which to draw to solve harder problems, Calculus III is required. The ability to program a computer is also useful to do simulations and sometimes to exhaustively search for solutions.

Resources:

1. Several computer labs (Frey 145, 166, and 245) equipped with appropriate software.
2. The mathematics reading room (Frey 341).
3. Student math resource people available Monday through Thursday nights in Frey 341.
4. Messiah College welcomes students with disabilities. **AMERICANS WITH DISABILITIES ACT:** Any student whose disability falls within ADA guidelines should inform the instructor within the first two weeks of any special accommodations or equipment needs necessary to complete the requirements for this course. Students must register documentation with the Office of Disability Services (Hoffman 101). If you have questions, call extension 5387.

Topics:

1. Develop a mathematical representation of a problem or situation; experimental, simulation, probabilistic.
2. Analyze the resulting mathematical structures.
3. Proportionality and geometric similarity.
4. Modeling with difference equations.
5. Modeling with differential equations.
6. Dimensional Analysis.
7. Curve fitting; least squares, cubic splines, curve smoothing.

During each class, we will discuss material from the text and work interactively on developing mathematical models. We will cover portions of chapters 1,2,3,4,5,6,8,9,10, and 11. You should read appropriate material as it is assigned. When this discussion is completed, a few practice problems will be assigned from the text. Throughout the semester we will work on several modeling problems (a total of about 8). These problems won't necessarily coincide with material from the text. You will work in groups of two or three to complete these problems. Since we will work on these problems in class, your attendance is expected at all class sessions. Absences will be deducted from the corresponding project grade. Your final will consist of one larger modeling project that you and your group will determine (with the instructor's approval). Work should be handed in at the beginning of class on the date it is due. Every day that the work is late will result in a 10% reduction of your grade. Exams may consist of material from the text or projects that have been completed. Exams may be made up only with a valid excuse.

Grading:	Hour Exams (2)	200 points
	Weekly projects	200 points
	Final Project	150 points
TOTAL POSSIBLE		550 points

Grading scale:	<u>Course %</u>	<u>Course Grade</u>
	90%	A
	80%	B
	70%	C
	60%	D

Exceptions to this table: Excessive absences may lower your grade. + and - given at instructor's discretion.

Important Dates:

Tests: October 21st, November 20th

Final project proposal: November 2nd

Final Project written report due: November 23rd

Final Exam Date (project presentations in lieu of final exam): December 14th at 10:30 a.m. School policy requires you to take the exam on this date. Make travel plans accordingly.