

**MATHEMATICS 4190**  
**MATHEMATICAL MODELLING**

This course is the culmination of the applied mathematics major. By now, the student has become proficient in some of the tools of mathematical modeling — differential equations, numerical methods, statistics — and has become familiar with mathematical modeling and computer applications. Applied Mathematics 4190 gives the student a good opportunity to apply this knowledge, while at the same time gaining familiarity with some mathematical models currently being discussed in scientific journals.

The projects considered in this course are open-ended. For any particular system about which you wish to know more, there are usually several possible viewpoints and levels for describing the problem, and several valid mathematical approaches to formulating and analyzing each description.

To be a mathematical modeller, you must have the ability both to ask and to answer a good question. This makes modeling much more challenging (but more interesting) than ordinary problem solving.

Say, for example, you wish to predict the size of the caplin stock off the shores of Newfoundland. You first must accurately identify the problem you want to solve: Do you want to estimate the total number of caplin in existence one year from now, or predict whether you will personally be able to catch some fish near Portugal Cove in each of the next 10 years? You then need to evaluate the pertinence of what is known or can be reasonably assumed about your system — the biology and behavior of the caplin, and the nature and strength of its interactions with the other fish, plants and fishermen in its environment. Finally, you can choose the type of mathematical model that fits your assumptions best and can be solved to provide you with the predictions you need; the model could be discrete or continuous, deterministic or stochastic, or purely statistical. Ultimately, the choice is up to you!

**Text.** Possible reference texts are *Mathematics for Dynamic Modelling* by Edward Beltrami (Academic Press) and *Mathematical Models in Population Biology and Epidemiology* by Brauer and Castillo-Chávez (Springer).

**Marks.** A written report and an oral presentation describing a mathematical model will be evaluated. Other assignments, projects or tests may be considered at the discretion of the instructor.

**Calendar description.** **4190 Mathematical Modelling** is intended to develop students' skills in mathematical modelling and competence in oral and written presentations. Case studies in modelling will be analyzed. Students will develop a mathematical model and present it in both oral and report form. Prerequisites: Mathematics 3100, 3161 and 4160, and a technical writing course offered by a Science department (Mathematics 2130 is recommended).

**Offered.** Winter