MATH 5329: Structure of Modeling with Rates of Change

Section 001, Fall 2011, CRN: 48062

I. COURSE INFORMATION

Instructor: Joe Champion, Ph.D.
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Webpage: http://sci.tamucc.edu/~jchampion
Office location: Center for Instruction #359
Office phone: 361-825-3165
Office hours: Mon 3-5, Tue/Thu 1:30-3

Meeting place: Center for Sciences 107
Meeting times: Mondays 7-9:30pm

II. COURSE DESCRIPTION

As suggested by the catalog description (below), this course provides an advanced perspective on the applications of mathematical change in secondary mathematics.

A study of rates of change through modeling. Direct applications of rates of change to number concepts, algebra, geometry, probability, and statistics.

III. PREREQUISITES for the COURSE

Graduate status

IV. REQUIRED TEXTBOOKS and OTHER MATERIALS

- A graphing calculator
- Regular access to high speed internet

V. STUDENT LEARNING OUTCOMES

Upon successful learning completion, students in the class will:

1. **Representations**: Move flexibly among graphical, numerical, and theoretical methods for analyzing data in mathematical contexts.
2. **Types of Growth**: Recognize and be able to work with linear, quadratic, and exponential growth of data presented graphically, numerically and theoretically.
3. **Discrete Modeling**: Recognize and be able to work with discrete-time models through difference equations, recursive relationships, and explicit formulas.
4. **Continuous Modeling**: Interpret and describe continuous-time mathematical models through derivatives, differential equations, and stability criterion for equilibria.
5. **Model Scope**: Communicate limitations of data as well as the assumptions and predictions of mathematical models.
6. **Application**: Independently explore an application of modeling and relate it to the secondary mathematics classroom.
VI. INSTRUCTIONAL METHODS and ACTIVITIES

The course will be a combination of instructional presentation of new material and concepts, whole-class discussion, individual investigations of mathematics, and optional one-on-one discussion time between students and the instructor outside of class. Students may be required to give individual or group presentations. All participants are expected to engage in group and whole class activities by contributing knowledge and thoughtful evaluation of others’ contributions.

VII. MAJOR COURSE REQUIREMENTS and ASSESSMENTS

Final course grades will be a weighted average of mean scores using the following weights:

- Classwork: 30%
- Project: 30%
- Quizzes: 20%
- Final Exam: 20%

Final weighted grades exceeding 90% will result in a letter grade of A. Those exceeding 80% will result in at least a B; ≥ 70% will result in at least a C; ≥ 60% will result in at least a D; below 60% will result in an F.

Classwork – participate in inquiry tasks, whole-class discussion, and group work activities during regularly scheduled class time. Homework may require high speed internet access, spreadsheets, and word processing software.

Project – Work individually or with a classmate to select and explore a modeling problem, then develop handouts and instructional materials for use in a secondary mathematics classroom.

Quizzes – demonstrate your mastery of select student learning outcomes during 30-60 minute group or individual assessments.

Final Exam – complete a comprehensive summative evaluation of your knowledge through a post-test. The final exam cannot be made-up if missed. If you have a conflict with the scheduled final exam time, please contact me at least one week prior to discuss scheduling options.

» The final exam is scheduled for **Monday, Dec. 12th at 7:15-9:45pm.**
VIII. COURSE OUTLINE (see course website for updates/changes)

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>TOPIC</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/29</td>
<td>Data-based Modeling</td>
<td>Introductions, pre-assessment, Atmospheric CO$_2$.</td>
</tr>
<tr>
<td>2</td>
<td>9/12</td>
<td>Difference Equations</td>
<td>Recursive Notation, Quiz #1</td>
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<tr>
<td>3</td>
<td>9/19</td>
<td>Linear Modeling</td>
<td>Scuba Diver, Soda Cans, Quiz #2</td>
</tr>
<tr>
<td>4</td>
<td>9/26</td>
<td>Polynomial Modeling</td>
<td>The Method of Differences, Calculators vs. Spreadsheets</td>
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<tr>
<td>5</td>
<td>10/3</td>
<td>Autocorrelation</td>
<td>Finite Markov Chains, Board Games</td>
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<tr>
<td>6</td>
<td>10/10</td>
<td>Model Simulation</td>
<td>Model Parameters, Equilibria, Stability, Quiz #3</td>
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<tr>
<td>7</td>
<td>10/17</td>
<td>Quadratic Growth</td>
<td>Networks, Lumber Company, Amusement Park</td>
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<tr>
<td>8</td>
<td>10/24</td>
<td>Coupled Dynamics</td>
<td>Predator-Prey, Marital Interactions, Quiz #4</td>
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<tr>
<td>9</td>
<td>10/31</td>
<td>Explicit Formulas</td>
<td>Backpacks, Leaky Tank</td>
</tr>
<tr>
<td>10</td>
<td>11/7</td>
<td>Math Modeling</td>
<td>Lake Erie, Choosing an Airline</td>
</tr>
<tr>
<td>11</td>
<td>11/14</td>
<td>Chaos and Dynamics</td>
<td>Modeling Fish Populations, Quiz #5</td>
</tr>
<tr>
<td>12</td>
<td>11/21</td>
<td>Presentations</td>
<td>Student applications</td>
</tr>
<tr>
<td>13</td>
<td>11/28</td>
<td>Presentations</td>
<td>Student applications, Quiz #6</td>
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<tr>
<td>14</td>
<td>12/5</td>
<td>Course Synthesis</td>
<td>Summary, key points, conclusions</td>
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<tr>
<td>15</td>
<td>12/12</td>
<td>Comprehensive</td>
<td>Final Exam at 9:15-9:45pm</td>
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IX. CLASS POLICIES

Attendance/Tardiness. Since the course duration is limited, you're expected to attend every class session, arrive on time, and complete all in-class activities. If you need to miss part or all of a class session, please contact me before class or as soon as possible. Email is usually best.

Late Homework. Homework will usually be due the next class, but may be submitted later if the student requests an extension prior to the deadline. The instructor may enforce strict deadlines on some assignments by announcing a "hard deadline." Partial credit on late submissions will be assigned at the instructor’s discretion.

Cell Phones/Electronic Devices. Please silence electronic devices during class and step out of class to use them. You may not use any personal electronic device during exams.

Written Work. Good writing skills are important in this class. Please type and proof-read your written assignments. The Writing Center is available for help with written assignments.
**In-Class Discussion.** Everyone in the class is encouraged to express personal views with an emphasis on evidence-based claims. Through maintaining a spirit of mutual respect and acknowledgement, the hope is that classroom discussion will be inviting, lively, and informative.

**Dropping a class.** I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance & participation WILL NOT automatically result in your being dropped from the class.

**Academic integrity.** University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a minimum of a 0 on the assignment or test.

**Disability services.** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101. If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

**Grade appeals process.** As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at tamucc.edu/provost/university_rules. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

**Classroom Behavior.** Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

**Changes.** The instructor may amend the syllabus at any time prior to the final exam by announcing the changes in class.