Texas A&M University - Corpus Christi  
College of Science and Engineering  
Department of Physical and Environmental Sciences  
Course Syllabus – CMSS 6352 – Environmental Forecasting  

Fall 2011  

INSTRUCTOR:  
Philippe Tissot  
Office: NRC-2801  
Office hours: T 12:00-1:00PM – T 4:00-5:00 -  
R 12:00-1:00PM  
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CLASS MEETINGS:  
TR 2:00-3:15 PM  
Classroom: ST-108  

TEXTBOOKS:  
Class Textbook, Required:  

Secondary Class References (not required, available at time from instructor):  
I. COURSE DESCRIPTION
Statistical techniques (classic and Bayesian) and new artificial intelligence based
techniques, such as neural networks, for the analysis of and forecasting of
environmental systems. Emphasis on the forecasting of coastal and marine
systems. Prerequisites: CMSS 6303, Natural Systems Analysis, CMSS 6305,
Natural Systems Modeling or approval of instructor.

II. COURSE AUDIENCE
PhD Students in the Coastal and Marine Science System Science program are the primary
audience for this course. Secondary audience includes graduate students (Masters) in
Mathematics and Environmental Science and professional forecasters from the local
office of the National Weather Service.

III. STUDENT LEARNING OUTCOMES
At the conclusion of this course the student should be able to:
1. Express forecasting problems with the proper mathematical formulation.
2. Recognize the differences between deterministic and chaotic systems and the limits
to the forecasting of chaotic systems.
3. Identify the differences between statistically based and first principle based models.
4. Generate climatic forecasts for environmental systems based on simple historical data
sets.
5. Utilize computer technology (the Matlab computational environment) to make
environmental forecasts.
6. Apply a range of statistical measures to characterize the performance of forecasting
models and analyze the results.
7. Recognize the main models presently used by researchers and state agencies to make
forecasts for oceanographic, atmospheric and ecological systems.
8. Recognize the difference between linear and non-linear forcings in environmental
systems.
9. Apply artificial neural network model to make basic environmental forecasts
10. Recognize the differences between training, verification, and testing sets and
formulate strategies to divide historical data sets into training, verification and
training sets.
11. Recognize the different Artificial Intelligence Based techniques applicable to the
forecast of environmental systems.
12. Write a proposal for the design and application of a forecasting model to an
environmental system.
13. Evaluate peer students proposals for forecasting models.
14. Design, apply and measure the performance of a forecasting model for a specific
environmental system, preferably related to the student’s own research area.

IV. COURSE TOPICS
Forecasting of environmental systems, deterministic and chaotic systems, climatic
forecasting, evaluation of forecasting models, analysis of time series, ARMA
models, seasonal time series, multivariate time series, non-linear systems,
artificial neural networks, ensemble forecasting.
V. INSTRUCTIONAL METHODS AND ACTIVITIES

Traditional lectures via board demonstrations and power point presentations, interactive model building with Matlab, classroom discussions, student projects, and visit of the local National Weather Service Office.

VI. EVALUATION AND GRADE ASSIGNMENT

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Overall Grade Percentage</th>
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<tbody>
<tr>
<td>Homework, Journal Article Reviews &amp; class topic presentations</td>
<td>15%</td>
</tr>
<tr>
<td>Mid-term Exam</td>
<td>20%</td>
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<tr>
<td>Research Proposal</td>
<td>15%</td>
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<tr>
<td>Assessment of Peers Research Proposals</td>
<td>10%</td>
</tr>
<tr>
<td>Project and Project Report/Poster</td>
<td>30%</td>
</tr>
<tr>
<td>Project Presentation</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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</tbody>
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Class Average X                      Grade
X ≥ 85.0%                         A - Excellent
70.0% ≤ X < 85.0%                  B – Good
55.0% ≤ X < 70.0%                  C - Satisfactory
40.0% ≤ X < 55.0%                  D - Passing
X < 40.0%                         F - Failing

VII. ATTENDANCE AND OTHER COURSE POLICIES

Students are required to attend all class meetings. Participation is essential to do well in the class. Discussions and student input are considered an important part of the class. Class exams cannot be retaken other than for an excused absence. Excused absences are limited to medical emergencies that can be certified in writing by a physician, participation in a TAMUCC sanctioned event or other similar circumstances justified in writing and specified in the TAMUCC graduate catalog for the ongoing academic year. Assignments are expected on time unless prior arrangements are made. Such prior arrangements will be granted only in exceptional circumstances as well. Submitting an assignment late without prior arrangement may lead to a grade of 0 and at least to a substantial penalty.
ACADEMIC HONESTY

Please review the University policies on academic integrity and honesty listed in the Graduate Catalog under the Academic Honesty section. The instructor will follow these guidelines if infractions such as plagiarism or other dishonest conduct occurs as part of this class. These guidelines will be followed for both the evaluation of the gravity of the infraction and the determination of an appropriate penalty. Any student who has been penalized for academic dishonesty has the right to appeal the judgment or the penalty assessed. The Appeals Procedure will be the same as that specified for grade appeals. The grade appeals procedure may be found in the University Rules manual at http://www.tamucc.edu/provost/university_rules/.

GRADE APPEAL 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 http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

VIII. DISABILITIES AND OTHER ACCOMMODATIONS

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. Certain accommodations for the successful completion of the course by students with disabilities, like testing in a quiet, secluded room, or providing extra time as deemed appropriate, can be made, after the above office has determined the appropriateness of such accommodations for the disabled student. Any action regarding such accommodation will require prior written notice to the instructor by the Office for Students with Disabilities.

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.
IX. TENTATIVE COURSE PROGRESSION

The class will tentatively follow the succession of topics below. Some adjustments to the succession and/or selection of topics may come as a result of class discussions to better address students’ needs and interests.

Introduction to forecasting and chaotic systems, formulation of forecasting problems, statistically and first principle based systems

Review of relevant probability and statistics concepts

Simple climatic forecasts

Forecast evaluations, verification

Analysis of time series, ARMA models, spectral analysis

Seasonal time series and multivariate time series

Description of present atmospheric, ocean, and ecological models used for coastal and marine systems

Visit of local office of National Weather Service Presentation– Discussion of student proposals

Survey of Artificial Intelligence (AI) techniques used in the environmental sciences

Artificial Neural Networks (ANN)

Random Forests (RFs)

Application of ANNs and RFs to environmental forecasting problems

Ensemble forecasting and other forecasting techniques

Presentations
BIBLIOGRAPHY


