This course is available for student registration only after the approval process has been completed.

**SUBJECT** M E T  
(e.g., CS2)  
**COURSE NO.** 4 3 1 1  
(e.g., 1301)  
**CREDIT HOURS** 3  
**TERM TO BE ADDED TO THE FILE** Spring 2012  
(e.g., Fall 2010)

**CLASS HOURS** 3/week  
**LECTURE HOURS** 3/week  
**LAB HOURS**  
**CONTACT HOURS (CEU ONLY)**

**DEPARTMENT** Marine and Environmental Systems  
(e.g., Computer Science)  
**SCHEDULE TYPE** Lecture (A)  
(e.g., Lecture, Lab or Special Topics/Project)

☐ COLLEGE OF AERONAUTICS - 23  
☐ COLLEGE OF PSYCHOLOGY AND LIBERAL ARTS - 25  
☐ NATHAN M. BISK COLLEGE OF BUSINESS - 24  
☐ COLLEGE OF SCIENCE - 26  
%X COLLEGE OF ENGINEERING - 1  
☐ EXTENDED STUDIES DIVISION / NATHAN M. BISK COLLEGE OF BUSINESS - 90

**COMPUTER TITLE** Restricted to 25 characters, including spaces  
**Numerical Weather Climate**

**CATALOG TITLE** Restricted to 350 characters, including spaces

Covers the physical and mathematical basis of numerical weather prediction; numerical methods and computational stabilities; modern operational and research forecast models; climate modeling and downscaling; post-processing methods; and coupling atmospheric models, model verification and methods for analyzing model output.

This description has been approved by the catalog office  
Catalog Director  
Date

**In addition, please attach a course syllabus and/or more detailed description.**

**RESTRICTIONS** ☑ Prerequisite MET 3402*  
☐ Corequisite Course Number  
☐ Corequisite Course Number  
☐ and ☐ or  

**GRADES TO BE ISSUED** ☑ A, B, C, D, F  
☐ A, B, C, D, F, CEU/Audit  
☐ CEU  
☐ S, U  
☐ P, F  
☐ Other

**ADDITIONAL RESTRICTION** ☑ or instructor permission  
(e.g., Major, Class Level, Department Head Approval)

If this course replaces a course currently offered in BANNER, please indicate old course information and the date/term the course may be removed from the system.

**SUBJECT** Alpha Prefix (e.g., CS2)  
**COURSE NO.** (e.g., 1301)  
**TERM TO INACTIVATE**

**APPROVALS:** Upon completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee for approval below and forward to Catalog Director.

Originator  
Date  
S. Mao  
March 31, 2011

Chair, Graduate Council  
Date  
Chair, Undergraduate Curriculum Committee  
Date

**CATALOG DIRECTOR**

These changes/additions have been made for the University Catalog/policy management system and entered into the BANNER term named above.

Catalog Director  
Date

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MET 4311 Numerical Weather and Climate Prediction

2011-2012 Catalog Data: MET 4311 NUMERICAL WEATHER AND CLIMATE PREDICTION (3 credits).
Covers the physical and mathematical basis of numerical weather prediction; numerical methods and computational stabilities; modern operational and research forecast models, climate modeling and downscaling, post-processing methods, and coupling atmospheric models, model verification, methods for analyzing model output.

Required

Prerequisites by Topics: MET 3402: “Synoptic Meteorology II”, or permission of the instructor.

Textbook (T) and References (R):


Course Learning Outcomes: The student will be able to:

1. Understand the basic mathematics for climate and weather modeling.
2. Understand weather and climate modeling capacity.
3. Conduct numerical forecasting and interpreting weather systems.
4. Apply simple models for numerical weather and climate predictions.

Topics Covered and Associated Time:

1. Historical development of NWP
2. Development of the governing equations
3. Map projections, objective analysis, smoothing
4. Numerical methods, including stability, consistency, convergence for finite difference and spectral methods
5. Wave motion, shallow water theory, and vertical structure
6. Compressible, anelastic, incompressible systems
7. Scale analysis, filtering, and development of the quasi-geostrophic system
8. Integral conservation laws and energetic consistency
9. Balance models and PE models
10. Spectral and pseudo-spectral models
12. Vertical coordinates and boundary conditions
13. Parameterization of physical processes
14. Initialization and assimilation
15. Atmospheric predictability
16. Model verification and performance
17. Techniques for analyzing (post-processing) model output
18. Climate and Regional Climate modeling and downscaling
19. Certain topics may be added or deleted pending time constraints.

Class/Laboratory Schedule: Fall, Tuesday and Thursday, 11:00 to 12:15 p.m.

Contribution of Course to Meeting the Professional Component: Atmospheric Science/Meteorology: 3 credit or 100%.

Grades: 2 exams plus final (20% each), Lab exercises (20%), and Homework (20%).

Relationship of Course to Program Outcomes:

| Course Outcomes                                                                 | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MET 4311 Numerical Weather and Climate Prediction                              | X | X |   |   | X |   |   |   |   |   |   |   |   |   |   |

Program Outcomes

A. Ability to apply knowledge of mathematics, science and engineering
B. Ability to design and conduct experiments, as well as to analyze and interpret data
C. Ability to design a system, component or process to meet desired needs
D. Ability to function on multi-disciplinary teams
E. Ability to identify, formulate and solve engineering problems
F. Understanding of professional and ethical responsibility
G. Ability to communicate effectively
H. Broad education to understand the impact of engineering solutions in global and societal context
I. Recognition of the need for, and an ability to engage in life-long learning
J. Knowledge of contemporary issues
K. Ability to use the techniques, skills, and engineering tools necessary for engineering practice
L. Knowledge and skills to apply principles of probability and statistics
M. Knowledge and skills to apply the principles of oceanography, waves and acoustics to engineering problems
N. An ability to integrate multiple technical areas
O. An understanding of the necessity for design optimization

Prepared By: S. Chiao, Ph.D., Associate Professor of Meteorology, 03/2011