Course Catalog - Fall 2006

Atmospheric Sciences

100 ***Introduction to Meteorology*** Credit: 3 hours.

Introduces the student to the basic concepts and principles of atmospheric science in a descriptive format; emphasizes the physics responsible for changes in the weather; uses current weather information to illustrate textbook material.

This course satisfies the General Education Criteria for a Physical Sciences, and Quant Reasoning II course.

120 ***Severe and Hazardous Weather*** Credit: 3 hours.

Most extreme manifestations of weather and climate are analyzed in terms of their physical basis and their historical, economic and human consequences. Emphasis is placed on the interplay between technological advances, the evolution of meteorology as a science, and the impacts of extreme weather (winter storms, floods, severe thunderstorms, hurricanes, El Nino). Technological advances include satellites, weather radars and profilers, and computer models used for weather prediction.

This course satisfies the General Education Criteria for a Physical Sciences course.

140 ***Climate and Global Change*** Credit: 3 hours.

Introduces climate change and its interactions with the global environment; surveys the physical, chemical, biological and social factors contributing to global change; includes topics such as greenhouse warming, acid rain, ozone depletion, regional drought and nuclear winter; distinguishes anthropogenic influences and natural variability of the earth system; addresses societal impacts, mitigation strategies, policy options and other human responses to global change. Prerequisite: A 100-level course in atmospheric science or chemistry or consent of instructor

This course satisfies the General Education Criteria for a Physical Sciences course.

199 ***Undergraduate Open Seminar*** Credit: 1 to 5 hours.

Special topics each term. May be repeated.

300 ***Weather Processes*** Credit: 3 hours.

Introduction to the mean state of the atmosphere, the fundamental physics of weather processes, and the mechanisms producing daily weather changes, both qualitative and quantitative in nature. Prerequisite: MATH 241 (formerly MATH 243) or MATH 242; or consent of instructor.

401 ***Atmospheric Physics*** Credit: 4 hours.

Quantitative introduction to atmospheric thermodynamics, cloud physics, and radiative transfer; topics include the structure, stability, and energy balance of the atmosphere, and the formation of clouds and precipitation. Prerequisite: MATH 241 (formerly MATH 243) or MATH 242; or consent of instructor.

402 ***Atmospheric Dynamics*** Credit: 4 hours.

Introduction to those elements of fluid dynamics and thermodynamics essential to understanding the large- and small-scale motions of the neutral atmosphere. Same as PHYS 429. Prerequisite: MATH 241 (formerly MATH 243) or MATH 380; or consent of instructor.

403 ***Weather Analysis & Forecasting*** Credit: 4 hours.

Course provides the student with the necessary skill to conceptualize the structure and dynamics of the atmosphere through interpretation and analysis of weather charts, time and cross sections, soundings, and forecast products. Students develop case studies of weather system structure, participate in discussions of weather processes as depicted by weather maps, and learn techniques of forecasting weather. The depiction of atmospheric kinematic and dynamic processes on weather charts is emphasized. Students learn conceptual models of the structure of mid-latitude cyclones and convective weather systems, including cyclogenesis, frontogenesis, the process of storm intensification, occlusion and frontolysis. Numerical weather prediction models and statistical forecasting techniques are reviewed and utilized. Prerequisite: ATMS 300, or consent of instructor.

410 ***Radar Meteorology*** Credit: 4 hours.

Basic principles of radar and references to other ground based remote sensing systems, with emphasis on radar.

Discusses principles of conventional and Doppler radar, data processing, and use of Doppler radar in meteorology. Emphasizes radar observations of meteorological phenomena, such as severe thunderstorms and wind shear. Students analyze data from national radar facilities. Prerequisite: ATMS 300, or consent of instructor.

411 ***Satellite Remote Sensing*** Credit: 4 hours.

Review of the basic techniques used in satellite remote sensing of the Earth's surface and atmosphere, as well as other planets in our solar system. Topics include radiative transfer, scattering and absorption processes, the Sun, mathematics of inversion, atmospheric properties and constituents, surface properties, precipitation, radiation budgets, image classification, satellite technology and orbital configurations. Laboratory work on radiative transfer modeling and satellite data analysis emphasized. All students participate in a team project that has novel and practical applications. Prerequisite: MATH 385 or MATH 386.

420 ***Atmospheric Chemistry*** Credit: 3 hours.

Same as CEE 447, and ENVS 450. See CEE 447.

421 ***Earth Systems Modeling*** Credit: 4 hours.

Introduction to systems modeling with applications to the earth and environmental sciences. Basic systems concepts and systems thinking in the contexts of hydrological, climatic, geochemical, and other environmentally relevant systems. Students identify key processes and relationships in systems, represent these elements quantitatively in models, test the models, use them to predict system behavior, and assess the validity of the predictions. No special mathematical or computing background is required. Same as GEOG 421, GEOL 481, and NRES 422. Prerequisite: Junior, senior, or graduate standing in a natural science, geography, natural resources and environmental studies, or engineering.

425 ***Air Quality Modeling*** Credit: 3 hours.

Same as CEE 445. See CEE 445.

449 ***Biogeochemical Cycles*** Credit: 4 hours.

Presents the key physical, biological, and chemical concepts of biogeochemical cycles central to understanding the causes of global changes in climate and air quality, focusing on an atmospheric sciences view of these cycles and their influences. Prerequisite: Consent of instructor.

468 ***Optical Remote Sensing*** Credit: 3 hours.

Same as ECE 468 and ATMS 468. See ECE 468.

490 ***Individual Study*** Credit: 1 to 4 hours.

Individual study or reading at an advanced undergraduate level in a subject not covered in normal course offerings. May be repeated to a maximum of 8 hours. May not be used to satisfy requirements for an M.S. or Ph.D. degree in Atmospheric Sciences. Prerequisite: Consent of advisor and of staff member supervising work.

491 ***Topics in Atmospheric Sciences*** Credit: 2 to 4 hours.

Special topics in atmospheric sciences at an advanced undergraduate level. May be repeated as topic varies to a maximum of 12 hours per term. Prerequisite: Advanced undergraduate standing and consent of instructor.

500 ***Synoptic Meteorology*** Credit: 4 hours.

Examines the observed behavior of the atmosphere through the application of physical and hydrodynamical principles to analyses of real meteorological data; develops concepts for studying atmospheric circulations, particularly extratropical cyclones and anticyclones. Laboratory work includes the development of diagnostic techniques suitable for a better understanding of the current weather. Prerequisite: ATMS 401 and ATMS 402.

501 ***Mesoscale Meteorology*** Credit: 4 hours.

Basic concepts and ideas on atmospheric processes that occur on scales of motions from a few kilometers to a few hundred kilometers, a scale loosely classified by meteorologists as "mesoscale". After an introductory discussion of mesoscale classifications and attendant forecast problems, the course will introduce various mesoscale phenomena, internally generated circulations, externally forced circulations, and mesoscale instabilities. Covers all three fundamental aspects of mesoscale meteorology: observations, theory and modeling, with particular emphasis on the dynamics of precipitating mesoscale systems Prerequisite: ATMS 401 and ATMS 402.

502 ***Numerical Fluid Dynamics*** Credit: 4 hours.
Intended to give the student practical numerical techniques for solving those linear and nonlinear differential equations which appear frequently as initial and boundary value problems in hydrodynamics and dynamic meteorology. Same as CS 505, and CSE 566. Prerequisite: MATH 241 (formerly MATH 243) or MATH 380; or consent of instructor.

510 ***Precipitation Physics*** Credit: 4 hours.
Develops an understanding of precipitation processes through cloud observations, microphysics, dynamics, and comprehensive theoretical models; includes growth by condensation, coalescence, and riming; and studies ice crystals, hail, and weather modification. Prerequisite: ATMS 401.

511 ***Atmospheric Radiation*** Credit: 4 hours.
Physical concepts and various methods of analysis of radiation scattering by atmospheric molecules, particulates, and clouds; infrared radiative transfer in a stratified inhomogeneous atmosphere; radiation and ozone photochemistry in the stratosphere; and remote temperature and composition sensing techniques using satellite radiation data. Prerequisite: ATMS 401.

520 ***General Circulation*** Credit: 4 hours.
Reviews the observed general circulation of the earth's atmosphere; discusses the balance requirements of mass, momentum, and energy conservation; illustrates, by means of mathematical models and laboratory physical models, the important processes which determine the earth's and other planets' general circulation. Prerequisite: ATMS 401 or equivalent, and ATMS 402.

521 ***Advanced Atmospheric Dynamics*** Credit: 4 hours.
Introduces the language and methods of modern atmospheric dynamics, covering the areas of atmospheric waves, dynamical instabilities, and wave-mean flow interactions. Emphasis is on gaining a physical understanding of atmospheric motions from planetary down to gravity wave scales, and on solving dynamical problems that arise in research. Prerequisite: ATMS 402 or consent of instructor.

530 ***Global Atmospheric Modeling*** Credit: 4 hours.
Course provides the student with training in the development, testing and application of physically based climate models. Physically based mathematical models of the earth's climate are used to study the causes of the ice ages which have occurred within a period of 100,000 years during the last two million years, the predictability of climate on the timescale of 1 to 3 months with particular attention to the worldwide El Nino phenomenon, and project the potential climatic consequences of the increasing concentrations of carbon dioxide and other greenhouse gases. Same as CSE 568. Prerequisite: ATMS 401 and ATMS 402, or consent of instructor.

535 ***Aerosol Sampling and Analysis*** Credit: 4 hours.
Same as CEE 545, ENVS 545, and ME 516. See CEE 545.

563 ***Tchg Higher Ed Earth & Env Sci*** Credit: 2 hours.
Introduction of curriculum development, pedagogy and teaching in atmospheric sciences at the university level. Topics covered include: learning styles, syllabus writing and course development, teaching methods and best science teaching practices, incorporating science research in the classroom, technology in the classroom, teaching philosophy, and assessment and evaluation. Students will participate in microteaching exercises and develop a teaching portfolio. Prerequisite: Consent of instructor.

571 ***Professional Development*** Credit: 1 hours.
Aimed at professional development in the atmospheric sciences so that students recognize the importance of breath of knowledge, effective oral and written scientific communication, and other skills they will need as professionals. May be repeated to a maximum of 2 hours. Approved for S/U grading only. Prerequisite: Graduate student in Atmospheric Sciences or consent of instructor.

590 ***Individual Study*** Credit: 2 to 8 hours.
Individual study or reading in a subject not covered in normal course offerings. Prerequisite: Consent of instructor.

591 ***Atmospheric Sciences Seminar*** Credit: 0 to 4 hours.
Seminar on topics of current interest. Approved for S/U grading only. Prerequisite: Consent of instructor.

596 ***Non-Thesis Research*** Credit: 4 hours.
Non-thesis research in the Atmospheric Sciences. Restricted to students in the non-thesis option. Approved for S/U grading only.

597 ***Special Topics in Atmos Sci*** Credit: 0 to 4 hours.
Lecture course in topics of current interest; subjects such as tropical meteorology, aerosol physics, and geophysical fluid dynamics will be covered in term offerings on a regular basis. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

599 ***Thesis Research*** Credit: 0 to 16 hours.
Section A: For master's degree candidates; Section B: For doctoral degree candidates. Approved for S/U grading only. Prerequisite: Consent of instructor.