ATMOSPHERIC SCIENCES, BS

Program Description

The Bachelor of Science program in Atmospheric Sciences addresses the needs of students interested in studying meteorology or climate science. The program provides students with an in-depth knowledge of the physical characteristics, motions and processes of air; as well as the interactions of this protective layer with the underlying oceans and continents. The undergraduate program emphasizes a systems approach, combining traditional atmospheric sciences with emerging fields. In particular, the program focuses on the fields of tropical meteorology and oceanography that are directly linked to the Gulf of Mexico and surrounding coastal regions where the university is strategically located.

Student Learning Outcomes

Students will:

- Possess a broad understanding of the field of atmospheric sciences in preparation for successful careers in related disciplines;
- Gain experience and professional competence in the use of scientific method to develop and conduct atmospheric sciences related work;
- Acquire the necessary skills to effectively communicate the meteorology and climate sciences information to a range of audiences and participate in community and/or professional service through various organizations.

General Requirements

The Bachelor of Science in Atmospheric Sciences degree requires a minimum of 120 semester credit hours: 42 are from designated University Core Curriculum Program courses, 57 are from atmospheric sciences core courses and 21 are from career track courses. The atmospheric sciences core provides students with a broad background in meteorology and climate sciences, and satisfy the requirements for federal employment as a National Weather Service meteorologist (also referred to as NOAA GS1340 positions). The students can choose a career track in either general atmospheric sciences or the broadcast meteorology. Students should select a career track as soon as possible after they complete their freshman year and well before they begin their junior year.

Requirements	Credit Hours
First-Year Seminars (when applicable)[1]	0-2
Core Curriculum Program (http://catalog.tamucc.edu/undergraduate/university-college/programs/core-curriculum-program/)	42
Atmospheric Sciences Core Courses	54
Atmospheric Sciences Career Track Courses - Electives	18-21
Electives to get to 120 [2]	6
Total Credit Hours	**120-125**

1

Full-time, first time in college students are required to take the first-year seminars.

- UNIV 1101 University Seminar I (1 sch)
- UNIV 1102 University Seminar II (1 sch)

2

Electives can range between 1-6 hours.

Program Requirements

Code	Title	Hours
Full-time, First-year Students		
UNIV 1101	University Seminar I	1
UNIV 1102	University Seminar II	1
Core Curriculum Program		
University Core Curriculum [1]		42
ATSC majors are required to take: [2]		
MATH 2413	Calculus I	
PHYS 2425	University Physics I	
PHYS 2426	University Physics II	
Atmospheric Sciences Core Courses		
ATSC 2403	Introduction to Meteorology	4
ATSC 2301	Weather Observations	3
ATSC 2302	Introduction of Data Analysis in Atmospheric Sciences	3
ATSC 3305	Physical Meteorology	3
ATSC 3306	Atmospheric Thermodynamics	3
ATSC 3401	Synoptic Meteorology	4
ATSC 3402	Mesoscale Meteorology	4
ATSC 4301	Dynamic Meteorology I	3
ATSC 4305	Remote Sensing	3
CHEM 1411	General Chemistry I	4
ATSC 4335	Climate and Climate Variability	3
MATH 2414	Calculus II (3 hours included in University Core)	1
MATH 3311	Linear Algebra	3
MATH 3315	Differential Equations	3
MATH 2415	Calculus III	4
ESCI 4360	Physical Oceanography	3
MATH 3345	Statistical Modeling and Data Analysis	3
Career Tracks in Atmospheric Sciences		
Select one of the following Tracks:		18-21
Atmospheric Sciences Track (p. 2)		
Broadcast Meteorology Track (p. 2)		
Electives		
Elective to get to 120		1-6
Total Hours		**120-125**

1

The ATSC Freshmen are encouraged to take advantage of the First-Year Writing classes (COMM 1311 Foundation of Communication (3 sch) & ENGL 1301 Writing and Rhetoric I (3 sch)) as part of the First-year Learning Communities Program to give them opportunities to work together, get to know each other, and learn together.

2

These three 4 semester credit hours courses will result in 3 extra semester credit hours, which may be counted as part of the Component Area Option in the University Core Curriculum.

Career Tracks in Atmospheric Sciences

The atmospheric sciences program offers the general Atmospheric Sciences Track and the Broadcast Meteorologist Track. The students from both tracks will satisfy the requirements for federal employment as a National Weather Service meteorologist (also referred to as NOAA GS1340 positions). A total of 21 semester hours of electives courses are required for both career tracks.

Atmospheric Sciences Track

The students in the general atmospheric sciences track are required to take 21 Sem. Hrs. from the following electives.

Code	Title	Hours
Select 21 hours of the following electives:		21
10 hours of electives must be Upper Division hours		
ATSC 2101	Weathercasting	
ATSC 4380	Atmospheric Modeling	
ESCI 1401	Environmental Science I: Intro to Environmental Science	
GEOL 4311	Paleoclimatology	
ESCI 3351	Oceanography	
GISC 1470	Geospatial Systems I	
ATSC 4496	Directed Independent Study	
ATSC 4590	Selected Topics	
PHYS 1304	Introduction to Astronomy: Solar System	
CHEM 1412	General Chemistry II	
CHEM 3411	Organic Chemistry I	
GEOL 4444	Hydrogeology	
MATH 4315	Partial Differential Equations	
GEOL 1403	Physical Geology	
MATH 2305	Discrete Mathematics I	
ATSC 4498	Internship in Atmospheric Science	
ATSC 4302	Dynamic Meteorology II	
GISC 1301	Physical Geography	
COSC 3385	Numerical Methods	
PHYS 4330	Mathematical Methods for Physicists	
ESCI 4344	Air Pollution and the Clean Air Act	
Total Hours		**21**

Broadcast Meteorology Track

Those students interested in becoming broadcast meteorologists should follow the Broadcast Meteorology Track. Students in this track take COMM 1311 Foundation of Communication (3 sch), ATSC 2101 Weathercasting (1 sch) and an additional 9 hours from the other electives listed below plus another 8 hours from the Atmospheric Sciences Track electives.

Students interested in English-only broadcasting need to take all 9 hours from the communication (COMM or MEDA) courses. Students interested in bilingual English-Spanish broadcasting must choose 3 hours from the communication (COMM or MEDA) courses, and 6 hours from the Spanish (SPAN) courses. An internship experience through ATSC 4498 Internship in Atmospheric Science (1-4 sch) is highly recommended for all broadcast meteorology students, preferably during their junior or senior years.

Code	Title	Hours
COMM 1311	Foundation of Communication [1]	3
ATSC 2101	Weathercasting	1
10 hours of electives must be Upper Division hours		
Select 9 hours of electives of the following:		9
COMM 1342	Voice and Diction	
MEDA 1380	Introduction to Media Production	
MEDA 2311	Media Writing	
MEDA 2350	Media Performance	
MEDA 2367	Media Industries	
MEDA 3314	Multimedia Journalism	
SPAN 2312	Continuing Spanish	
MEDA 2315	News Reporting	
SPAN 2313	Spanish for Heritage Speakers	
SPAN 3302	Spanish Composition	
SPAN 3303	Spanish Conversation	
ATSC 4498	Internship in Atmospheric Science	
Select 8 hours of additional electives of the general Atmospheric Sciences Track [2]		8
Total Hours		**18-21**

1

If COMM 1311 Foundation of Communication (3 sch) is taken as part of the university core, only 18 hours are required for this section.

2

Additional 8 semester hours of the electives from the general Atmospheric Sciences Track will be needed to satisfy the 18 semester hours of electives requirement. Other MEDA/COMM courses may be substituted with faculty mentor approval.

Course Sequencing

General Atmospheric Sciences

First Year		
Fall		**Hours**
UNIV 1101	University Seminar I	1
MATH 2413	Calculus I	4
ATSC 2403	Introduction to Meteorology	4
ENGL 1301	Writing and Rhetoric I	3
ATSC 2302	Introduction of Data Analysis in Atmospheric Sciences	3
	Hours	**15**
Spring		
UNIV 1102	University Seminar II	1
PHYS 2425	University Physics I	4
COMM 1311	Foundation of Communication	3
POLS 2306	State and Local Government	3
MATH 2414	Calculus II	4
	Hours	**15**
Second Year		
Fall		
MATH 2415	Calculus III	4

ATSC 3306	Atmospheric Thermodynamics	3
HIST 1302	U.S. History Since 1865	3
PHYS 2426	University Physics II	4
	Hours	**14**
Spring		
ATSC 4301	Dynamic Meteorology I	3
ATSC 2301	Weather Observations	3
CHEM 1411	General Chemistry I	4
HIST 1302	U.S. History Since 1865	3
ATSC Elective		4
	Hours	**17**
Third Year		
Fall		
MATH 3311	Linear Algebra	3
ATSC 3305	Physical Meteorology	3
ATSC 3401	Synoptic Meteorology	4
POLS 2305	U.S. Government and Politics	3
Social and Behavioral Sciences Core Requirement		3
	Hours	**16**
Spring		
MATH 3315	Differential Equations	3
ATSC 3402	Mesoscale Meteorology	4
ESCI 4360	Physical Oceanography	3
ATSC Elective		4
ATSC Elective		3
	Hours	**17**
Fourth Year		
Fall		
MATH 3345	Statistical Modeling and Data Analysis	3
ATSC 4335	Climate and Climate Variability	3
UL ATSC Elective		3
Language, Philosophy, & Culture Core Requirement		3
	Hours	**12**
Spring		
ATSC 4305	Remote Sensing	3
UL ATSC Elective		3
UL ATSC Elective		4
Creative Arts Core Requirement		3
Electives as needed for min 120		1
	Hours	**14**
	Total Hours	**120**

Broadcast Meteorology

First Year		
Fall		**Hours**
UNIV 1101	University Seminar I	1
MATH 2413	Calculus I	4
ATSC 2403	Introduction to Meteorology	4
ENGL 1301	Writing and Rhetoric I	3
ATSC 2302	Introduction of Data Analysis in Atmospheric Sciences	3
	Hours	**15**
Spring		
UNIV 1102	University Seminar II	1
PHYS 2425	University Physics I	4
COMM 1311	Foundation of Communication	3
POLS 2306	State and Local Government	3
MATH 2414	Calculus II	4
	Hours	**15**
Second Year		
Fall		
MATH 2415	Calculus III	4
ATSC 3306	Atmospheric Thermodynamics	3
HIST 1301	U.S. History to 1865	3
PHYS 2426	University Physics II	4
	Hours	**14**
Spring		
ATSC 4301	Dynamic Meteorology I	3
ATSC 2301	Weather Observations	3
CHEM 1411	General Chemistry I	4
HIST 1302	U.S. History Since 1865	3
ATSC Elective		3
	Hours	**16**
Third Year		
Fall		
MATH 3311	Linear Algebra	3
ATSC 3305	Physical Meteorology	3
ATSC 3401	Synoptic Meteorology	4
POLS 2305	U.S. Government and Politics	3
Social and Behavioral Sciences Core Requirement		3
	Hours	**16**
Spring		
MATH 3315	Differential Equations	3
ATSC 3402	Mesoscale Meteorology	4
ESCI 4360	Physical Oceanography	3
ATSC 2101	Weathercasting	1
Elective		3
ATSC Elective		3
	Hours	**17**
Fourth Year		
Fall		
MATH 3345	Statistical Modeling and Data Analysis	3
ATSC 4335	Climate and Climate Variability	3
UL ATSC elective		4
Language, Philosophy, & Culture Core requirement		3
	Hours	**13**
Spring		
ATSC 4305	Remote Sensing	3
UL ATSC Elective		3
UL Elective or ATSC 4498 Internship in Atmospheric Science		3-4
Creative Arts Core Requirement		3

Electives as needed for min 120	2
Hours	**14-15**
Total Hours	**120-121**

Courses

ATSC 2101 Weathercasting
1 Semester Credit Hour (1 Lecture Hour)
This course is to practice in preparing and presenting weathercasts for radio and television. The instructors of this course will provide the students with: (1) information in the form of lectures and supplemental readings; (2) opportunities to practice weathercasting on video, and (3) advice, supervision, and guidance. In lecture, students will spend most of the course learning about geography and weathercasting rules. A large portion of the course is to practice the weathercasting and report.
Prerequisite: ATSC 2403.

ATSC 2301 Weather Observations
3 Semester Credit Hours (3 Lecture Hours)
This course is an introduction of the basic concept of meteorology. The focus is on the measurements of the atmosphere and weather related phenomenon. The principle of the instruments used to measure temperature, pressure, moisture, radiation, precipitation and other weather related properties of the atmosphere will be introduced. The differences among the observations from in-situ, balloon borne, airborne, and satellite borne instruments will be examined and discussed.
Prerequisite: ATSC 2403.

ATSC 2302 Introduction of Data Analysis in Atmospheric Sciences
3 Semester Credit Hours (3 Lecture Hours)
This course will enhance student skills for analyzing atmospheric science-related datasets under various scientific programming environments. The focus is on developing a data analysis and problem-solving skillsets using mostly Python. The course includes: basic concepts of operating systems and high-level programming languages; basics of programming in Python; general data analysis methods and tools; scientific data formats used in remote sensing data and numerical model output; publication-quality scientific graphics; and critical steps of building a large programming project. Examples with IDL and FORTRAN are also included.

ATSC 2403 Introduction to Meteorology
4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)
This course is an introduction to meteorology and the dynamics of planetary atmospheres. Emphasis on atmospheric accretion, composition, evolution, structure, and dynamics. Lab exercises cover basic measurement techniques, weather maps, and forecasting.
Co-requisite: SMTE 0096.

ATSC 3305 Physical Meteorology
3 Semester Credit Hours (3 Lecture Hours)
This course will cover the fundamentals of atmospheric physics including atmospheric composition, kinetic theory of gases, stratospheric ozone chemistry, magnetosphere phenomena, fair-weather electric field, nucleation processes, cloud microphysics, precipitation processes, visibility and optics, lightning and atmospheric electrification, hydrometeors and aerosol science, air pollution concepts and transport, and scattering of electromagnetic radiation.
Prerequisite: ATSC 2403 and PHYS 2425*.
* May be taken concurrently.

ATSC 3306 Atmospheric Thermodynamics
3 Semester Credit Hours (3 Lecture Hours)
This course introduces a foundation in the thermodynamics of the atmosphere. After a brief review of general thermodynamics, the emphasis is given to the basic principles that are useful for the application to atmospheric problems. The course covers a number of atmospheric processes that are basically thermodynamic in nature. The specific topics include aerological diagrams, atmospheric statics, and vertical stability.
Prerequisite: ATSC 2403 and PHYS 2425*.
* May be taken concurrently.

ATSC 3401 Synoptic Meteorology
4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)
This course focuses on introducing middle-latitude synoptic weather phenomenon, including planet waves, frontal systems etc. We will apply principles of Dynamic Meteorology in regards to processes in the atmosphere, weather elements and forecasting. We will examine the structure and dynamics of these systems by integrating weather observations with the current state of dynamic theory, numerical weather prediction models, and the physical principles of atmospheric thermodynamics and cloud and precipitation physics.
Prerequisite: ATSC 3306* and MATH 2413.
* May be taken concurrently.
Co-requisite: SMTE 0096.

ATSC 3402 Mesoscale Meteorology
4 Semester Credit Hours (3 Lecture Hours, 2 Lab Hours)
This course focuses on introducing mesoscale weather systems including thunderstorms, squall lines and hurricanes, as well as the mechanisms of tornado and lighting. The methods of observing, analyzing, and predicting these severe weather systems with the interpretation of satellite and radar images will also be introduced in this class.
Prerequisite: ATSC 3306.
Co-requisite: SMTE 0096.

ATSC 4301 Dynamic Meteorology I
3 Semester Credit Hours (3 Lecture Hours)
This course focuses on introductory-level atmospheric dynamics. Basic concepts of geophysical fluid dynamics and its application to a variety of atmospheric phenomena are introduced. Specific topics include the equations of motion on rotating earth, vorticity, potential vorticity, divergence, circulation theorem, and planetary wave.
Prerequisite: MATH 2413.

ATSC 4302 Dynamic Meteorology II
3 Semester Credit Hours (3 Lecture Hours)
This course is a continuation of ATSC 4301 (Dynamic Meteorology I), which covers the introductory-level atmospheric dynamics. The course introduces more advance materials including equatorial waves, baroclinic and barotropic instability, two-dimensional turbulence, atmospheric teleconnection, El Nino/Southern Oscillation, Madden-Julian Oscillation, global warming, and numerical modeling of atmospheric circulations.
Prerequisite: ATSC 4301.

ATSC 4305 Remote Sensing
3 Semester Credit Hours (3 Lecture Hours)
This course aims to introduce the fundamentals of satellite/airborne remote sensing techniques and demonstrates its application to various aspects of Earth Sciences. Topics include physical principles of remote sensing from ultraviolet to the microwave, radiometry, sensors and sensor technology, calibration, and environmental applications for land, ocean and atmosphere research.
Prerequisite: PHYS 2426.

ATSC 4335 Climate and Climate Variability
3 Semester Credit Hours (3 Lecture Hours)
This course intended to guide environmental science undergraduate students in developing a conceptual understanding of Earth's global climate and its variability. Review past climates, present mean state of the climate system, climate variability from seasonal to multi-decadal time scales, and climate change. Special attention will be given to climates of the Gulf of Mexico, Caribbean Sea and surrounding land regions. Plausible climate-change scenarios, as well as mitigation and adaptation strategies will also be discussed. Cross listed with ESCI 4335.
Prerequisite: ATSC 2403.

ATSC 4380 Atmospheric Modeling
3 Semester Credit Hours (3 Lecture Hours)
Numerical modeling solves prognostic equations using a time-stepping procedure to simulate fluid behavior. Atmospheric models input a statistically optimized set of observations and solve momentum equations, a thermodynamic equation, the ideal gas law, and a conservation of mass equation. Atmospheric models are used for weather forecasting, case study simulations, climate change studies, and diagnostic studies. This course teaches the fundamental concepts of atmospheric modeling and a variety of practical applications.
Prerequisite: MATH 2413.

ATSC 4496 Directed Independent Study
1-4 Semester Credit Hours (1-4 Lecture Hours, 4 Lab Hours)
Requires a formal proposal of study to be completed in advance of registration and to be approved by the supervising faculty, the Chairperson, and the Dean of the College. This class may be repeated for credit after proper approval.

ATSC 4498 Internship in Atmospheric Science
1-4 Semester Credit Hours
ATSC 4498 (Internship in Atmospheric Science) gives ATSC undergraduates an opportunity to obtain valuable paid or unpaid work experience related to atmospheric science, to better position them for employment after graduation. Students contract to work a specified number of hours weekly over a full semester with a state or federal agency or private industry related to atmospheric science, in return for college credit as follows: 3-6 hrs./week=1 sem. hr., 6-9 hrs./week =2 sem. hrs., 9-12 hrs./week=3 sem. hrs., 12-15 hrs./week=4 sem. hrs. Students may contract for 1-2 sem. hrs. in a single summer session (5.5 weeks) but may contract for up to 4 sem. hrs. if carrying out internship over a regular long semester or two summer sessions (11 weeks). If interning for the summer, students should increase the number of hours interned weekly to account for the shortened period worked, so total hours interned will be equivalent to those in a regular long semester. A student may intern only twice with a single office or agency. The internships will not apply towards graduate credit.

ATSC 4590 Selected Topics
1-5 Semester Credit Hours (1-5 Lecture Hours, 5 Lab Hours)
This course includes special topics with variable content. May be repeated for credit. Offered on sufficient demand.