The University of Georgia

University Council
Athens, Georgia 30602

October 2, 2015

UNIVERSITY CURRICULUM COMMITTEE – 2015-2016
Dr. William K. Vencill, Chair
Agricultural and Environmental Sciences - Dr. Robert B. Beckstead
Arts and Sciences - Dr. Sujata Iyengar (Arts)
Dr. Rodney Mauricio (Sciences)
Business - Dr. Myra L. Moore
Ecology - Dr. James W. Porter
Education - Dr. Seock-Ho Kim
Engineering - Dr. Sudhagar Mani
Environment and Design - Mr. David Spooner
Family and Consumer Sciences - Dr. Silvia Giraudo
Forestry and Natural Resources - Dr. John C. Maerz
Journalism and Mass Communication - Dr. Alison F. Alexander
Law - Ms. Elizabeth Weeks Leonard
Pharmacy - Dr. Cory Momany
Public and International Affairs - Dr. Robert Grafstein
Public Health - Dr. Katie D. Hein
Social Work - Dr. David O. Okech
Veterinary Medicine - Dr. Kira L. Epstein
Graduate School - Dr. Timothy L. Foutz
Ex-Officio - Provost Pamela S. Whitten
Undergraduate Student Representative – Ms. Taylor K. Lamb
Graduate Student Representative – Ms. A. June Brawner

Dear Colleagues:

The attached proposal for a new major in Atmospheric Sciences (B.S.) will be an agenda item for the October 9, 2015, Full University Curriculum Committee meeting.

Sincerely,

William K. Vencill

William K. Vencill, Chair
University Curriculum Committee

cc: Provost Pamela S. Whitten
Dr. Rahul Shrivastav

The University of Georgia

Department of Geography
Telephone (706) 542-2856
Fax (706) 542-2388
http://geography.uga.edu/

Room 204
Geography/Geology Building
Athens, Georgia 30602-2502
USA

2 February 2015

Hugh Ruppersburg
Senior Associate Dean
Franklin College of Arts and Sciences
University of Georgia
CAMPUS

Dear Dean Ruppersburg,

I am pleased to present the attached proposal for a Bachelor of Science major in Atmospheric Sciences, administered by the Department of Geography. This proposal was approved by the faculty of the department by a vote of 19 yes, 0 no, on 28 January 2015. I am particularly delighted to present this proposal both as the head of the Department of Geography and as the first director of the Program in Atmospheric Sciences.

History

In 1996, department head George Brook and I shared a staffing proposal with Dean Wyatt Anderson to develop a new undergraduate program in atmospheric sciences. The addition of new faculty members in 1999 provided the staffing necessary to propose a 21-hour interdisciplinary undergraduate certificate, which became effective in 2001. We expanded the certificate to 31 hours in 2010 in response to new curriculum requirements by the American Meteorological Society. Dr. J. Marshall Shepherd became the director of the program in 2011, and he guided the university's successful application to the University Corporation for Atmospheric Research (UCAR), an organization of the leading universities in atmospheric and related sciences. He also served as president of the American Meteorological Society, the leading professional society in the atmospheric sciences, in 2013-2014. Dr. Shepherd is now developing a cooperative education MOU with the National Weather Service Forecast Office in Peachtree City.

Draft proposals for a major were circulated among our faculty as early as 2003, but discussions began in earnest after we expanded the certificate to 31 hours. (By comparison, the geography A.B. and B.S. majors each require 24 hours.) An initial draft of a major proposal was developed nearly two years ago and was first presented in a faculty meeting in Fall 2013. A revised version of the proposal was reconsidered at our Fall 2014 faculty retreat, and it was finally presented for a vote at our most recent faculty meeting.

Rationale

The core requirements identified in this major proposal are identical to the requirements in the existing certificate program. We do not require additional staffing to implement the program, although we can identify several opportunities for growth that would benefit our students, the program and the institution.

Our certificate students complete a curriculum equivalent to that of a major in atmospheric sciences or meteorology at other universities. Moreover, a number of certificates are now offered at other institutions that are less rigorous than our existing program. Unfortunately, some prospective employers view our certificate as equivalent to these lesser certificates, placing our students at a competitive disadvantage after graduation. Many prospective students do not consider the University of Georgia because a major is not available, even though our curriculum meets the federal civil service requirements and the American Meteorological Society's recommendations. Although our curriculum appears to meet Air Force ROTC requirements, UGA students are not eligible for ROTC scholarships to pursue education in atmospheric sciences or meteorology because of the lack of a major.

One of the unique and compelling aspects of our program is the integration with geography. For example, many prospective employers seek applicants with expertise in atmospheric sciences and geographic information science (GIS). We have designed the atmospheric sciences major so that it can be completed with a double major in geography, and we have produced a sample course schedule that demonstrates how students can complete both majors within 120 hours. Our program also includes a requirement in climate science that is lacking in most majors at other universities. We believe knowledge of climate science is critical for professionals in the atmospheric and related earth and environmental sciences.

Summary

This proposal represents a thoughtful transition from a successful certificate to an undergraduate major, and it retains the unique aspects of our existing program. Our existing curriculum is equivalent to majors offered at other universities, and this proposal does not require additional staffing to implement.

If you have any questions about this proposal, please contact me at tmote@uga.edu or 706-542-2856.

Sincerely,

Thomas L. Mote

Thomas L. Mote
Professor and Department Head

FORMAL PROPOSAL FOR A NEW DEGREE PROGRAM
(Traditional/Face-to-Face Delivery)

Institution: The University of Georgia

Approval by President or Vice President for Academic Affairs:

Pamela Whitten, Senior Vice President for Academic Affairs and Provost

Date: 2 February 2015

School/Division: Franklin College of Arts and Sciences

Department: Department of Geography

Departmental Contact: Thomas L. Mote, Department Head

Name of Proposed Program/Inscription: Atmospheric Sciences Major

Degree: Bachelor of Science

Major: Atmospheric Sciences

CIP Code:

Anticipated Implementation Date: Spring 2016

1. Description of the program's fit with the institutional mission, existing degrees and majors.

Atmospheric Sciences have been part of the University of Georgia curriculum since its founding. Josiah Meigs, the president responsible for opening UGA, "*was not a minister but a scientist and a serious student of meteorology and physics with a deep interest in natural phenomena*" (The University of Georgia: A Bicentennial History, 1785-1985 by Thomas G. Dyer, UGA Press 1985 pg. 12).

In the 50 years prior to the Undergraduate Certificate in Atmospheric Sciences in 2001, Atmospheric Sciences courses were taught primarily by the Geography Department. Responding to students' requests in the late 1990s, UGA developed an Undergraduate Certificate in Atmospheric Sciences in 1999. In 2001, the Board of Regents approved the undergraduate certificate program with a requirement of 21 credit hours. Several additional courses were developed for the certificate program, and the program was expanded to its current 31-hour requirement in 2010.

This proposal would convert the existing Undergraduate Certificate in Atmospheric Sciences to a major with minimal modification to the existing requirements. No new students will be allowed to begin the certificate program upon approval of the major. Students currently enrolled in the certificate will be allowed to complete the certificate or leave the certificate program and pursue the major. The certificate program will terminate upon graduation of the final student in the certificate program, or five years after the approval of the major, whichever occurs first.

Because a B.S. degree with a major in Geography can be completed with only a few additional courses beyond the Atmospheric Sciences major, most students will be encouraged to consider a double major with Geography. Appendix A is the proposed four-year course sequence for a major in Atmospheric Sciences, and Appendix B is the proposed four-year course sequence with a second major in Geography. This course sequence demonstrates a pathway that leads to an expedient program of study without extended semesters required.

2. Program Description and Goals:

   a. Institutional Priority: Describe how the proposed program is aligned with the institution's academic strategic plan. Indicate where this program falls in terms of the institution's top priorities for new degrees.

      The conversion of the Atmospheric Sciences certificate to a major is in line with strategic direction I, strategic priority g, "*Enhance the educational experience for students through co-curricular opportunities that intentionally support the academic mission of the university*" (pg. 8, "Building on Excellence: University of Georgia 2020 Strategic Plan). The major is in line with UGA's educational mission as a land-grant and sea grant university.

      The program is also aligned with strategic direction IV, strategic priority a, "*Document educational and outreach programs that enhance the social, economic and environmental well-being and health of individuals and communities, make business more successful, and make businesses more*

successful; and make government more efficient and responsive." It also aligns with strategic priority b, "*Linking UGA research and innovation to real-world problems…by linking classroom findings to critical issues in Georgia including economic development, the environment, and public health*." (pg. 19-20, "Building on Excellence: University of Georgia 2020 Strategic Plan). The required New Program Prospectus provides a clear overview Georgia's employment needs, economic impacts, and broader implications related to the program.

b. Brief description of the program and how it is to be delivered

The Atmospheric Sciences major will be delivered in a residential education setting in the same manner as the existing Undergraduate Atmospheric Sciences Certificate program.

c. Goals/objectives of the Program

The objectives of the major in Atmospheric Sciences are similar to the objectives of the current Undergraduate Certificate in Atmospheric Sciences. The objectives of the Atmospheric Sciences major are to educate atmospheric scientists in an academic setting that provides a liberal arts background, and whose graduates have the ability to integrate knowledge from several disciplines and skills to analyze atmospheric systems and solve atmospheric related problems. The graduates of this program will have a sound background in Atmospheric Sciences, mathematical, physical, and environmental sciences.

Specific objectives of the proposed program are to produce graduates that:

- have a fundamental understanding of the workings of the atmosphere and other environmental systems;
- have the necessary knowledge and skills to pursue graduate work or employment in the Atmospheric Sciences or other environmental related disciplines;
- have an understanding of the interactions between the atmosphere and other environmental systems; and
- have the necessary background to continue personal study in the Atmospheric Sciences and other environmental sciences.

d. Location of the program – main campus or other approved site

University of Georgia, Athens campus.

3. Curriculum: List the entire course of study required and recommended to complete the degree program. Provide a sample program of study that would be followed by a representative student. Include Area F requirements (if applicable).

a. Clearly differentiate which courses are existing and those that are newly developed courses. Include course titles as well as acronyms and credit hour requirements associated with each course.

All courses are existing courses, except ATSC 3990: Internship in Atmospheric Sciences. A new prefix "ATSC" will be requested for Atmospheric Sciences courses. Existing Atmospheric Science courses in Geography will be cross-listed as ATSC and GEOG. Other departments will be encouraged to cross-list relevant classes as appropriate.

CORE PREFERENCES SPECIFIC TO MAJOR

Area III Preference

CSCI 1301-1301L: Introduction to Computing and Programming (4 hours)

Area V Preference

GEOG 1101: Human Geography: People, Places, and Cultures (3 hours)

CORE REQUIREMENTS SPECIFIC TO MAJOR

Area VI Requirements (18 hours)

CHEM 1211: Freshman Chemistry I (3 hours)
GEOG 1112, GEOG 1112L: Introduction to Weather and Climate /w Lab (4 hours)
MATH 2270: Calculus III for Science and Engineering (4 hours)
MATH 2700: Elementary Differential Equations (3 hours)
PHYS 1212-1212L: Principles of Physics for Scientists and Engineers-Electricity and Magnetism, Optics, Modern Physics (4 hours)

MAJOR REQUIREMENTS

A. All students must complete 21 hours of core requirements

Complete all of the following (12 hours):
ATSC(GEOG) 3120-3120L: Weather Analysis and Forecasting (3 hours)
ATSC(ENGR)(GEOG) 4111/6111-4111L/6111L: Atmospheric Thermodynamics (3 hours)
ATSC(GEOG)(ENGR) 4112/6112: Atmospheric Dynamics (3 hours)
ATSC(ENGR)(PHYS) 4131/6131-4131L/6131L: Introductory Atmospheric Physics (3 hours)

Select one course in climatology (3 hours):
ATSC(ENGR)(GEOG) 4161/6161-4161L/6161L: Environmental Microclimatology (3 hours)

ATSC/GEOG 3110: Climatology (3 hours)
ATSC/GEOG 3180: Global Climate Change (3 hours)
ATSC/GEOG 4150: Physical Climatology (3 hours)
ATSC/GEOG 4160: Applied Climatology in the Urban Environment (3 hours)

Select one course in advanced atmospheric dynamics (3 hours):
ATSC 4114: Atmospheric Dynamics II (3 hours)
ATSC 4116-4116L: Introduction to Data Assimilation (3 hours)

Select one research or internship course (3 hours):
ATSC 4911: Collaborative Research in Atmospheric Sciences (3 hours)
ATSC 3990: Internship in Atmospheric Sciences (3 hours, new course)

B. All students must complete 9 hours from the following electives

Students interested in meeting the federal civil service requirements should complete ATSC/GEOG 4120, 4140 and 4170+L.

ATSC(GEOG) 3110: Climatology
ATSC(GEOG) 3130: Atmospheric Hazards
ATSC(GEOG) 3180: Global Climate Change: Causes and Consequences
ATSC(GEOG) 4120/6120: Synoptic Meteorology/Climatology
ATSC(GEOG) 4140/6140: Satellite Meteorology/Climatology
ATSC(GEOG) 4150/6150: Physical Climatology
ATSC(GEOG) 4160/6160: Applied Climatology in the Urban Environment
ATSC(ENGR)(GEOG) 4161/6161-4161L/6161L: Environmental Microclimatology
ATSC(GEOG) 4170/6170-4170L/6170L: Mesoscale and Radar Meteorology/Climatology
ATSC(ENGR)(GEOG) 4180/6180: Special Topics in Atmospheric Sciences.
ENGR 3160: Fluid Mechanics
ENGR 3410: Introduction to Natural Resource Engineering
ENVE 4460/6460: Groundwater Hydrology for Engineers
GEOL 4220/6220: Hydrogeology
WASR(FORS) 4110/6110-4110L/6110L: Forest Hydrology
WASR 4500/6500: Quantitative Methods in Hydrology

b. Append course descriptions for all courses (existing and new courses).

Please see Appendix C for a list of course descriptions and prerequisites. Please see Appendix A for a sample program of study.

c. When describing required and elective courses, list all course prerequisites.

Please see Appendix C for a list of course descriptions and prerequisites.

d. Provide documentation that the program and all courses in the proposed curriculum have been approved by all relevant campus curriculum governance bodies.
All courses are currently listed in the UGA Undergraduate Bulletin http://bulletin.uga.edu/index.aspx. ATSC 3990: Internship in Atmospheric Sciences will be submitted for approval with the approval of the ATSC prefix.

e. Append materials available from national accrediting agencies or professional organizations as they relate to curriculum standards for the proposed program.

Not applicable.

f. Indicate ways in which the proposed program is consistent with nationally accepted trends and standards in the discipline.

The major in Atmospheric Sciences meets the American Meteorological Society's recommendations for the education of an atmospheric scientist/meteorologist (http://www.ametsoc.org/policy/2010degree_atmosphericscience_amsstatement.html). Additionally, with the selection of ATSC/GEOG 4120, 4140, and 4170 as electives, the major meets federal civil service and military educational requirements for a meteorologist. The major also meets the civil service requirements for many additional environmental occupations, including hydrology and oceanography.

The University of Georgia recently became the 78th member of the University Corporation for Atmospheric Research (UCAR). Programs that meet the rigorous requirements for membership are considered among the leading institutions for instruction and research in the Atmospheric Sciences in the United States and Canada.

g. If internships or field experiences are required as part of the program, provide information documenting internship availability as well as how students will be assigned, supervised, and evaluated.

Internships will be coordinated by the Internship Coordinator in the Department of Geography. If sufficient demand arises, a separate coordinator will be named for the major. An internship is not required for the proposed major. Students may elect to complete an undergraduate research course or an internship. Students in the existing Undergraduate Certificate in Atmospheric Sciences regularly complete internships for credit as GEOG 3990, arranged on an individual basis.

h. Indicate the adequacy of core offerings to support the new program.

Neither additional personnel nor fiscal resources will be required for conversion of the Undergraduate Certificate in Atmospheric Sciences to a major in Atmospheric Sciences. All courses are currently being taught as part of the

undergraduate Atmospheric Sciences certificate program, with the exception of a new course ATSC 3990: Internship in Atmospheric Sciences.

i. Indicate the method of instructional delivery.

The Atmospheric Sciences major will be delivered in a face-to-face residential education setting on the University of Georgia campus in Athens, identical to the existing certificate program.

4. Admissions criteria. Please include required minima scores on appropriate standardized tests and grade point average requirements.

The major in Atmospheric Sciences will have the same admission standards as undergraduate admissions to the University of Georgia.

5. Availability of assistantships (if applicable).

Not applicable.

6. Evaluation and Assessment:
   a. Provide the student learning outcomes and other associated outcomes of the proposed program.

Students completing the requirements for the major in Atmospheric Sciences will be able to demonstrate:

- the application of the physical and mathematical sciences to weather analysis, synoptic meteorology/climatology, atmospheric dynamics, atmospheric energetics, and climate sciences;
- a qualitative and quantitative understanding of climate patterns and climate processes;
- weather analysis procedures used in understanding mesoscale and synoptic scale weather and forecasting;
- a qualitative and quantitative understanding of atmospheric processes involving atmospheric dynamics, atmospheric thermodynamics, and atmospheric energy transfer and balance;
- an understanding of current issues in the Atmospheric Sciences including, but not limited to, climate change, weather hazards, water resource, etc.;
- an understanding of scientific and professional ethics in the Atmospheric Sciences;
- the ability to communicate scientific information, in written and/or oral format, to broader audiences and stakeholders.

   b. Describe how the institution will monitor and ensure the quality of the degree program.

These learning outcomes will be assessed by grades in core and elective Atmospheric Sciences courses, independent research projects, internships, exit interviews, and interviews with employers and acceptance to graduate programs.

7. Administration of the program:
    a. Indicate where the program will be housed within the academic units of the institution.

       The program will be housed in the Department of Geography, Franklin College of Arts and Sciences.

    b. Describe the administration of the program inclusive of coordination and responsibility.

       The Director of the Atmospheric Sciences program will be responsible for the day-to-day administration of the major. Academic advising will be directed by the Undergraduate Coordinator for Atmospheric Sciences, which may be the same individual as the Undergraduate Coordinator for the Department of Geography.

8. Waiver to Degree-Credit Hour (if applicable): If the program exceeds the maximum credit hour requirement at a specific degree level, then provide an explanation supporting the increase of hours (NOTE: The maximum for bachelor's degrees is 120-semester credit hours and the maximum for master's degrees is 36-semester credit hours).

   Students can meet the major requirements within the 120-hour limit.

9. Accreditation (if applicable): Describe the program's alignment with disciplinary accreditation requirements and provide a time line for pursuing accreditation. Indicate the source of institutional funding that will be used, if needed, for the accreditation process.

   There are no accreditation processes for programs in Atmospheric Sciences. No funds will be needed for accreditation process. The major meets the civil service requirements for employment as a physics environmental scientist (as a hydrologist, physical oceanographer, environmental scientist, biological scientist, etc.). Students who select the proper electives in this major will meet the civil service requirements for a meteorologist. The major also meets the undergraduate educational requirements for atmospheric scientist as recommended by the American Meteorological Society, which can be reviewed at the following site: http://www.ametsoc.org/policy/2010degree_atmosphericscience_amsstatement.html.

10. External Reviews (This item only applies to doctoral level programs): Provide a list of five to eight reviewers, external to the System, from aspirational or comparable programs/institutions. This list should contain contact information for each reviewer, and include an explanation of why the reviewer was suggested. The list should not include individuals for whom the department or institution has consulted during the process of program proposal development.

    Not applicable.

11. Enrollment Projections and Monitoring

Narrative Explaining Projection Methodology

The University of Georgia has an existing base of students in the Atmospheric Sciences Certificate Program. The methodology assumes that in year 1 the existing certification students will be shifted into the new major and 5 new students will enter the major. The numbers shifted from other programs decline in subsequent years because the existing certificate students range from 2nd to 4th year students. The method assumes a certain percentage of graduates. Additionally, we conservatively estimate new enrollments at 10 new students per year after year 1. This number is believed to be conservative because the new major will allow the University of Georgia's Atmospheric Sciences program to appear in high school guidance counselor databases. As a certificate, it currently does not appear, so many high school students interested in atmospheric sciences are not aware of the program before coming to campus. Enrollments are not cohort-based.

If projections are not met, the director of the program, Geography head, and program undergraduate advisor will develop a recruitment strategy to increase enrollment. The program is already pilot-testing innovative marketing strategies in the local media, on campus, and at national conferences. We also believe the inclusion of the program in high school counselor databases will help with enrollment numbers going forward.

	First FY 16	Second FY 17	Third FY 18	Fourth FY 19
I. ENROLLMENT PROJECTIONS				
Student Majors				
Shifted from other programs	25	15	10	0
New to the institution	5	10	10	10
Total Majors	30	40	50	60
Course Sections Satisfying Program Requirements				
Previously existing	9	9	9	9
New	0	0	0	0
Total Program Course Sections	9	9	9	9
Credit Hours Generated by Those Courses				
Existing enrollments	360	300	300	540
New enrollments	0	0	0	0
Total Credit Hours	360	300	300	540

12. Provide the year when the program is expected to be reviewed in the institution's comprehensive program review process.

The Certificate in Atmospheric Sciences is scheduled in conjunction with the Department of Geography review. The next scheduled review is 2015-16. The major will also be reviewed in conjunction with the department.

13. Describe anticipated actions to be taken if enrollment does not meet projections.

If enrollment in the major falls below enrollment in the existing certificate, the director of the program will work closely with the department head and advisor(s) on a strategic recruitment plan to increase numbers. However, we are confident that the modification of the certificate program to a degree program will increase numbers. Currently, the certificate program does not appear in high school guidance counselor databases when a student expresses interest in weather or climate. Additionally, though our certificate program meets AMS and Federal meteorology standards as previously noted, there is a "stigma" among students and employers that will be eroded with a degree program. If the program is ultimately not successful, the certificate program can be reinstated.

14. Faculty Qualifications and Capacity:
    a. Provide an inventory of faculty directly involved with the program. On the list below indicate which persons are existing faculty and which are new hires. For each faculty member, provide the following information:

Faculty Name	Rank	Highest Degree	Degrees Earned	Academic Discipline	Area of Specialization	Current Workload
Andrew Grundstein	Professor	Ph.D.	Ph.D., Climatology, Delaware	Geography	Climate and health, hydroclimatology, physical climatology	4 courses / yr
John Knox	Assoc. Professor	Ph.D.	Ph.D., Atmospheric Science, Wisconsin	Geography	Atmospheric dynamics, geoscience education, atmospheric hazards	4.5 courses / yr
Pamela Knox	Public Service Assistant	M.S.	M.S., Atmospheric Science, Wisconsin	Crop and Soil Science	Climate, weather, agriculture, water resources	0 courses / yr (*no current Atmos. Sci. courses*)
Thomas Mote	Professor and Head, Geography	Ph.D.	Ph.D., Geography (meteo./clim.), Nebraska	Geography	Synoptic meteorology/climatology, satellite meteorology/climatology	2 courses / yr
David Porinchu	Assoc. Professor	Ph.D.	Ph.D., Geography, UCLA	Geography	Paleoclimate, climate change	4 courses / yr
David Stooksbury	Assoc. Professor	Ph.D.	Ph.D., Environmental Science, Virginia	Engineering	Climate, coastal systems, wind/solar resources	4 courses / yr
Alan Stewart	Assoc. Professor	Ph.D.	Ph.D., Counseling Psychology, Georgia. Atmospheric	Counseling Psychology	Weather salience, psychology of weather	4 courses / yr (*no current Atmos. Sci. courses*)

			Sciences Cert, Georgia			
J. Marshall Shepherd	Professor and Atm. Sci. Program Director	Ph.D.	Ph.D., Meteorology, Florida State	Geography	Meso/radar meteorology, urban, meteorology/climatology, satellite meteorology/climatology	3 courses / yr

Total Number of Faculty: ____8_____

If it will be necessary to add faculty to support the program, give the desired qualifications of the persons to be added, and a timetable for adding new faculty.

Funds are budgeted for two courses per year from a part-time faculty member to ensure sufficient coverage of courses at the lower-division level, providing opportunities for existing faculty to cover additional sections of our current courses.

b. If existing faculty will be used to deliver the new program, include a detailed faculty load analysis that explains how additional courses in the new program will be covered and what impact the new courses will have on faculty current workloads. (For example, if program faculty are currently teaching full loads, explain how the new course offerings will be accommodated.)

All lecture/lab courses are already offered for the existing Certificate in Atmospheric Sciences.

15. Budget – Complete the form below and provide a narrative to address the following:

a. For Expenditures:
   i. Provide a description of institutional resources that will be required for the program (e.g., personnel, library, equipment, laboratories, supplies, and capital expenditures at program start-up and recurring).

   ii. If the program involves reassigning existing faculty and/or staff, include the specific costs/expenses associated with reassigning faculty and staff to support the program (e.g. cost of part-time faculty to cover courses currently being taught by faculty being reassigned to the new program or portion of full-time faculty workload and salary allocated to the program).

Narrative Justification for Expenditures

In response to (i), no new tenure-track faculty lines are requested with the proposal, but it was estimated that part-time faculty will likely be required for two courses per academic year. These positions are budgeted assuming the standard rate of $5,500 developed by the Franklin College of Arts and Sciences. Equipment and laboratory space are adequate for the major since we are utilizing pre-existing resources from the Atmospheric Sciences Certificate Program.

Given the reliance on the existing Atmospheric Sciences Program faculty, the following analysis per (ii) was used to determine the reallocated cost of personnel. The average faculty salary is $86,500 per academic year for the Department of Geography. Only one-half of this is for instructional purposes (i.e., $43,250). The yearly cost of $43,250 was divided by four to estimate cost per course. We assume that 80% of the students are from the Atmospheric Sciences Program; therefore, taking 80% of the course cost. The summary total of $77,850 for personnel is the cost per course at $8,650 multiplied by 9 courses.

b. For Revenue:
    i. If using existing funds, provide a specific and detailed plan indicating the following:
        1. Source of existing funds being reallocated.
            a. The department will reallocate existing faculty currently teaching courses. The existing instructional funds for the current faculty will be reallocated at $77,850.
        2. How the existing resources will be reallocated to specific costs for the new program.
        3. The impact the redirection will have on units that lose funding.
    ii. Explain how the new tuition amounts are calculated.
    iii. Explain the nature of any student fees listed (course fees, lab fees, program fees, etc.). Exclude student mandatory fees (i.e., activity, health, athletic, etc.).
    iv. If revenues from Other Grants are included, please identify each grant and indicate if it has been awarded.

    If Other Revenue is included, identify the source(s) of this revenue and the amount of each source.

Narrative Justification for Revenue

New tuition amounts (item ii) were calculated based on tuition rate of $312 per credit hour multiplied by total credit hours generated. An example: FY16 estimated total credit hours are 360 x $312 = $112,320.

c. When Grand Total Revenue is not equal to Grand Total Costs:
    i. Explain how the institution will make up the shortfall. If reallocated funds are the primary tools being used to cover deficits, what is the plan to reduce the need for the program to rely on these funds to sustain the program?
    ii. If the projected enrollment is not realized, provide an explanation for how the institution will cover the shortfall.

Narrative Justification for Grant Total Revenue

No grant funding is anticipated in the budget.

I. EXPENDITURES	First FY Dollars	Second FY Dollars	Third FY Dollars	Fourth FY Dollars
Personnel – reassigned or existing positions				
Faculty **(see 15.a.ii)**	77,850	77,850	77,850	77,850
Part-time Faculty **(see 15 a.ii)**		0	0	0
Graduate Assistants **(see 15 a.ii)**	0	0	0	0
Administrators**(see 15 a.ii)**	0	0	0	0
Support Staff **(see 15 a.ii)**	0	0	0	0
Fringe Benefits	0	0	0	0
Other Personnel Costs	0	0	0	0
Total Existing Personnel Costs	77,850	77,850	77,850	77,850

EXPENDITURES (Continued)				
Personnel – new positions (see 15 a.i)				
Faculty	0	0	0	0
Part-time Faculty	11,000	11,000	11,000	11,000
Graduate Assistants	0	0	0	0
Administrators	0	0	0	0
Support Staff	0	0	0	0
Fringe Benefits	0	0	0	0
Other personnel costs	0	0	0	0
Total New Personnel Costs	11,000	11,000	11,000	11,000
Start-up Costs (one-time expenses) (see 15 a.i)				
Library/learning resources	0	0	0	0
Equipment	0	0	0	0
Other	0	0	0	0
	0	0	0	0
Physical Facilities: construction or renovation (see section on Facilities)	0	0	0	0
Total One-time Costs	0	0	0	0
Operating Costs (recurring costs – base budget) (see 15 a.i)				
Supplies/Expenses	0	0	0	0
Travel	0	0	0	0
Equipment	0	0	0	0
Library/learning resources	0	0	0	0
Other	0	0	0	0
Total Recurring Costs	0	0	0	0
GRAND TOTAL COSTS	88,850	88,850	88,850	88,850

III. REVENUE SOURCES				
Source of Funds				
Reallocation of existing funds **(see 15 b.i)**	0	0	0	0
New student workload			0	0
New Tuition **(see 15 b.ii)**	112,320	93,600	93,600	168,480
Federal funds	0	0	0	0
Other grants **(see 15 b.iv)**	0	0	0	0
Student fees **(see 15 b.iii)** Exclude mandatory fees (i.e., activity, health, athletic, etc.).	0	0	0	0
Other **(see 15 b.v)**	0	0	0	0
New state allocation requested for budget hearing	0	0	0	0
GRAND TOTAL REVENUES	0	0	0	0
Nature of Revenues				
Recurring/Permanent Funds	0	0	0	0
One-time funds	0	0	0	0
Projected Surplus/Deficit (Grand Total Revenue – Grand Total Costs) (see 15 c.i. & c.ii).	23,470	4,750	4,750	79,630

16. Facilities—Complete the table below.

			Total GSF
a.	**Indicate the floor area required for the program in gross square feet (gsf). When addressing space needs, please take into account the projected enrollment growth in the program over the next 10 years.**		4,900
b.	**Indicate if the new program will require new space or use existing space. (Place an "x" beside the appropriate selection.)**		
	Type of Space		**Comments**
i.	Construction of new space is required		
ii.	Existing space will require modification		
iii.	If new construction or renovation of existing space is anticipated, provide the justification for the need.		NA
iv.	Are there any accreditation standards or guidelines that will impact facilities/space needs in the future? If so, please describe what the impact will be.		NA
v.	Will this program cause any impacts on the campus infrastructure, such as parking, power, HVAC, etc. If so, indicate the nature of the impact, estimated cost and source of funding.		NA
vi.	Existing space will be used as is	X	
c.	**If new space is anticipated, provide information in space below.**		
i.	Estimated construction cost		0
ii.	Estimated total project budget cost		0
iii.	Proposed source of funding		NA
iv.	Availability of funds		NA
v.	When will the construction be completed and ready for occupancy? (Indicate semester and year).		NA
vi.	How will the construction be funded for the new space/facility?		NA
vii.	Indicate the status of the Project Concept Proposal submitted for consideration of project authorization to the Office of Facilities at the BOR. Has the project been authorized by the BOR or appropriate approving authority?		NA

d.	**If existing space will be used, provide information in space below.**
	Provide the building name(s) and floor(s) that will house or support the program. Indicate the campus, if part of a multi-campus institution and not on the main campus. Please do not simply list all possible space that could be used for the program. We are interested in the actual space that will be used for the program and its availability for use.
	Most classes will continue to meet in the Geography-Geology Building in space assignable by the Department of Geography. Most upper-division classes will meet in (BLDG-ROOM) 1002-0200D and 1002-0300A. Labs requiring computer resources will meet in 1002-0153 and 1002-0311. Seminars and general meeting space will be provided in 1002-0215. 1002-0153 and 1002-0215 are mostly dedicated space, while the other rooms are shared with other GEOG courses. Additional space can be reallocated as demand warrants.

e.	**List the specific type(s) and number of spaces that will be utilized (e.g. classrooms, labs, offices, etc.)**			
i.	**No. of Spaces**	**Type of Space**	**Number of Seats**	**Assignable Square Feet (ASF)**
	2	Classrooms	80	2,638
	2	Labs (dry)	52	1,580
	0	Labs (wet)	-	
	1	Meeting/Seminar Rooms	12	706
	0	Offices		
	0	Other (specify)		
		Total Assignable Square Feet (ASF)		**4,924**

ii.	If the program will be housed at a temporary location, please provide the information above for both the temporary space and the permanent space. Include a time frame for having the program in its permanent location.
	NA

Chief Business Officer or Chief Facilities Officer Name & Title	**Phone No.**	**Email Address**
	Signature	

Note: A Program Manager from the Office of Facilities at the System Office may contact you with further questions separate from the review of the new academic program.

Appendix A

4 YEAR / 8 SEMESTER EXAMPLE COURSE SCHEDULE FOR MAJOR IN ATMOSPHERIC SCIENCES (B.S.)

	Fall Semester		**Spring Semester**	
First Year	ENGL 1101	3	ENGL 1102 or 1103	3
	MATH 1113	3	MATH 2250	4
	GEOG 1112 + L	4	PHYS 1211 + L	4
	Foreign Language I	4	Foreign Language II	4
	FYOS 1001	1		
	TOTAL HOURS:	15	TOTAL HOURS:	15
Second Year	MATH 2260	4	MATH 2500	3
	PHYS 1212 + L	4	CHEM 1211	3
	PHYS 2001	1	POLS 1101	3
	Foreign Language III	3	ATSC Climatology	3
	ATSC(GEOG) 3120 + L	3	Programming	2-3
	TOTAL HOURS:	15	TOTAL HOURS:	14-15
Third Year	MATH 2700	3	ATSC(GEOG) 4114 or 4116	3
	ATSC(GEOG) 4112 + L	3	Life Science	3
	HIST 2111 or 2112	3	STAT 2000	4
	Literature Course	3	ATSC(GEOG) 4111 + L	3
	FA/PH/RL #1	3	FA/PH/RL #2	3
	TOTAL HOURS:	15	TOTAL HOURS:	16
Fourth Year	ATSC(GEOG) 4140	3	ATSC(GEOG) 4170 + L	3
	GEOG 1101	3	ATSC 3990	3
	Upper-Division general elective	3	ATSC(ENGR) 4131 + L	3
	Upper-Division general elective	3	ATSC(GEOG) 4120	3
	Upper-Division ATSC elective	3	General elective	2-3
	TOTAL HOURS:	15	TOTAL HOURS:	14-15

Appendix B

4 YEAR / 8 SEMESTER EXAMPLE COURSE SCHEDULE FOR DOUBLE MAJOR IN ATMOSPHERIC SCIENCES (B.S.) AND GEOGRAPHY (B.S.)

	Fall Semester		**Spring Semester**	
First Year	ENGL 1101	3	ENGL 1102 or 1103	3
	MATH 1113	3	MATH 2250	4
	GEOG 1112 + L	4	PHYS 1211 + L	4
	Foreign Language I	4	Foreign Language II	4
	FYOS 1001	1		
	TOTAL HOURS:	15	TOTAL HOURS:	15
Second Year	MATH 2260	4	MATH 2500	3
	PHYS 1212 + L	4	CHEM 1211	3
	PHYS 2001	1	POLS 1101	3
	Foreign Language III	3	GEOG Climatology course	3
	ATSC(GEOG) 3120 + L	3	Programming	2-3
	TOTAL HOURS:	15	TOTAL HOURS:	14-15
Third Year	MATH 2700	3	ATSC(GEOG) 4114 or 4116	3
	ATSC(GEOG) 4112 + L	3	Life Science	3
	HIST 2111 or 2112	3	STAT 2000	4
	Literature Course	3	GEOG 4111 + L	3
	FA/PH/RL #1	3	FA/PH/RL #2	3
	TOTAL HOURS:	15	TOTAL HOURS:	16
Fourth Year	ATSC(GEOG) 4140	3	ATSC(GEOG) 4170 + L	3
	GEOG 1101	3	ATSC 3990	3
	GEOG 3510	3	ATSC(ENGR) 4131 + L	3
	GEOG 36xx or 46xx or 47xx	3	GEOG 4120	3
	Upper-Division ATSC elective	3	General elective	2-3
	TOTAL HOURS:	15	TOTAL HOURS:	14-15

Appendix C

COURSE DESCRIPTIONS

Course ID: **GEOG 1112**. 3 hours.
Course Title: **Introduction to Weather and Climate**
Description: Atmospheric composition and structure, clouds, precipitation, and atmospheric motion and winds. Organized weather systems, including air masses, fronts, and severe weather. Discussion of global climates includes circulation, wind systems, climate classification, and climate change.
Short Title: INTRO WEATH & CLIM
Offered: Offered fall, spring and summer semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 1112L**. 1 hour. 2 hours lab per week.
Course Title: **Introduction to Weather and Climate Laboratory**
Description: Optional laboratory for Introduction to Weather and Climate.
Short Title: INTRO WEA & CLI LAB
Pre or Corequisite: GEOG 1112
Offered: Offered fall, spring and summer semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 2120H**. 3 hours.
Course Title: **Introduction to Weather and Climate (Honors)**
Description: Atmospheric composition and structure, clouds, precipitation, and atmospheric motion and winds. Organized weather systems, including air masses, fronts, and severe weather. Discussion of global climates includes circulation, wind systems, climate classification, and climate change.
Short Title: INTRO WEA & CLI HON
Duplicate Credit: Not open to students with credit in GEOG 1112
Prerequisite: Permission of Honors
Offered: Offered spring semester every even-numbered year.
Grading System: A-F (Traditional)

Course ID: **GEOG 3110**. 3 hours.
Course Title: **Climatology**
Description: Climatology from local to global scales. Topics include radiation/heat exchanges, the hydrologic cycle, global climate patterns, climate change, measurement and data sources, relationships of climate with ecosystem processes, and human activities, and climate forecasting.
Short Title: CLIMATOLOGY
Prerequisite: GEOG 1111 or GEOG 1112 or GEOG 2110H
Offered: Offered spring semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 3120-3120L**. 3 hours. 2 hours lecture and 2 hours lab per week.
Course Title: **Weather Analysis and Forecasting**
Description: The collection, display, and application of weather data. The use of meteorological instruments, codes, maps, atmospheric soundings, and thermodynamics diagrams. Interpretation of weather maps using basic meteorological principles.
Short Title: WEATHER ANALYSIS
Prerequisite: GEOG 1112
Offered: Offered fall semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 3130**. 3 hours.
Course Title: **Atmospheric Hazards**
Description: The causes, impacts and policies regarding hazards due to atmospheric phenomena, including hurricanes, tornadoes, windstorms, extreme temperature and precipitation events, and climate change.
Short Title: ATMOS HAZARDS
Prerequisite: GEOG 1111 or GEOG 1112 or GEOG 2110H
Offered: Offered fall semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 3180**. 3 hours.
Course Title: **Global Climate Change: Causes and Consequences**
Description: Provides students with the opportunity to critically evaluate the climatic and environmental changes currently facing our planet. Students will gain knowledge of the mechanisms that force climate and the human activities that affect the magnitude and direction of these forcing mechanisms and the impacts associated with these changes.
Short Title: GLOBAL CLIM CHANG
Pre or Corequisite: GEOG 1111 or GEOG 1112
Offered: Offered spring semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 4040/6040**. 3 hours.
Course Title: **Global Environmental Change During the Quaternary**
Description: Chronology and geomorphic, isotopic, and palynological evidence of Quaternary paleoclimates. The effects of past climatic changes upon present landscapes, historic short-term fluctuations in temperature and precipitation, and possible explanations for climatic change are emphasized.
Short Title: GLOBAL ENVIR CHANGE
Prerequisite: GEOG 3010 or permission of department
Offered: Offered fall semester every year.
Grading System: A-F (Traditional)

Course ID: **ENGR(GEOG) 4111/6111-4111L/6111L**. 3 hours. 2 hours lecture and 3 hours lab per week.
Course Title: **Atmospheric Thermodynamics**
Description: An introduction to atmospheric thermodynamics with emphasis on the first and second laws of thermodynamics, equation of state for gases, moisture variables, adiabatic and diabatic processes of dry and moist air, phase changes of water, and atmospheric statics.
Short Title: ATMOS THERMO
Prerequisite: MATH 2500 and (PHYS 1212-1212L or PHYS 1312-1312L)
Pre or Corequisite: MATH 2700 and (CHEM 1211 or CHEM 1311H or CHEM 1411) and (CSCI 1301-1301L or ENGR 1140)
Offered: Offered spring semester every odd-numbered year.
Grading System: A-F (Traditional)

Course ID: **GEOG(ENGR) 4112/6112**. 3 hours.
Course Title: **Atmospheric Dynamics**
Description: A quantitative investigation of large-scale atmospheric motion. Equations of motion are derived from basic physical laws. Concepts of vorticity, quasi-geostrophic theory, and general circulation are addressed.
Short Title: ATMOS DYNAMICS
Offered: Offered fall semester every even-numbered year.
Prerequisite: (GEOG 1112 and GEOG 1112L and MATH 2200) or permission of department
Grading System: A-F (Traditional)

Course ID: **GEOG 4114/6114**. 3 hours.
Course Title: **Atmospheric Dynamics II**
Description: A quantitative investigation of atmospheric phenomena, including boundary-layer dynamics; balanced dynamics theory; atmospheric waves; geostrophic adjustment theories; atmospheric instabilities and cyclogenesis theories; frontogenesis theories; jet stream dynamics; introduction to finite difference methods; survey of tropical dynamics and middle atmosphere dynamics.
Short Title: ATMOS DYNAMICS II
Prerequisite: GEOG(ENGR) 4112 or permission of department
Offered: Offered spring semester every odd-numbered year.
Grading System: A-F (Traditional)

Course ID: **GEOG 4116/6116-4116L/6116L**. 3 hours. 3 hours lecture and 3 hours lab per week.
Course Title: **Introduction to Data Assimilation**
Description: Introduction to the concepts, theory, and computational methods of data assimilation in the atmospheric and related sciences. Topics include the history of data assimilation, the "rejection problem," adjustment to balance, balance constraints, nonlinear normal mode initialization, variational data assimilation, Kalman filter methods and applications to different disciplines and data types.
Short Title: INTRO DATA ASSIM
Prerequisite: GEOG(ENGR) 4112 or permission of department
Offered: Offered spring semester every odd-numbered year.
Grading System: A-F (Traditional)

Course ID: **GEOG 4120/6120**. 3 hours.
Course Title: **Synoptic Meteorology/Climatology**
Description: Theory and observations to understand mid-latitude weather systems. Focus is on application of quasi-geostrophic theory in weather forecasting. Analysis and interpretation of weather maps and numerical models. Development and life cycle of cyclones, fronts, and jet streams.
Short Title: SYNOP METEOR & CLIM
Prerequisite: GEOG 3120-3120L or permission of department
Grading System: A-F (Traditional)

Course ID: **GEOG 4121/6121**. 1-3 hours. Repeatable for maximum 9 hours credit.
Course Title: **Weather Forecasting Seminar**
Description: A weather forecasting practicum that provides an opportunity for students to obtain real-time, real-world experience forecasting conventional weather parameters at selected cities in the United States.
Short Title: WEATHER FCST SEMINA
Format: Class hours are by arrangement with the relevant faculty and vary depending on credit hours.
Pre or Corequisite: GEOG 3120-3120L
Offered: Offered fall and spring semester every year.
Grading System: A-F (Traditional)

Course ID: **GEOG 4140/6140**. 3 hours.
Course Title: **Satellite Meteorology/Climatology**
Description: Application of satellite remote sensing in meteorology and climatology. Applications include clouds, atmospheric water vapor and precipitation, the Earth's radiation budget, sea and land surface temperatures.
Short Title: SATEL METEOR & CLIM
Prerequisite: (GEOG 1111 and GEOG 1111L) or (GEOG 1112 and GEOG 1112L) or (GEOG 2110H and GEOG 2110L) or permission of department
Grading System: A-F (Traditional)

Course ID: **GEOG 4150/6150**. 3 hours.
Course Title: **Physical Climatology**
Description: Advanced, quantitative study of Earth's physical climate. Includes global energy balance, surface-atmosphere energy exchanges, surface hydrology and water budget at various temporal and spatial scales. Methods of measuring and modeling are discussed. Case studies are used to illustrate how the physical processes govern the climate system.
Short Title: PHYS CLIMATOLOGY
Prerequisite: GEOG 3110 or GEOG 3120-3120L or GEOG 4140/6140 or GEOG 4160/6160 or ENGR(GEOG) 4161/6161-4161L/6161L or GEOG(ENGR) 4112/6112 or permission of department
Offered: Offered fall semester every odd-numbered year.
Grading System: A-F (Traditional)

Course ID: **GEOG 4160/6160**. 3 hours.
Course Title: **Applied Climatology in the Urban Environment**
Description: Do cities create their own thunderstorms? Will pollution from emerging mega-cities change climate? Exploration of fundamental concepts of the urban-climate system, observational and modeling strategies for studying the urban-climate system, and context for how human activity in the built environment is changing Earth's weather and hydro-climate.
Short Title: APPLIED CLIMATOLOGY
Undergrad Prereq: GEOG 3110 or GEOG 3120-3120L or permission of department
Graduate Prereq: GEOG 3110 or GEOG 3120-3120L or permission of department
Offered: Offered fall semester every even-numbered year.
Grading System: A-F (Traditional)

Course ID: **ENGR(GEOG) 4161/6161-4161L/6161L**. 3 hours. 3 hours lecture and 2 hours lab per week.
Course Title: **Environmental Microclimatology**
Description: An introduction to the interactions between the biosphere and atmosphere. Energy, moisture, and carbon exchange in the soil-plant-atmosphere continuum with applications to managed and natural environments. The impact of weather and climate on humans and domesticated animals. Elementary turbulent exchange theory will be introduced.
Short Title: ENV MICROCLIMATE
Prerequisite: (MATH 2500 or MATH 2700) and (PHYS 1211-1211L or PHYS 1311-1311L)
Offered: Not offered on a regular basis.
Grading System: A-F (Traditional)

Course ID: **GEOG 4170/6170-4170L/6170L**. 3 hours. 2 hours lecture and 2 hours lab per week.
Course Title: **Mesoscale and Radar Meteorology/Climatology**
Description: Fundamental theory, analysis, and exercises on mesoscale weather phenomena and principles of radar meteorology. A major topical focus will be thunderstorms, mesoscale convective systems, and tornadic supercells. Other topics will include mesoscale classification, observing systems, the boundary layer, circulations, flooding, mesoscale tropical systems, mesoscale modeling, short-range forecasting/nowcasting, and mesoscale climatology.
Short Title: MESO-RADAR MET/CLIM
Prerequisite: GEOG 3120-3120L
Pre or Corequisite: MATH 2250
Offered: Offered spring semester every year.
Grading System: A-F (Traditional)

Course ID: **ENGR(GEOG) 4180/6180**. 3 hours. Repeatable for maximum 6 hours credit.
Course Title: **Special Topics in Atmospheric Sciences**
Description: Special interest topics in atmospheric sciences.
Short Title: TOPICS ATMOS SCI
Prerequisite: Permission of department
Offered: Offered every year.
Grading System: A-F (Traditional)

Course ID: **ENGR 3160**. 3 hours. 2 hours lecture and 2 hours lab per week.
Course Title: **Fluid Mechanics**
Description: Laws of fluid behavior used in calculating the forces and energies generated by fluids at rest and in motion; applications to pipe systems, including pumps and turbines.
Short Title: FLUID MECHANICS
Prerequisite: ENGR 2120
Pre or Corequisite: MATH 2700
Offered: Offered fall and spring semester every year.
Grading System: A-F (Traditional)

Course ID: **ENGR 3410**. 3 hours. 2 hours lecture and 3 hours lab per week.
Course Title: **Introduction to Natural Resource Engineering**
Description: Engineering hydrology, soil erosion, introduction to open channel design, runoff estimations and calculations, engineered containment structures, landscape-scale water distribution, and non-point water quality.
Short Title: NAT RESOURCE ENGR
Pre or Corequisite: ENGR 3160
Offered: Offered fall semester every year.
Grading System: A-F (Traditional)

Course ID: **ENVE 4460/6460**. 3 hours. 2 hours lecture and 2 hours lab per week.
Course Title: **Groundwater Hydrology for Engineers**
Description: Occurrence and movement of ground water, derivation of equations of saturated and unsaturated flow, aquifer hydraulic parameter estimation, analytical solutions to flow problems. Solute transport equations and development of analytical solutions. Use of numerical tool for solving flow and transport problems.
Short Title: GROUNDWATER HYDROL
Prerequisite: ENGR 3160
Offered: Offered every year.
Grading System: A-F (Traditional)

Course ID: **GEOL 4220/6220**. 3 hours.
Course Title: **Hydrogeology**
Description: Groundwater in the hydrologic cycle. Examination of flow through porous media, regional flow, influence of wells, water chemistry, and contaminant transport. Emphasis on practical environmental problems.
Short Title: HYDROGEOLOGY
Offered: Offered fall semester every year.
Grading System: A-F (Traditional)

Course ID: **WASR(FORS) 4110/6110-4110L/6110L**. 4 hours. 3 hours lecture and 3 hours lab per week.
Course Title: **Forest Hydrology**
Description: Multidisciplinary examination of the terrestrial components of the hydrologic cycle focusing on the qualitative analysis of precipitation, snowmelt, runoff generation, routing, infiltration, and subsurface flow and transport. Emphasis is on the definition of hydrologic processes, identification of hydrologic resources, development of environmental monitoring techniques, and application to hydrologic resources management.
Short Title: FOREST HYDROLOGY
Prerequisite: ENGR 3410 or CRSS(FORS) 3060-3060L or CRSS(FANR) 3060-3060L or GEOL 4220/6220 or GEOG 4030/6030 or ECOL 3520 or CRSS 3050-3050L or CRSS 4600/6600-4600L/6600L
Offered: Offered spring semester every year.
Grading System: A-F (Traditional)

Course ID:	**WASR 4500/6500**. 3 hours.
Course Title:	**Quantitative Methods in Hydrology**
Description:	Advanced analysis of hydrologic processes to provide a theoretical understanding of precipitation, evapotranspiration, streamflow, groundwater occurrence and movement, and soil zone flow and transport. Emphasis is upon quantitative methods used in conjunction with field and laboratory data to identify flow and transport dynamics in hydrologic systems.
Short Title:	QUANT HYDROLOGY
Duplicate Credit:	Not open to students with credit in FORS 4120/6120
Prerequisite:	ENGR 3410 or CRSS(FORS) 3060-3060L or CRSS(FANR) 3060-3060L or WASR(FORS) 4110/6110-4110L/6110L or FORS 4110/6110-4110L/6110L or GEOL 4220/6220 or GEOG 4030/6030 or CRSS 4600/6600-4600L/6600L or permission of school
Offered:	Offered fall semester every year.
Grading System:	A-F (Traditional)