2024-2025 Course Catalog

STATE UNIVERSITY OF NEW YORK

College of Environmental Science and Forestry

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ABOUT ESF

ESF has 27 undergraduate majors, 23 leading to the Bachelor of Science degree, one leading to the Bachelor of Landscape Architecture degree, and three leading to the Associate of Applied Science degree. Our programs cover chemical engineering, paper engineering, bioprocessing engineering, environmental sciences, environmental health, sustainable resources management, environmental resources engineering, environmental biology, environmental design, environmental policy, environmental social science, and the utilization of natural resources.

ESF's programs are administered through eight academic departments and the interdisciplinary Division of Environmental Science. The A.A.S. programs are conducted at ESF's Wanakena Campus in the Adirondacks under the auspices of the Department of Sustainable Resources Management (SRM).

ESF's Graduate School oversees nine graduate programs, each with multiple options, and all focusing on science, engineering, or management.

ESF's academic programs rely heavily on experiential learning, including indoor and field laboratories, internships, research experiences, and applied capstone projects. In the most recent National Survey of Student Engagement (2020), ESF graduating seniors reported having significantly more research experiences, culminating senior experiences, and service-learning experiences, than peer comparison groups.

The overall student/faculty ratio is 16:1; the undergraduate ratio is 13:1.

For the class entering 2017, the six-year graduation rate calculated in 2023 was 71% (These are the students who completed a Bachelor's degree). The SUNY average for the year 2016 is 67%. This compares to a national Public average of 63.5%, according to SUNY fast facts website. In a survey of 2023 baccalaureate graduates (86.7% response rate), 90% reported employment or graduate school placement within 6 months of graduation; 86% of respondents reported working in a position related to their majors.

ESF Campuses

- www.esf.edu/about/campus

ESF is a multiple-campus institution that includes approximately 1 million square feet of facilities in 186 buildings on 25,000 acres of land. Facilities for education and research are provided on the main campus in Syracuse and at five regional campuses and three field stations.

About the State University of New York (SUNY)

- www.suny.edu

The State University of New York's 64 geographically dispersed campuses bring educational opportunity within commuting distance of virtually all New Yorkers and comprise the nation's largest comprehensive system of public higher education.

Accreditation

The State University of New York College of Environmental Science and Forestry is accredited by:

Middle States Commission on Higher Education
1007 North Orange St.
4th Floor, MB #166
Wilmington, DE 19801

The Middle States Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The master of forestry degree; the bachelor of science degrees in forest resource management, forest ecosystem science and natural resources management; and the associate in applied science degree in forest technology are accredited by the Society of American Foresters (SAF). SAF is recognized by the Commission on Recognition of Postsecondary Accreditation as the specialized accrediting body for forestry in the United States:
Society of American Foresters
5400 Grosvenor Lane
Bethesda, MD 20814-2198
301-897-8720

The bachelor of science degrees in bioprocess engineering, environmental resources engineering, and paper engineering are accredited by:
Engineering Accreditation Commission of ABET
111 Market Place, Suite 1050
Baltimore, MD 21202
410-347-7700

The associate in applied science degree in land surveying technology is accredited by:
Engineering Technology Accreditation Commission of ABET
111 Market Place, Suite 1050
Baltimore, MD 21202
410-347-7700

The bachelor of landscape architecture and master of landscape architecture degrees are accredited by:
Landscape Architectural Accreditation Board
603 Eye St. NW, Suite 500
Washington, D.C. 20001

Admission

Undergraduate Admission

Undergraduate enrollment for Fall 2024 was 1,844. Approximately 12% of our undergraduate students are transfers from other colleges and universities and 2% are international students; of Fall 2024 first-year students, 77% residents are of New York state.

Admission at the undergraduate level is selective, with 65-70% of first-year applicants admitted.

- www.esf.edu/admissions/undergraduate

High School Students

High School seniors may apply for admission under one of the three pathways available:

- **Early Action First-Year**
- **Regular First-Year**
- **Guaranteed Transfer** (future entry as a sophomore or junior)

The level of the applicant's interest in ESF and the quality of their academic performance in high school will determine which pathway is most appropriate. Admissions staff members can assist applicants in selecting their admission pathway. Students who have completed college level coursework prior to high school graduation will be considered as first year applicants.

Transfer Students

- www.esf.edu/admissions/undergraduate/transfer/

SUNY ESF welcomes transfer students in all undergraduate programs of study. Approximately 30% of our students transfer to ESF. Applicants who have completed college-level coursework following high school graduation will be considered as transfer applicants.

Graduate School Admission

- www.esf.edu/graduate

ESF is a Carnegie Doctoral/Research university. Other Carnegie descriptors include STEM dominant, high undergraduate, more selective, primarily residential, and higher transfer-in. ESF is the only Carnegie Doctoral/Research university that is classified as "small."

Graduate enrollment for Fall 2024 was 362 students. 47% are enrolled in doctoral programs; 36% M.S., 16% in professional master's, and the remainder are in certificates of advanced studies or are visiting students. 31% of graduate students are international.

Admission to the Graduate School is conditional upon review and acceptance of an applicant's credentials by appropriate faculty members and upon the recommendation of the appropriate department chairman or program director to the Interim Associate Provost for Academic Affairs and Dean of the Graduate School.

Faculty

- www.esf.edu/faculty

International Education

- www.esf.edu/international

The Office of International Education (OIE) services include immigration advising for F-1 and J-1 students and J-1 visiting scholars, and immigration document processing for Admissions and the Graduate School. The office also offers study abroad advisement for all students wanting to have an international experience, and the office supports international education programming and orientation for newly arrived international students and scholars. OIE serves as an emergency point of contact for students conducting research abroad, participating in international programs, and ESF faculty-led courses abroad.

Open Academy

- www.esf.edu/open-academy

The ESF Open Academy is an academic unit that encompasses the College's outreach programs including online education, summer semester, professional and public education, and visiting student support.

To these ends, ESF faculty, staff and students, along with our partners, pursue a diverse range of programs and projects—all with an aim to enhance leadership, education, and practice in the science, design, engineering and management of natural resources and the environment. Programs include on-campus, off-campus, and online credit and non-credit opportunities for professionals, middle and high school students, ESF students, and lifelong learners.

Research

- www.esf.edu/research

Research at ESF is remarkably diverse, current, and challenging, with contributions being made in fields like aquatic ecosystems, bioenergy, biotechnology, biodiversity, ecology, genetic engineering, nanotechnology, remote sensing, wildlife disease prevention, and many others.

ESF is a leader in integrating the energy and excitement of research with the formal requirements of degree and certificate programs. A high percentage of undergraduates and virtually all graduate students participate in research activity as part of their educational experience.

Staff and Administration

- www.esf.edu/about/leadership/president
- www.esf.edu/about/leadership/executive-vp-and-provost
- www.esf.edu/about/leadership/board-of-trustees

Student Affairs

- www.esf.edu/student-affairs

The Division of Student Affairs is guided by the College’s strategic goal of providing an outstanding student experience. The creative and dedicated team of professionals in Student Affairs will work to achieve this goal by creating opportunities for personal and leadership development, through community-focused learning experiences, and by offering services to promote academic and career success.

Key Policies and Procedures

- www.esf.edu/employees/policies

Campus Safety Report

- www.esf.edu/safety/annual-security-reports.php

A Campus Safety Report is filed as required by the federal "Crime Awareness and Campus Security Act," or "Clery Act." The purpose of this report is to provide our faculty, staff and students with campus safety information including crime statistics and procedures to follow to report a crime.

The report is prepared and published each Oct. 1 by our University Police, Judicial Affairs and Environmental Health and Safety Department. It is also available in printed format from the University Police Department in Room 19 Bray Hall on request.

Collegewide Smoking Policy

- www.esf.edu/employees/policies/policies-tobacco-free.php

New York State legislation regulates smoking in all workplaces. Effective July 24, 2003, smoking is prohibited in all indoor areas on College property. Individuals who choose to smoke may do so outdoors, no closer than 20 feet from building openings such as doors, windows, air intakes, loading docks or similar structures, or in any area where flammable substances or combustible materials are used or stored. Smoking also is prohibited in all College vehicles.

Student Consumer Information

- www.esf.edu/consumer

This website provides student consumer information as required by the Federal Higher Education Opportunity Act and the United States Department of Education.

Title IX

- www.esf.edu/administration/titleix

Title IX is the federal anti-discrimination law that states: "No person in the U.S. shall, on the basis of sex, be excluded from participation in, or denied the benefits of, or be subjected to discrimination under any educational program or activity receiving federal aid." (Title IX of the Education Amendments of 1972).

This applies to all College programs and activities including, but not limited to, academic and athletic programs, financial aid and student records and accounts, health and counseling services, and housing and residence life programs.

Title IX prohibits sex discrimination against students, employees, or third parties. Sex discrimination includes sexual harassment, sexual assault, and sexual violence.

VA Pending Payment Compliance

In accordance with Title 38 US Code 3679 subsection (e), this school adopts the following additional provisions for any students using U.S. Department of Veterans Affairs (VA) Post 9/11 G.I. Bill® (Ch. 33) or Vocational Rehabilitation and Employment (Ch. 31) benefits, while payment to the institution is pending from the VA. This school ***will not:***

- Prevent nor delay the student's enrollment
- Assess a late penalty fee to the student
- Require the student to secure alternative or additional funding
- Deny the student access to any resources available to other students who have satisfied their tuition and fee bills to the institution, including but not limited to access to classes, libraries, or other institutional facilities

However, to qualify for this provision, such students may be required to:

- Produce the Certificate of Eligibility by the first day of class
- Provide written request to be certified
- Provide additional information needed to properly certify the enrollment as described in other institutional policies

ACADEMIC CALENDAR

Spring 2025

Syracuse Campus

Classes begin	January 13
Martin Luther King Day (no classes)	January 20
Last day to add a class	January 21
Last day to drop a class	February 7
Mid-term Grading	March 3 - 7
Spring break (no classes)	March 9 - 16
Advising for Fall 2025	March 26 - April 1
Registration for Fall 2025	April 2 - June 30
Last day to withdraw from a class	April 18
Last day of classes	April 28
Reading days	April 29 - 30
Final Exams	May 1 - 2
Reading days	May 3 - 4
Final Exams	May 5 - 6
ESF May Commencement	May 10
ESF/SU Joint May Commencement	May 11
Grades due	May 13

Wanakena Campus

Ranger School Arrival/Move-in	January 20
Ranger School classes begin	January 21
Ranger School spring break (no classes)	March 22 - 30
Last Day of Classes	May 23
Ranger School Graduation	May 24
Grades due	May 28

Summer 2025

Maymester	May 12 - May 23
Summer Session 1	May 19 - June 27
Combined Summer Session	May 19 - August 8
Memorial Day - no classes	May 26
Juneteenth - no classes	June 19
Summer Session 2	June 30 - August 8
Independence day - no classes	July 4

Fall 2025

Syracuse Campus

Classes begin	August 25
Labor Day (no classes)	September 1
Last day to add a class	September 2
Last day to drop a class	September 19
Fall break (no classes)	October 13 - 14
Mid-term grading	October 13 - 17
Advising for Spring 2026	October 27 - November 4
Registration for Spring 2026	November 5 - January 2
Thanksgiving Recess (no classes)	November 23 - 30
Last day to withdraw from a class	November 28
Last day of classes	December 9
Reading day	December 10
Final Exams	December 11 - 12
Reading days	December 13 - 14
Final Exams	December 15 - 16
Grades due	December 23

Wanakena Campus

Ranger School Arrival/Move-in	August 17

Ranger School classes begin	August 20
Labor Day (no classes)	September 1
Fall break (no classes)	October 13
Thanksgiving Recess	November 23-November 30
Last day of classes Ranger School	December 19
Grades due Ranger School	December 26

Spring 2026

Syracuse Campus

Classes begin	January 12
Martin Luther King Day (no classes)	January 19
Last day to add a class	January 20
Last day to drop a class	February 6
Mid-term Grading	March 2 - 6
Spring break (no classes)	March 8 - 15
Advising for Fall 2026	April 1 - April 7
Registration for Fall 2026	April 8 - June 30
Last day to withdraw from a class	April 17
Last day of classes	April 27
Reading days	April 28 - 29
Final Exams	April 30 - May 1
Reading days	May 2 - 3
Final Exams	May 4 - 5
ESF May Commencement	May 9
ESF/SU Joint May Commencement	May 10
Grades due	May 12

Wanakena Campus

Ranger School Arrival/Move-in	January 19
Ranger School classes begin	January 20

Ranger School Spring Recess (no classes)	March 21-29
Last day of classes Ranger School	May 22
Ranger School Commencement	May 23
Grades due Ranger School	May 27

Fall 2026

Syracuse Campus

Classes begin	August 31
Labor Day (no classes)	September 7
Last day to add a class	September 8
Last day to drop a class	September 25
Fall break (no classes)	October 12 - 13
Mid-term grading	October 12 - 16
Advising for Spring 2027	November 2 - November 10
Registration for Spring 2027	November 11 - January 1
Thanksgiving Recess (no classes)	November 22 - 29
Last day to withdraw from a class	November 11
Last day of classes	December 15
Reading day	December 16
Final Exams	December 17 - 18
Reading days	December 19 - 20
Final Exams	December 21 - 22
Grades due	December 29

Spring 2027

Syracuse Campus

Classes begin	January 11
Martin Luther King Day (no classes)	January 18
Last day to add a class	January 19
Last day to drop a class	February 5

Mid-term Grading	March 1 - 5
Spring break (no classes)	March 7 - 14
Advising for Fall 2027	March 29 - April 6
Registration for Fall 2027	April 7 - June 30
Last day to withdraw from a class	April 16
Last day of classes	April 26
Reading days	April 27 - 28
Final Exams	April 29 - 30
Reading days	May 1 - 2
Final Exams	May 3 - 4
ESF May Commencement	May 8
ESF/SU Joint May Commencement	May 9
Grades due	May 11

Fall 2027

Syracuse Campus

Classes begin	August 30
Labor Day (no classes)	September 6
Last day to add a class	September 7
Last day to drop a class	September 24
Fall break (no classes)	October 11 - 12
Mid-term grading	October 18 - 22
Advising for Spring 2028	November 1 - November 9
Registration for Spring 2028	November 10 - December 31
Thanksgiving Recess (no classes)	November 21 - 28
Last day to withdraw from a class	December 3
Last day of classes	December 14
Reading day	December 15
Final Exams	December 16 - 17

Reading days	December 18 - 19
Final Exams	December 20 - 21
Grades due	December 28

Spring 2028

Syracuse Campus

Martin Luther King Day (no classes)	January 17
Classes begin	January 18
Last day to add a class	January 25
Last day to drop a class	February 11
Mid-term Grading	March 6 - 10
Spring break (no classes)	March 12 - 19
Advising for Fall 2028	March 27 - April 4
Registration for Fall 2028	April 5 - June 30
Last day to withdraw from a class	April 21
Last day of classes	May 1
Reading days	May 2 - 3
Final Exams	May 4 - 5
Reading days	May 6 - 7
Final Exams	May 8 - 9
ESF May Commencement	May 13
ESF/SU Joint May Commencement	May 14
Grades due	May 16

Fall 2028

Syracuse Campus

Classes begin	August 28
Labor Day (no classes)	September 4
Last day to add a class	September 5
Last day to drop a class	September 22

Fall break (no classes)	October 9 - 10
Mid-term grading	October 16 - 20
Advising for Spring 2029	November 1 - 9
Registration for Spring 2029	November 8 - December 31
Thanksgiving Recess (no classes)	November 19 - 26
Last day to withdraw from a class	December 1
Last day of classes	December 12
Reading day	December 13
Final Exams	December 14 - 15
Reading days	December 16 - 17
Final Exams	December 18 - 19
Grades due	December 26

Spring 2029

Syracuse Campus

Martin Luther King Day (no classes)	January 15
Classes begin	January 16
Last day to add a class	January 23
Last day to drop a class	February 9
Mid-term Grading	March 5 - 9
Spring break (no classes)	March 11 - 18
Advising for Fall 2029	April 2 - 10
Registration for Fall 2029	April 11 - June 29
Last day to withdraw from a class	April 20
Last day of classes	April 30
Reading days	May 1 - 2
Final Exams	May 3 - 4
Reading days	May 5 - 6
Final Exams	May 7 - 8

ESF May Commencement	May 12
ESF/SU Joint May Commencement	May 13
Grades due	May 15

Fall 2029

Syracuse Campus

Classes begin	August 27
Labor Day (no classes)	September 3
Last day to add a class	September 4
Last day to drop a class	September21
Fall break (no classes)	October 8 - 9
Mid-term grading	October 15 - 19
Advising for Spring 2030	October 29 - November 6
Registration for Spring 2030	November 7 - December 31
Thanksgiving Recess (no classes)	November 18 - 25
Last day to withdraw from a class	November 30
Last day of classes	December 11
Reading day	December 12
Final Exams	December 13 - 14
Reading days	December 15- 16
Final Exams	December 17 - 18
Grades due	December 26

Spring 2030

Syracuse Campus

Classes begin	January 14
Martin Luther King Day (no classes)	January 21
Last day to add a class	January 22
Last day to drop a class	February 8
Mid-term Grading	March 4 - 8

Spring break (no classes)	March 10 - 17
Advising for Fall 2030	April 1 - 9
Registration for Fall 2030	April 10 - June 28
Last day to withdraw from a class	April 19
Last day of classes	April 29
Reading days	April 30 - May 1
Final Exams	May 2 - 3
Reading days	May 4 - 5
Final Exams	May 6 - 7
ESF May Commencement	May 11
ESF/SU Joint May Commencement	May 12
Grades due	May 14

Statement of Academic Integrity

The College of Environmental Science and Forestry is an institution of higher learning where growth and development are fostered, excellence is pursued and the highest standards of academic integrity are expected. The Code of Student Conduct (“the Code”) outlines the behaviors that are expected of all students at the College. As a condition of enrollment, all students are required to acknowledge that they have (a) received a copy of the Code; (b) read the Code; (c) understand the provisions of the Code; and (d) agree to abide by the provisions of the Code.

The ESF Student Judicial Handbook and Code of Student Conduct are available online.

College-wide Academic Policies

General Requirements

A student seeking a degree must be in matriculated status. All degree requirements must be completed through a combination of formally accepted transfer credits and/or courses taken at ESF and Syracuse University.

Attendance

Students are expected to adhere to the attendance policy stated by each course instructor. Instructors may make attendance part of the course requirement.

Timely Feedback

Faculty shall provide all students with timely and appropriate feedback regarding their performance and progress toward meeting prescribed learning outcomes on all assigned coursework, projects and examinations.

Course-numbering System

Courses at ESF are numbered according to the following system:

- 100-499 Undergraduate courses for which no graduate credit may be given.
- 500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs. Qualified undergraduate students may enroll with permission of the instructor.
- 600-699 Graduate courses designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition.
- 700-999 Advanced graduate level courses for which no undergraduate students may register.

Shared resources courses, designated as 400/500 or 400/600, are designed when the topic coverage of both courses is the same. Separate course syllabi are developed expressly differentiating the requirements and evaluative criteria between the undergraduate course and the graduate course. No type of cross listing may be offered unless approved by the ESF faculty.

Courses listed are offered subject to the availability of instructional faculty and sufficient student enrollment. Students and advisors should consult the actual schedule of courses published each semester to determine the availability and time of courses.

Dropping or Adding Courses

For those students receiving financial support through the College, dropping courses that result in the student being less than full time will have an impact on support received. Contact the Office of Financial Aid and Scholarships for more detailed information.

Students may add courses with the approval of both their academic advisor and the course instructor and may drop courses with their advisor/major professor's approval and notification to the course instructor using an appropriate drop/add form until the last day for program adjustments as listed in the ESF academic calendar. Courses dropped during this time will not appear on the student's transcript. Courses that begin after the published add date may be added prior to the start of the course. Courses that last for less than one semester may be dropped no later than halfway through the course. In either case, the student must submit a completed drop/add form. Following the last day to add a class, students may withdraw from individual courses. Withdrawal policies and deadlines are described in the **Withdrawal from Individual Courses** section below.

Incomplete and missing grades

A temporary grade of I may be assigned by an instructor only when the student has nearly completed the course but because of significant circumstances beyond the student's control the work is not completed. Grades of I should be resolved within one academic year. If the incomplete is not resolved within one year, it will be changed to a grade of I/F or I/U, depending on the grading basis for the course. No degree will be conferred until all grades of I have been resolved.

Repeating Courses

Undergraduate students may repeat any course previously taken either to earn a higher grade or because of a previous failure. Courses taken at ESF or Syracuse University that contribute to the GPA may be repeated. Ability to repeat a course may be limited by space availability, providing priority for first time registrants.

Repeated courses will be reported as follows: a) the original and the repeated grade(s) appear on the transcript; b) only the higher (or highest) grade is included in the calculation of the cumulative grade point average. The highest grade will be marked with an "I" for included to show that it is included in the cumulative GPA. Any other grades will be marked with an "E" for excluded to show that it is excluded from the cumulative GPA.

When a student earns the same grade in a repeated course a) the grade is calculated once in the cumulative grade point average and b) the credits and quality points are applied to the most recent term or semester in which the grade was earned. Credit hours for the repeated course may be counted only once toward meeting graduation requirements.

For state-based financial aid, repeated courses in which students have received a passing grade will not count toward full time status. Students retaking courses may find their financial aid reduced if they fall below 12 credits when the retaken courses are not included. Students should contact the Financial Aid Office to determine the impact of retaking courses on their financial aid. Students receiving Federal Aid may repeat a previously passed course one time and still receive aid. Students may receive aid for previously failed courses that are repeated more than once. All repeated courses count as attempted credits for the purposes of measuring Satisfactory Academic Progress.

Exceptions to Curriculum and Academic Policy Requirements

Exceptions to academic policies stated in this document and curriculum requirements may be made by the Faculty Subcommittee on Academic Standards, which also may delegate this authority. Exceptions may not violate standards established by the State University of New York or the New York State Education Department.

Exceptions must be requested on a petition form and must have a recommendation from the student's advisor and department chair or designee. In those cases where an action is requested involving a specific course, the petition must also have a recommendation from the course instructor.

Withdrawal from ESF

Students who withdraw from matriculation at the College on or before the last day of classes for a semester will have their records marked: "Withdrew on (date)." Courses will appear for that semester with the grade of W.

Students who wish to withdraw from ESF should schedule a meeting to review the withdrawal process and complete an exit interview in the Office of Student Affairs.

- www.esf.edu/student-affairs/academic-support/

If a student registers but then leaves without notifying the College of their intent to withdraw, the student will continue to incur tuition, room, board, and other charges.

Course registrations will remain, and any grades submitted by the student's instructors will be recorded on the student's transcript. A student cannot receive Incomplete grades for courses in which the student was enrolled if the student takes a leave of absence or is withdrawn before the end of the semester; only grades of W or F can be recorded on the student's transcript. If a student registers for a future semester and subsequently takes a leave of absence or is withdrawn, then the student's registration for that semester will be canceled. For students who do not register at all, they will be automatically withdrawn from the college, and the notation "did not register" will also be recorded on their transcript. Students who do not register and are subsequently withdrawn must follow formal readmission procedures.

Withdrawal from Individual Courses

Students may drop individual courses up until the **last day to add** as set by the Registrar in the ESF Academic Calendar using an **add/drop form**. Dropped courses during this period will be completely removed from the transcript when dropped on or before this deadline.

Deadlines and actions to be taken after the last day to add deadline are:

- **Last day to add – Week 4**: After the **last day to add** (as per the academic calendar), students may drop a course without record of registration, until the end of the 4th week of classes.
- **Weeks 5-14**: Students who withdraw from a course after the last day of the **4th week and by the last day of the 14th week** will receive a W (Withdraw) grade on their permanent transcript, and the student(s) will remain on the course roster. The W grade will not affect the GPA.

Precise deadline dates noting the official end of weeks above shall be listed on the ESF Academic Calendar found on the Registrar's webpage (www.esf.edu/registrar/calendar.php)

Readmission to ESF

Students wishing to return to ESF **must** apply for readmission by contacting the Office of the Dean for Student Affairs at least 45 days prior to the semester they wish to return. Readmission applies to those students returning from a leave of absence (medical or military), who withdrew from the college, or have been dismissed for academic or disciplinary reasons.

- www.esf.edu/student-affairs/academic-support/

Resumption of Degree Programs

Students who have withdrawn from matriculated status in a degree program at ESF may seek to resume or complete a degree program with the following conditions:

1. A former student **must** apply for either:
   - Readmission and resumption of the student's original degree program and curriculum as described in the college catalog at the time of the student's original matriculation; or transfer of additional credit from another university sufficient to complete content or credit-hour requirements of the student's original degree program.
   - Readmission to complete a current ESF degree program and curriculum as described in the current college catalog; or transfer of additional credit from another university sufficient to complete content or credit hour requirements of a current ESF degree program.
2. Resumption and completion of original degree programs is permissible only if application for readmission is made no more than **10 years** after the student's original matriculation at ESF.
3. Degree completion will be posted to the academic record in the term when the last program requirement was completed. Degrees may not be conferred retroactively.
4. Students whose case exceeds the statute of limitation for degree resumption (i.e. 10 years as noted in (2.) above) will be advised by the department regarding those current programs that the student may pursue that most closely match his or her previously completed coursework. Past coursework may be accepted toward completion of a current degree program at the discretion of the department.

In the event of a dispute resulting from departmental or administrative review of a returning student's academic record, final authority regarding the completion of curricular requirements for degree programs rests with the college President, within the limits prescribed by the New York State Department of Education (such as those requiring a minimum number of total credit hours, etc.).

Syracuse University Courses

Courses offered at ESF should be taken at Syracuse University only under extraordinary conditions authorized by the department chair or designee. Students who propose to register for Syracuse University courses and no courses at ESF during any semester may do so only upon acceptance to special ESF-SU cooperative programs that require block registration. Students who are in their final semester may register for no more than six credits of Syracuse University courses beyond those necessary to meet ESF requirements.

Syracuse University courses may be audited only under extraordinary conditions that must be approved by the department chair or designee. Physical education courses, when taken, must always be for credit and never audited. Students may not retake Syracuse University courses in which credit has been previously earned.

Upper-division undergraduate students are normally expected to take upper-division courses and graduate students are normally expected to take graduate-level courses at Syracuse University.

Religious Beliefs Law

Students unable, because of religious beliefs, to attend classes on certain days are guided by Section 224a of the New York State Education Law, which is as follows:

- No person shall be expelled from or be refused admission as a student to an institution of higher education for the reason that one is unable, because of religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.
- Any student in an institution of higher education who is unable, because of religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.
- It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school because of religious beliefs an equivalent opportunity to make up any examination, study or work requirements which may have been missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said student such equivalent opportunity.
- If classes, examinations, study or work requirements are held on Friday after four o'clock post meridian or on Saturday, similar or makeup classes, examinations, study or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student for these classes, examinations, study or work requirements held on other days.
- In effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of implementation of the provisions of this section.
- Any student, who is aggrieved by the alleged failure of any faculty or administrative officials to comply in good faith with the provisions of this section, shall be entitled to maintain an action or proceeding in the supreme court of the county in which such institution of higher education is located for the enforcement of rights under this section.

Grade Grievances/Appeals

Assignment of grades is at the discretion of the Instructors of Record. However, assignment of grades must not be arbitrary or prejudicial; all students must be treated equally and in accordance with grading policies articulated in the course syllabus. Grade grievances, therefore, are restricted to claims of arbitrary or prejudicial grading practices. Third party grade grievances will not be accepted.

Undergraduate Academic Policies

General Requirements

While a student is matriculated at ESF, all courses taken at ESF and Syracuse University to meet degree requirements must be graded on a scale of A-F, and the grades will be computed in the grade point average. As an exception, at the discretion of the instructor, courses numbered 132, 496 and 497 may be graded on a Satisfactory/ Unsatisfactory basis. This must be announced on the first day of class and will apply to all students enrolled in that course section.

Curriculum Requirements

The development and administration of course offerings, prerequisites, sequencing and program requirements are primarily the responsibility of each program with the approval of the ESF faculty.

Students must satisfy the requirements for graduation presented in the catalog in effect as of the date they first matriculated at ESF. Students may graduate under the requirements stated in any catalog issued subsequent to the one in effect the date they matriculated, but they may not use a prior catalog.

Supplementary courses are available to ESF students at Syracuse University. However, these courses may be limited only to those specifically required by a particular program.

Students who change majors are required to submit a completed change of curriculum form approved by representatives of both programs and must complete all the requirements of their new major.

Applied Learning

Each undergraduate student shall complete an approved "applied learning experience" as a curricular requirement for degree completion at SUNY-ESF.

Dual Majors

Students who are pursuing undergraduate degrees may pursue dual majors. Program requirements must be satisfied concurrently (i.e., a student cannot graduate from ESF and return later to complete coursework for a second major). The diploma will state the completion of a single degree. The transcript will state the completion of two majors. Admission to a dual major will be accomplished by petition to the primary degree department or academic unit that has been endorsed (approved) by the secondary degree department.

Inter-department dual majors:

Students must satisfy requirements of both majors.

Intra-department dual majors:

- **PBE**: Bioprocess Engineering allowed with Paper Engineering;
- **SRM**: no dual majors between the three majors (FRM, NRM, and FES); forest technology and surveying technology degrees allowed for A.A.S. degrees;
- **EFB**: Only Biotechnology with other EFB majors **except environmental biology**.

Students may petition for admission to a dual major A.A.S. degree after completing 18 credits and before 45 credits with an unambiguous GPA of 2.000 or greater (no grades of incomplete or missing grades).

Students pursuing the B.S. degree may petition admission to a dual major after completing 30 credits and before completing 90 credits in the primary major with an unambiguous GPA of 2.000 or greater (no grades of incomplete or missing grades).

Physical Education and ROTC

Physical Education and ROTC course credits may be used to satisfy elective requirements with the permission of the student's academic advisor.

General Education

Resolution 98-241 (December 1998) of the State University Board of Trustees requires general education coursework for all University baccalaureate candidates in specific knowledge and skill areas and in two competencies. Each ESF undergraduate program meets or exceeds the general education requirements. These general education requirements are in effect for all students who began college courses during or after the fall semester 2000, exclusive of any courses taken while in high school.

On **November 9, 2021**, the SUNY Board of Trustees passed Resolution 2021-48 establishing the new SUNY General Education Framework (SUNY GE). The new SUNY GE policy is consistent with SUNY's continuing commitment to a strong general education program—now applicable to all SUNY undergraduate degree programs—that addresses the fundamental aims of postsecondary undergraduate education. This includes proficiency with essential skills and competencies, familiarization with disciplinary and interdisciplinary ways of knowing, enhancement of the values and disposition of an engaged 21st century global citizenry, and encouragement of individual campuses to develop unique signature features, including their respective array of educational offerings and pedagogical approaches.

The SUNY General Education Framework is effective fall 2023, for new first-time students entering AA-, AS-, and all baccalaureate-degree programs; and effective fall of 2024, for new first-time students entering AAS- and AOS-degree programs.

Credit-Hour Load

To be classified as full time, a student must register for at least 12 credit hours during a semester. A student may not register for more than 18 credits during a semester unless permission from the student's advisor is obtained.

Audits

Students may audit ESF courses informally with the permission of the course instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits.

Students may audit courses formally with the permission of their academic advisor and the course instructor. Formally audited courses may not be used to satisfy any graduation requirements. They will appear on a student's transcript and will be graded either SAU (satisfactory audit) or UAU (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor. Registration guidelines for audited courses are the same as for courses taken for credit.

Evaluation

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A-		3.700
B+		3.300
B	Good	3.000
B-		2.700
C+		2.300
C	Passing	2.000
C-		1.700
D	Minimum Passing	1.000
F	Failure	0.000
I/F	Unresolved Incomplete	0.000

In order to receive a bachelor's degree, a student must complete all courses taken as a matriculated student at ESF with a cumulative grade point average of at least 2.0.

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
S	Satisfactory (equal to C or better)
U	Unsatisfactory (equal to below C)
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete
R	Failed course which was repeated

NR	[Grade] Not Received

Grade Point Averages

Semester and cumulative averages are computed by dividing the total grade points earned by the total credit hours completed for all courses graded A-F.

Mid-term Grading Policy

Faculty shall provide mid-term grades for undergraduate students only. Such grades are a progress report for the undergraduate students to serve as an evaluation of the quality of the work to date. Mid-term grades are informational, therefore do not become part of the student’s permanent record.

Mid-term grades shall be submitted within seven (7) calendar days after the designated midterm date set by the Registrar’s Office. These grades should reflect the standing of each student based on the current coursework completed.

Academic Advising

Each undergraduate student is assigned an academic advisor in the student’s major. The advisor assists the student in developing a program of study and approves course registration each semester. The advisor serves as a mentor and counselor and makes referrals to appropriate offices and resources as needed. The curriculum coordinator of each of the departments also assists the student by clarifying program and course requirements and providing additional advising and career-planning information.

Academic Honors

Dean’s List
Students who carried 12 or more credits of coursework graded on a scale of A-F, with no grades of I or F in that semester, with a minimum grade point average of 3.500 will be placed on the Dean’s List for that semester. Any grade changes, resolution of grades, or repeated courses after Dean's List Honors are awarded do not qualify a student to be placed on the Dean's List retroactively. A commendation is sent by the Dean to the student.

President’s List
Students who carried 12 or more credits of coursework graded on a scale of A-F with no grades of I or F in that semester, with a grade point average of 3.850 or better will be placed on the President's List for that semester. Any grade changes, resolution of grades, or repeated courses after President’s List Honors are awarded do not qualify a student to be placed on the President's List retroactively. A commendation is sent by the President to the student.

Students who carried 12 or more credits of coursework graded on a scale of A-F with no grades of I or F in that semester, with a grade point average of 4.000 will receive an additional commendation from the President.

Graduation Requirements

Students pursuing an associate of applied science's degree are responsible for meeting the following requirements for graduation:

- Matriculated status as an undergraduate student;

- All program requirements must be satisfied;
- A minimum cumulative grade point average of 2.000 (4.000=A) for all courses taken as a matriculated student at the Ranger School (Wanakena Campus);
- At least 44 of the 64 credits must be registered for through ESF;
- Successful completion of a total of at least 64 appropriate college-level credits.

Students pursuing a bachelor's degree are responsible for meeting the following requirements for graduation:

- Matriculated status as an undergraduate student;
- All program requirements must be satisfied;
- A minimum cumulative grade point average of 2.000 (4.000=A) for all courses taken as a matriculated student at ESF;
- At least 24 of the last 30 credits must be registered for through ESF;
- Successful completion of a total of at least 120 appropriate college-level credits.

Graduation Honors

Students will be graduated with the appropriate honor if the following criteria have been met:

- Students have completed a minimum of 30 credits of ESF and Syracuse University courses as a matriculated, upper-division student, and
- Students have earned a cumulative grade point average of 3.000-3.333 (*cum laude)*; 3.334-3.829 (*magna cum laude)*; or 3.830-4.000 (*summa cum laude)*.

Statement of Good Academic Standing

Students are in good standing when their semester and cumulative grade point average is 2.0 or greater and they have successfully completed at least 12 credits when registered full-time.

Progress Notice

Students are on progress notice who have a cumulative GPA above a 2.0 and a semester GPA below a 2.0 for the most recently completed semester; or a student who has not successfully completed at least 12 credits when registered full-time in the most recently completed semester. Students on progress notice receive a reminder of policies and resources available for support, but there is no academic penalty. Please refer to Financial Aid guidelines for further guidelines on successful academic progress.

Academic Warning

Students who have earned less than a 2.0 cumulative GPA are placed on academic warning at the end of the semester. Students on Academic Warning must participate in the Academic Recovery Program with the Academic Success Center each semester that they are on Academic Warning. With permission of the student's advisor, students may participate in an equivalent academic success program offered at ESF (e.g. EOP Academic Recovery Program).

Note: Academic Warning status is evaluated at the end of the fall and spring semesters. Changes to grades from a previous semester or summer course grades will not change your warning status.

Academic Suspension

Students who were placed on academic warning at the end of the previous semester and who have a cumulative GPA below a 2.0 and a semester GPA below a 2.0 for the current semester will be placed on academic suspension.

Academic Suspension Policy for Educational Opportunity Program Students:
Students enrolled through the Educational Opportunity Program may be granted an additional semester on Academic Warning before they are subject to Academic Suspension, even if their cumulative GPA is below a 2.00, by permission of the Educational Opportunity Program Director and the Associate Provost of Academic Affairs.

Appeal to Academic Suspension

Each student placed on academic suspension will be given the opportunity to appeal this action based on any extraordinary conditions that may have contributed to their academic performance. This appeal must be made in writing and submitted within the stated time limit in accordance with
guidelines provided by the Office of Academic Administration. Every appeal will be reviewed by the
Academic Standards Committee, which will recommend to the Associate Provost of Academic Affairs either to accept the appeal or sustain the suspension. Students will be notified in writing of the final decision.

Students who have been suspended may not enroll in any courses at ESF until at least one fall or spring semester has elapsed. If suspension occurs following the spring semester, students may not
enroll in a summer classes at ESF or SU.

Reinstatement after Academic Suspension

After one full fall or spring semester has elapsed, students may apply for readmission through the
Office of Student Affairs. Applications for readmission must be started at least 45 days prior to the
semester the student wishes to return.

Academic Dismissal

Students suspended a second time for unsatisfactory academic performance, consistent with all policies noted above, and without a successful appeal will be dismissed from ESF and may not be considered again for readmission. If, however, after a period of not less than 10 years has elapsed,
a previously dismissed student should desire to return to ESF, they may then apply for readmission.
Candidates for readmission under these unusual conditions will be considered on a limited, caseby-case basis, and may be required to provide substantial additional justification for readmission.
For information regarding Satisfactory Academic Progress for financial aid eligibility, please refer to
the Financial Aid section of this catalog.

***Due to the unique accelerated nature of programs offered at The Ranger School in Wanakena,
students matriculated in these programs are not subject to these policies and may be placed
on academic warning or suspension at any time their semester or cumulative GPA falls below 2.000.**

Graduate Academic Policies

General Requirements

While a student is matriculated at ESF, all coursework taken at ESF and Syracuse University to meet degree requirements must be graded on a scale of A-F, and the grades will be computed in the grade point average. As an exception, at the discretion of the instructor, courses numbered 796 and 797 may be graded on a Satisfactory/Unsatisfactory basis. This must be announced on the first day of class and will apply to all students enrolled in that course section. Courses numbered 898, 899 and 999 are graded on a Satisfactory/Unsatisfactory basis.

Curriculum Requirements

The development and administration of course offerings, prerequisites, sequencing and program requirements are primarily the responsibility of each program with the approval of the ESF faculty.

Students must satisfy the requirements for graduation presented in the catalog in effect as of the date they first matriculated at ESF. Students may graduate under the requirements stated in any catalog issued subsequent to the one in effect the date they matriculated, but they may not use a prior catalog.

Transfer Credit

Credit hours appropriate to the graduate degree in which a minimum grade of B was earned from an accredited institution can be transferred to the College, but grades and grade points cannot be transferred.

Up to six credits of graduate coursework not used to complete another degree may be accepted toward completion of a master's or doctoral degree as approved by the steering committee.

Up to 30 credits of graduate level coursework earned as part of a conferred master's degree may be transferred (by petition) to a doctoral degree with approval of the steering committee.

Students may transfer no more than nine credits of credit-bearing non-degree ESF coursework to graduate degree programs.

All transfer credit will remain tentative until official, final transcripts are received. It is the student's responsibility to ensure that official, final transcripts are sent to and received by the College.

Credit-Hour Load

To meet academic requirements, graduate students must be registered for at least one credit each semester, excluding summers, from the first semester of matriculation until all degree requirements have been completed. Failure to register for each semester will result in the student being withdrawn from graduate study and, if the student wishes to return in the future, a new application must be filed and reviewed prior to readmission. Students are required to register for at least one credit of thesis/dissertation research, professional experience, or independent study in the summer if they will complete all requirements during that time. Graduate students who hold an assistantship and/or a tuition scholarship must be in full-time status each semester while holding such an award. Registration for nine credits usually equates to full-time status for a student holding an assistantship. Graduate students not holding an assistantship are considered full-time if they are registered for at least 12 credits each semester. To maintain valid F-1 or J-1 student status in compliance with SEVIS, international students are required to maintain the institutional equivalent of full-time enrollment status during all required academic semesters. Audited courses may not be used to satisfy full-time status. Undergraduate courses may not be used to satisfy full-time status requirements for federal and state financial aid (TAP) but may be applied toward full-time status requirements for SEVIS. Student loan deferrals may be maintained by achieving half-time status for graduate students, or approximately 6 credit hours, if full-time status is not required for other reasons.

Doctoral candidates (i.e., those who have successfully completed their doctoral candidacy examination), master's students (M.P.S., M.L.A., and M.F.) who have met all academic coursework requirements, and master of science (M.S.) students who have requested the appointment of a defense committee and intend to defend a thesis may be considered full time if registered for at least one credit of thesis/dissertation research, professional experience, or independent study and submit a “Request for Full-time Certification Form” to the Office of Instruction and Graduate Studies.

Part-Time Study

During any semester, students who are enrolled in part-time graduate degree programs (M.F. or M.P.S.) may register for the equivalent of full-time study. Graduate students who are enrolled in part-time degree programs are held to the policy for continuous registration, but not to the policy for time to degree (delimitation).

Re-enrollment

Full and part-time students in good academic standing who have a 1 to 2 semester lapse in registration may, with permission of their major professors or advisors, re-enroll for classes by filling out this form. Students whose last enrollment status was "visitor" or who were suspended for unsatisfactory academic performance must use an admission application form. Students who have not been enrolled at the college for a period of more than 1 academic year must also re-apply.

Audits

ESF Courses may be audited formally or informally, and informally with special audit status. Each is defined as follows:

- Formal Course Audit: A course may be audited formally by registering for a course using the standard course registration process. Formally audited courses do not carry course credit and may not be used to satisfy any graduation requirements. They will appear on a student’s transcript and will be graded either SAU (satisfactory audit) or UAU (unsatisfactory audit). The grade will be assigned based on the criteria for audit established by the course instructor. Both matriculated and non-matriculated students may formally audit courses.
- Informal Course Audit: A course may be informally audited by gaining permission of the instructor. No record will be maintained of the informal audit nor will any grade be assigned. No fee is required for informal audits. Only matriculated ESF students may informally audit courses.
- Special Informal Course Audit: “Special audit status” is granted to all New York state citizens of age 60 and over. Courses may be audited informally with special audit status by requesting confirmation of available space from the Office of Outreach and Instructional Quality. A record of the number of special auditors participating in each course is kept, however, no individual transcript is maintained of special informal audits nor will any grade be assigned. No fee is required for informal special audits.

Evaluation

For each course completed, one of the following grades will be awarded:

Grade	Definition	Grade Points
A	Excellent	4.000
A-		3.700
B+		3.300
B	Satisfactory	3.000
B-		2.700
C+		2.300
C		2.000
C-	Minimum Passing	1.700
F	Failure	0.000
I/F, I/U	Unresolved Incomplete	0.000

Under conditions defined elsewhere, the following grades may be assigned, none of which yield grade points:

Grade	Definition
W	Withdraw
WP	Withdraw Passing
WF	Withdraw Failing
S	Satisfactory (equal to B or better)
U	Unsatisfactory (equal to below B)
SAU	Audit (Satisfactory)
UAU	Audit (Unsatisfactory)
I	Incomplete
NR	[Grade] Not Received

Grade Point Average

Semester and cumulative averages are based on graduate-level courses only and are computed by dividing the grade points earned by the credit hours completed in all courses graded A-F.

Time Limits

Graduate students must complete all requirements for the master of forestry, master of professional studies, the master of landscape architecture, and the master of science degree within four years of the first date of matriculation or they may be withdrawn from graduate study. For the doctoral degree, students must complete the candidacy exam within three years of the first date of matriculation. Students must pass the doctoral candidacy examination covering selected fields of study at least one year prior to dissertation defense. Doctoral candidates must successfully defend the dissertation and complete all degree requirements within seven years of matriculation, or they will be required to retake the candidacy examination or be withdrawn from their program of graduate study.

Graduation Requirements

Students are responsible for meeting the following requirements for graduation:

- Matriculated status as a graduate student;
- All requirements for the appropriate program and degree level must be satisfied, and
- A minimum cumulative grade point average of 3.000 (4.000 = A) for all courses taken as a matriculated student at ESF.

Academic Performance

Students who earn less than a 3.000 cumulative grade point average for graduate-level courses, or who receive two or more grades of Unsatisfactory (U) for work on their thesis or dissertation shall have their records reviewed by the Dean of Instruction and Graduate Studies. These students shall be either placed on academic probation or suspended from ESF. The action taken will be based on recommendations from the students' major professors, department chairs and other appropriate faculty and staff. If, in a subsequent semester, a graduate student in probationary academic status achieves a grade of Satisfactory (S) on their thesis or dissertation work, they shall be removed from probationary academic status. The Dean of Instruction and Graduate Studies will inform each student in writing of actions taken. When a student is removed from probationary academic status, the Dean of Instruction and Graduate Studies will additionally notify the student's major professor and committee members.

Each student suspended will be given the opportunity to appeal this action based on any extraordinary conditions which may have contributed to the unsatisfactory performance. This appeal must be made in writing and submitted to the Office of Instruction and Graduate Studies within the stated time limit. Each appeal will be reviewed by the Faculty Subcommittee on Academic Standards which will recommend to the dean of Instruction and Graduate Studies either to sustain the suspension or place the student on probation. The dean of Instruction and Graduate Studies will inform each student in writing of the Subcommittee action. There is no appeal beyond this process.

Students who have been suspended for unsatisfactory academic performance may not reapply until at least one semester has elapsed. Students may not take any courses at ESF or Syracuse University during this first semester following suspension. Suspended graduate students who wish to be readmitted must apply for readmission through the Office of Instruction and Graduate Studies.

Students suspended from a graduate degree program for a second time for unsatisfactory academic performance may not be considered for readmission.

ADMISSION POLICIES & REQUIREMENTS

NOTE: The following information on admission to SUNY ESF is limited to specific policies and requirements necessary for inclusion in a catalog of record.

For complete, current information on admission to ESF, visit our admission websites:

- www.esf.edu/admissions/undergraduate/
- www.esf.edu/graduate/prospective/admission.php
- www.esf.edu/international-education (undergraduate and graduate)

Student Status

Required Application Materials

All applicants for first year or transfer entry are required to submit the online admissions application (choose either the Apply SUNY application or The Common Application), official high school transcript or documentation of high school graduation (or equivalent) and any college-level coursework (or equivalent) completed, even if it does not pertain to their intended program of study at ESF. Additional required credentials for each admission pathway are outlined below. Failure to submit this documentation by the stated deadlines may result in the withdrawal of the application or denial of admission.

Early Action First Year Admission for High School Seniors

The application and official high school transcripts, including 12th-year first-quarter grades must be received by this date. Please refer to the next section, “Regular First Year Admission for High School Seniors,” for additional information on the first year application process.

Regular First Year Admission for High School Seniors

High school seniors may apply for Regular First Year admission. High school seniors who are not offered first year entry may be offered Guaranteed Transfer. Please refer to the next section, "Guaranteed Transfer Option for High School Seniors," which explains this process.

First Year applicants should present strong academic credentials in a college preparatory high school curriculum. A minimum of three units each of college preparatory mathematics and science are required for all majors. For most programs of study completion of additional units of math and science, or design or art sequences for Landscape Architecture applicants, as well as advanced level coursework (honors or college level) indicates strong preparation for the academic rigor students will experience at ESF. An official high school transcript, including 12th-year first-quarter grades, must be submitted as part of the student's application credentials. First Year applicants are encouraged to submit the ESF Supplemental Questions. They are available on the applicant portal when the application is received.

Guaranteed Transfer Option for High School Seniors

Under this option, admitted students are guaranteed admission to ESF for either their sophomore or junior year provided they meet the conditions specified in the offer of Guaranteed Transfer. Guaranteed Transfer applicants may file the SUNY application or the Common Application as outlined in the section above and send an email to esfinfo@esf.edu indicating the entry semester for which they wish to be considered. Applicants must submit the same credentials as outlined under "Regular First Year Admission for High School Seniors" (see preceding section). Successful applicants for this option must present a strong academic background including at least three years each of college preparatory mathematics and science. First year applicants who are not offered admission may be offered Guaranteed Transfer. To satisfy the guarantee of admission, students must satisfactorily complete, with a minimum cumulative grade point average of 2.80 for bachelor's degree programs and 2.50 for associate degree programs (A=4.000), any of the lower-division requirements, which are part of their program of study. Only coursework with grades of C or higher will transfer to meet ESF degree requirements.

Regular Transfer Admission for College Students

Transfer students' admissibility is based on how much of their previous college-level coursework applies to the requirements of their intended major at ESF, overall academic performance at their previous colleges and specific interest in ESF programs. For most programs, a significant emphasis is placed on students' backgrounds in mathematics and science.

Transfer applicants must submit official transcripts and examination scores from all college-level coursework completed and an official final high school transcript or equivalent. Transfer applicants are encouraged to submit the ESF Supplemental Questions. They are available on the Applicant Portal when the application is received. Students who have completed less than 30 semester hours of college-level coursework are required to submit copies of their high school transcript and SAT I or ACT test scores as part of the admissions process.

Students who apply as transfers to ESF are expected to have successfully completed some portion of the established required sequence of courses appropriate to their intended major at the College. Applicants to Landscape Architecture should have some background in art or graphic design. Students attending one of our ESF Cooperative College Partners will find information on course equivalencies for all of our programs of study on our web page.

Transfer students applying for bachelor degree programs at the Syracuse campus should have a 2.80 (A=4.00) or higher cumulative grade point average at the last institution they attended in full-time status. Those applying for associate degree programs at The Ranger School campus should have a 2.50 or higher cumulative grade point average at the last institution they attended in full-time status. Applicants with cumulative grade point averages below these thresholds will be considered on a case-by-case basis. In some cases, transfer applicants may be updated for consideration for a future entry date, one or two semesters beyond their original entry date, to allow them the opportunity to complete additional core degree requirements and/or improve academic performance. Students with cumulative grade point averages less than 2.00 will not be considered for transfer admission to SUNY ESF. Only coursework with grades of C or higher will transfer to meet ESF degree requirements.

Transfer Credit

Coursework appropriate to the ESF curriculum can be transferred to the College, but grades and grade points cannot be transferred. Courses transferred to meet graduation requirements for any curriculum must be acceptable in content, and credit will be awarded only for those completed with a grade of C or higher (a C- is not acceptable).

All transfer credit will remain tentative until official, final transcripts are received. It is the student's responsibility to ensure that official, final transcripts are sent to and received by the College.

Only coursework completed at institutions that are fully accredited by one of six regional accrediting agencies will be considered for possible transfer credit toward ESF degree requirements. These agencies are the Middle States Association of Colleges and Schools, New England Association of Schools and Colleges, North Central Association of Colleges and Schools, Northwest Association of Schools and Colleges, Southern Association of Colleges and Schools, and Western Association of Schools and Colleges.

Policy for Students Transferring from Syracuse University to SUNY ESF

With the approval of the home institution and subject to availability, SUNY ESF students may take Syracuse University courses, and SU students may take SUNY ESF courses.

For Syracuse University transfer students, Syracuse University is the college of record. SUNY ESF does not maintain a transcript record of ESF courses taken by Syracuse University students. A student previously matriculated at Syracuse University, who is subsequently admitted to SUNY ESF, will have all coursework taken while a Syracuse University student, including SUNY ESF courses, treated and evaluated as transfer credit from Syracuse University. Such Syracuse University courses will not appear or calculate on the SUNY ESF transcript, except as they are included in a block of transfer credits, i.e., total credit hours, accepted from Syracuse University. However, such Syracuse University courses do not count toward the SUNY ESF residency requirement. Departments at their discretion include such courses in manual calculations, e.g., for determination of subsequent intra-university transfer eligibility.

Syracuse University courses taken by matriculated ESF students appear on the SUNY ESF transcript and calculate in the same way as ESF courses. Syracuse University courses do not count toward the SUNY ESF undergraduate residency requirement.

The ESF transfer credit policy requiring a minimum grade of C will be waived for Syracuse University students only and any coursework taken at Syracuse University with a passing grade will be treated as if it was taken at SUNY ESF.

Advanced Placement

The College will consider for advanced standing credit the results of examinations from standardized testing agencies such as the College Entrance Examination Board's Advanced Placement Program (AP) or the College Level Examination Programs (CLEP) as well as the Higher Level Exams of the International Baccalaureate (IB) program.

AP Course Score Requirements

Course	Score
Art History	3 or higher
Biology	4 or higher
Chemistry	4 or higher
Chinese	3 or higher
Computer Science A	3 or higher

Computer Science AB	3 or higher
English: Language & Composition	3 or higher
English: Literature & Composition	3 or higher
Environmental Science	3 or higher
European History	3 or higher
United States History	3 or higher
Economics: Microeconomics	3 or higher
Economics: Macroeconomics	3 or higher
French Language	3 or higher
French Literature	3 or higher
German Language	3 or higher
Human Geography	3 or higher
Italian	3 or higher
Japanese	3 or higher
Latin	3 or higher
Latin: Literature	3 or higher
Mathematics: Calculus AB	4 or higher
Mathematics: Calculus BC	4 or higher
Music Theory	3 or higher
Physics B	4 or higher
Physics 1 (effective fall 2014)	4 or higher
Physics 2 (effective fall 2014)	4 or higher
Physics C (Mechanics)	4 or higher
Physics C (Electricity & Magnetism)	4 or higher
Psychology	3 or higher
Spanish Language	3 or higher
Spanish Literature	3 or higher
Statistics	3 or higher
Government & Politics: United States	3 or higher

Government & Politics: Comparative	3 or higher
Art 2D design	3 or higher
Art 3D design	3 or higher
Art Drawing	3 or higher
World History	3 or higher

IB Requirements

Course	Score
Arabic Language B (HL)	5 or higher
Biology (HL)	5 or higher
Business Management (HL)	5 or higher
Business Organization (HL)	5 or higher
Chemistry (HL)	5 or higher
Chinese A-1 (HL)	5 or higher
Classical Languages (HL)	5 or higher
Computer Science (HL)	5 or higher
Design Technology (HL)	5 or higher
Economics (HL)	5 or higher
English A1 (HL)	5 or higher
English A2 (HL)	5 or higher
Film (HL)	5 or higher
Geography (HL)	5 or higher
French A2 (HL)	5 or higher
French B (HL)	5 or higher
History (HL) – Africa	5 or higher
History (HL) – Americas	5 or higher
History (HL) – East and South Asia	5 or higher
History (HL) – Europe	5 or higher
History (HL) – South Asia and the Middle East	5 or higher

Islamic History (HL)	5 or higher
Information Technology (HL)	5 or higher
Japanese B (HL)	5 or higher
Korean (HL)	5 or higher
Mongolian A1	5 or higher
Music (HL)	5 or higher
Philipino Language (HL)	5 or higher
Philosophy (HL)	5 or higher
Physics (HL)	5 or higher
Psychology (HL)	5 or higher
Social and Cultural Anthropology (HL)	5 or higher
Spanish Language A2 (HL)	5 or higher
Spanish Language B (HL)	5 or higher
Theater Arts (HL)	5 or higher
Visual Arts (HL)	5 or higher

CLEP Requirements

Course	Score
COMPOSITION AND LITERATURE	
American Literature	50
Analyzing and Interpreting Literature	50
College Composition	50
College Composition with Modular	50
First Year College Composition	50
English Composition with or without Essay	50
English Literature	50
Humanities	50
FOREIGN LANGUAGES	
French - Level 1	50

French - Level 2	59
German - Level 1	50
German - Level 2	60
Spanish - Level 1	50
Spanish - Level 2	63
HISTORY ANDSOCIAL SCIENCES	
American Government	50
Introduction to Educational Psychology	50
History of the United States I: Early Colonization to 1877	50
History of the United States II: 1865 to the Present	50
Human Growth and Development	50
Principles of Macroeconomics	50
Principles of Microeconomics	50
Introductory Psychology	50
Social Sciences and History	50
Introductory Sociology	50
Western Civilization I: Ancient Near East to 1648	50
Western Civilization II: 1648 to the Present	50
SCIENCE AND MATHEMATICS	
College Algebra	50
College Algebra – Trigonometry	50
Calculus	50
Natural Sciences	50
Trigonometry	50
Pre-calculus	50
BUSINESS	
Principles of Accounting	50

Introductory Business Law	50
Financial Accounting	50
Information Systems and Computer Applications	50
Principles of Management	50
Principles of Marketing	50

Ranger School Admission

The SUNY ESF Ranger School does not enroll first year students. Students complete their first year requirements at ESF's Syracuse campus or at the college of their choice. They complete the sophomore year of their A.A.S. program in residence at The Ranger School campus. Candidates may apply for acceptance into these programs under the guaranteed transfer option while a senior in high school or as a regular transfer student.

High school students who wish to enroll in these programs should apply during their senior year to receive a guaranteed entry date one year later. Transfer students apply for sophomore year entry during the academic year prior to their intended fall semester entry at The Ranger School (spring admission is not available). For further information on The Ranger School, visit the website or refer to The Ranger School section of this catalog.

Educational Opportunity Program

Offered only to full-time students who are New York state residents, first year and transfer students who qualify, both academically and economically, may be eligible for the EOP program.

High school seniors who wish to apply for first year enrollment and EOP status at the College must file a SUNY application or The Common Application and indicate they want to be considered for EOP. In addition, they must submit a copy of the Free Application for Federal Student Aid (FAFSA), indicating ESF as a receiving institution.

In order for transfer students to participate in the program at the College, they must have been enrolled in or qualified for EOP, Higher Education Opportunity Program (HEOP), Search for Education Elevation and Knowledge (SEEK) or similar program at their prior college. Therefore, students who are applying to ESF as high school seniors through the Guaranteed Transfer option should also apply for EOP, HEOP or SEEK at their lower-division college, and must enroll in or be qualified for such a program in order to continue in EOP at ESF.

All EOP applicants must file applications for undergraduate admission and financial aid as described in those two sections of this catalog.

Deferred Admission

Students accepted to ESF who wish to defer their enrollment for one or two semesters beyond their original entry term must make this request in writing directly to the Office of Undergraduate Admissions. Students will receive written notification if their request has been approved.

Graduate Admission Policies & Requirements

- Graduate Admissions (complete, current information for prospective students)

Admission to Graduate School is conditional upon review and acceptance of an applicant's credentials by appropriate faculty members and upon the recommendation of the appropriate department chairman or program director to the Interim Associate Provost for Academic Affairs and Dean of the Graduate School.

Application Requirements

Submit securely via our online application.

- **Transcripts**
  Transcripts of an earned bachelor's degree from a recognized institution with an academic record showing at least a "B" average for junior and senior years of the baccalaureate program or for the master's program
- **Application**
  The graduate application
- **Scores**
  Scores from the Graduate Record Examination (GRE) and for some degree programs, advanced test scores(institution code for official score reports:**2530**)
- **Recommendations**
  Three letters of recommendation from individuals who can attest to your academic or professional skills. This should NOT include personal friends and family
- **Resume**
  A resume or CV
- **Statement**
  A statement of educational and professional goals
- **Fee**
  A nonrefundable $60(US) application fee

Students whose primary language is not English are also required to provide evidence of English language proficiency.

Applying for Admission

Faculty seek graduate students who are well prepared for rigorous study, responsive and receptive to constructive feedback, and a good fit with their programs. The most effective way for applicants to demonstrate these qualities is to communicate with faculty prior to applying and to understand the programs ESF has to offer. Therefore, individuals who are interested in applying for graduate study should contact ESF faculty to discuss degree programs and learn about specific opportunities for study and research at ESF. Faculty Web pages provide contact information and additional insights about ESF degree programs. We also encourage applicants to visit campus and meet with faculty and current graduate students.

Application Deadlines

While the following dates are particularly important for applicants wishing to be considered for fellowships, assistantships, and other forms of financial assistance, ESF will continue to accept and fully consider graduate applications beyond each of the noted deadlines:

Application Target Dates

Semester of Matriculation	Application Deadline *
Fall	**January 15**
Spring	**November 1**

*Applications completed by these deadlines by these dates will normally receive decisions by mid-March for fall matriculation and by early December for spring matriculation.

Graduate Record Exam Subject Tests

Subject tests are recommended by the following programs:

Graduate Program	Subject Test
Environmental and forest chemistry	Chemistry - recommended
Biochemistry area of study within environmental and forest chemistry	Chemistry or Biology - recommended

Transfer Credit

Credit hours appropriate to the graduate degree in which a minimum grade of B was earned from an accredited institution can be transferred to the College, but grades and grade points cannot be transferred.

Up to six credits of graduate coursework **not used to complete another degree** may be accepted toward completion of a master's or doctoral degree as approved by the steering committee**.**

Up to 30 credits of graduate level coursework **earned as part of a conferred master's degree** may be transferred (by petition) to a doctoral degree with approval of the steering committee.

Students may transfer no more than nine credits of credit-bearing **non-degree ESF** coursework to graduate degree programs.

All transfer credit will remain tentative until official, final transcripts are received. It is the student's responsibility to ensure that official, final transcripts are sent to and received by the College.

Part-time Study

Part-time study at the graduate level provides an excellent opportunity for working professionals to extend their educational credentials or broaden their general knowledge by enrolling for courses on a part-time basis. The M.P.S. or M.F. professional degrees are available for students who are initially matriculated on a part-time basis. Part-time students apply, matriculate and register through the same processes that all ESF graduate students complete. During any semester, students who enroll in part-time programs may register for the equivalent of full-time study, which is at least 12 credit hours. Part-time students are held to the policy for continuous registration, but not to the policy for time to degree (delimitation).

Deferred Admission

Students accepted to graduate programs at ESF who wish to defer their enrollment beyond their original entry term must make this request in writing directly to the The Graduate School.

Faculty as Students

Employees of the College who carry faculty status in accordance with SUNY ESF Faculty Bylaws and are at or above the rank of assistant professor or equivalent, may not enter into matriculated status at the College.

International Student Admission Policies & Requirements

- International Admissions (complete, current information for prospective international students)

In addition to the admission requirements that all prospective students must meet, international applicants must provide the following:

Standard	Undergraduate Admission Score (Minimum)	Graduate Admission Score (Minimum)
TOEFL (paper-based)	550	550
TOEFL (internet-based)	79	80 (with no individual component score < 17)
IELTS	Total: 6.0 (with no less than 5 in Writing)	Total: 6.0 (with no less than 5 in Writing)
Duolingo English Test (DET)	100	105
PTE Academic	53	53
STEP EIKEN	Grade pre-1	(University level) Grade 1
Syracuse University - English Language Institute (ELI)	Successful completion of ELI "Level 4"	Successful completion of ELI "Level 4"
ELS	Successful completion of Level 112	Successful completion of Level 112
Previous college-level instruction in English	Completion of at least one three-credit English course at an institution where the language of instruction is in English. ESL courses will not count toward meeting this requirement.	• Completion of at least two years of college (academic studies, not English language instruction) at an institution where the courses were taught in English. • Successful completion of at least one semester at SUNY ESF

SAT	500 Evidence-Based Reading & Writing Score	N/A
ACT	22 Composite Score	N/A
Duolingo (DET)	(Minimum) = 100	(Minimum) = 105

Note: SUNY ESF accepts MyBest TOEFL scores for both undergraduate and graduate admissions.

1. **Transcripts and international academic credentials**—International applicants must provide complete translations into English of all transcripts required by the admissions application without any additions or deletions by the translators. Translations of documents by the applicant will not be accepted. Credential evaluator and translation services for academic documents may be found through the National Association of Credential Evaluation Services (NACES).
    - **International freshman applicants** are required to demonstrate the completion of a college preparatory secondary school program by submitting academic credentials translated into English. This evaluation must be completed by an approved international credentials evaluation agency.
    - **International transfer applicants** are required to submit a detailed course-by-course evaluation of all international academic credentials in English. This evaluation must be completed by an approved international credentials evaluation agency.
2. **Copy of the passport** should be submitted with application materials.

International Students Currently Attending an Educational Institution in the U.S.

In addition to the entrance requirements for other international students, international students who are currently enrolled at a U.S. educational institution must obtain permission (usually through a Transfer-In Form) from their current educational institution to transfer their SEVIS record to ESF. Students will also have to complete a **SUNY ESF SEVIS Transfer-In Form** (F-1 Students / J-1) so that ESF is aware of when your current institution will release your SEVIS record to ESF so that a new I-20 or DS-2019 can be issued for the ESF program of study. Additional information about transferring your SEVIS record to ESF is available **online**.

I-20 Issuance for International Students

An I-20, required for the F-1 student **visa application**, will be issued once a student has:

1. a. **Been officially admitted to ESF**;
   b. **Submitted adequate financial support documentation for at least one year of** expenses at ESF;

In order to obtain an I-20 from ESF, a potential F-1 student must complete the "FSA-4 - Financial Statement" and submit credible documentary evidence that they have enough readily available funds to meet all expenses (tuition, fees, and living expenses) for the entire first year of study. (It is expected that barring unforeseen circumstances, students will have adequate funds available for each subsequent year of study from the same source or from one or more other specifically identified and reliable financial sources.)

Documentation of sufficient funding may come from any combination of dependable sources, including scholarships, assistantships, fellowships, sponsoring agencies, personal funds, or funds from a student's family. Documentation of scholarships, assistantships, and fellowships must be in the form of an official award letter from the school or sponsoring agency; documentation of personal or family funds should be on an official signed letter of support from the bank that includes the U.S. dollar amount of support and certified bank statements which indicate that the sponsor has sufficient funds to meet a student's first-year expenses at ESF (the bank statement does not have to show the full amount of the account), or in the form of a legally binding affidavit. The Form I-134, "Affidavit of Support," can be used to document support being provided by a U.S. citizen or U.S. legal permanent resident. Government-sponsored applicants should submit a certified copy of the award letter that includes the U.S. dollar amount of the award per year, the duration of the award and a list of expenses covered by the award.

1. Indicate your intention to enroll at ESF through your ESF Applicant Portal by submitting the required admissions deposit.
2. Submitted the New Undergraduate International Student Information Form.
3. Submitted a passport copy.

Once all of the above materials have been received, an I-20 will be issued and mailed to the prospective international student by the Office of International Education.

Health Insurance Requirement

ESF students who are not U.S. citizens or permanent residents are required by SUNY policies to maintain comprehensive health insurance with medical evacuation and repatriation coverage for themselves (and their dependents in the United States) for the duration of their ESF program of study. International students are automatically enrolled in the SUNY Health Insurance Plan unless proof of comparable health insurance is provided to the Bursar's Office within 30 days of the start of each semester.

STUDENT FINANCIAL INFORMATION

NOTE: *All information regarding college expenses and financial aid is subject to change without notice by official action.*

College Expenses

- www.esf.edu/tuition-aid/bursar/

The ESF tuition and college fee structure is set by the State University of New York Board of Trustees and generally covers the costs associated with instruction and the use of facilities and services at the College.

Tuition Schedule

- www.esf.edu/tuition-aid/bursar/costs.php

Residency

For purposes of tuition, “residence” refers to the principal or permanent home to which the student returns. Students who believe they qualify as New York residents may apply for a change in residency after they are accepted by ESF. Application forms are available in the Office of Business Affairs in 101 Bray Hall.

Tuition Schedule as of the beginning of the 2024-2025 Academic Year

NOTE: Tuition is subject to change at any time by official action.

Status	New York State Resident Students	Out-of-State Students
Undergraduate Full-time*	$3, 535 per semester (maximum total tuition for 12 credit hours or more)	$10, 015 per semester (maximum total tuition for 12 credit hours or more)
Undergraduate Part-time	$295/credit hour	$835/credit hour
Graduate Full-time	$5,655 per semester (maximum total tuition for 12 credit hours or more)	$13,345 per semester (maximum total tuition for 12 credit hours or more)
Graduate Part-time	$471 per credit hour	$1112 per credit hour

Additional Expenses

Fees and Other Expenses

- www.esf.edu/tuition-aid/bursar/

Several mandatory, optional and/or program-specific fees add to the cost of attendance. In addition to the costs of books and supplies, there may be expenses associated with a specific degree program, including summer field experience costs, study abroad expenses, Syracuse University course or lab fees, etc. Personal expenses include clothing, transportation, recreation, etc. Details are found on the bursar website

Housing and Meal Plans

- www.esf.edu/student-affairs/living-dining/
- www.esf.edu/student-affairs/living-dining/mealplans/

Most entering first-year (freshmen) students are required to live in college housing and have a minimum meal plan that includes both Syracuse University Dining Services and ESF's Trailhead Cafe. Students are not required to live on campus after their first year. Entering transfer students and continuing ESF students may choose to live on campus or off campus, with housing and meal costs charged accordingly. Visit the ESF housing website for details.

Terms of Payment

- www.esf.edu/tuition-aid/bursar/billing.php

New undergraduate students pay an advance payment deposit and must pay ensuing bills according to a payment schedule set by the college. Information on the deposit, payment schedule, late fees, refunds and all other topics related to student financial obligation are available on the Bursar's website.

Financial Aid

- www.esf.edu/tuition-aid/financialaid/
- www.esf.edu/consumer/ (student consumer information, including student financial assistance resources)

The College offers these basic forms of student financial assistance: scholarships or grants; part-time employment; educational loans; assistantships, tuition scholarships, and fellowships for graduate students; a deferred tuition payment plan; and sources of non-need loans to students and parents.

Federal and state financial aid programs are for United States citizens, permanent residents or other eligible non-citizens. International students will be considered for academic merit-based scholarships, assistantships and fellowships, but are not eligible for need-based student financial assistance. Aid programs are coordinated to supplement parental support, summer work, savings, and assistance from other sources. The sources of funds for financial assistance programs, the guidelines for determining the recipients, the procedures for applying, and the method of disbursement of funds vary from one program to another. This information is presented in detail on the ESF Financial Aid Web Page.

Financial aid is awarded primarily on the basis of financial need. Some scholarships and fellowships, however, are based on other criteria, such as academic achievement. Assistantships, tuition scholarships and fellowships for graduate students are awarded based upon academic achievement.

In order for students to receive aid, they must be making satisfactory academic progress toward a degree. Please refer to the appropriate sections under ESF College Aid, Federal Student Aid, and New York State Aid later in this chapter for satisfactory academic progress requirements.

In addition, students are only eligible to receive most types of aid for courses that are required for degree completion. Students enrolled in credits beyond the number required for the degree or enrolled in courses that are not applicable to a degree requirement will have financial aid adjusted accordingly.

Financial aid advisors are aware of the many problems associated with financing higher education and meeting living expenses for both undergraduate and graduate students and are available to discuss individual problems. All students are encouraged to apply for financial aid.

Applying For and Receiving Aid

How to Apply

Students interested in receiving financial assistance, with the exception of graduate assistantships, graduate tuition scholarships, graduate fellowships, and merit-based scholarships, must complete the Free Application for Federal Student Aid (FAFSA). It is highly recommended that all students complete the FAFSA as soon as possible each year. Timely completion of the FAFSA, which is available starting October 1 each year, will ensure that aid eligibility is maximized and any problems can be resolved without delaying the arrival of funds. In order to receive priority consideration and maintain eligibility for need-based grants and scholarships, a processed FAFSA must be received by the Financial Aid Office no later than February 1 each year. The school code for SUNY ESF is 002851.

Paper versions of the FAFSA are available for download at https://studentaid.gov/apply-for-aid/fafsa/filling-out.

Students completing the FAFSA online (recommended) will need an FSA ID in order to access the application and provide electronic signatures. Parents of dependent students will also need an FSA ID in order to sign the student's FAFSA. New or forgotten FSA IDs can be requested at https://studentaid.gov/fsa-id/sign-in/landing.

While completing the FAFSA, you will have the option to automatically import your tax data directly from the IRS into your application. All students and parents are highly encouraged to take advantage of this tool as it will make the FAFSA process much easier and simplify the application verification process for any students selected to submit tax forms and other information. Tax information reported should be from the "prior-prior year" (ex. 2021 tax year data when applying for the 2023-2024 school year, 2022 tax year data when applying for the 2024-2025 school year, etc.).

Students interested in receiving financial assistance for the summer must complete the separate SUNY ESF Summer Aid Application.

Application	Deadlines
Free Application for Federal Student Aid (FAFSA)	October 1 - Application Available March 1 - Priority Deadline

	Last Day of Enrollment Each Year - Final Deadline June 30 - Official Federal Application Close
New York State Grants and Scholarships	October 1 - Application Available May 1 (Following Year) - Final Deadline

New York State Tuition Assistance Program (TAP)

New York State residents are encouraged to apply for state grants and scholarships, including the Tuition Assistance Program (TAP), Excelsior Scholarship, STEM Incentive Grant, and others. The Express TAP Application (also known as the Application for Payment of New York State Grants and Scholarships) is required annually for determination of TAP Grant eligibility. It must also be completed for other state awards, which require separate applications, to be awarded and paid. Students who are New York State residents and list a New York State school while completing the FAFSA will be given the opportunity to complete an online TAP Application by clicking on the link which appears on the FAFSA Submission Confirmation Page. The online application may also be accessed at https://www.tap.hesc.ny.gov/totw/.

Eligibility for TAP and other New York State grants and scholarships is determined by the New York State Higher Education Services Corporation (HESC). Students interested in applying for NY grants and scholarships other than TAP should be sure to complete each separate application in addition to the TAP application.

The SUNY ESF School Code for state aid applications is 0950. If searching for ESF use "SUC En" as the criteria. Students will be asked to provide a college issued ID number when completing the applications. If known at the time of application, students should enter their ESF Banner ID, which begins with "F". If not known, this step can be skipped with no ID entered.

Graduate Student Assistantships

Assistantships and tuition scholarships for graduate students are not awarded by the Financial Aid Office. Students interested in these forms of financial assistance should contact the Office of Instruction and Graduate Studies.

Verification of Information

All students who request financial assistance may be required to submit information about their and/or their family's personal financial situation prior to aid disbursement. The College may request copies of parents' and/or students' federal tax transcripts, along with other statements which will be used to verify other sources of income, family size, number of dependents in college, and other pertinent information.

Requests for verification information are authorized by the FAFSA signature process. **Failure to comply with a request to verify pertinent information will result in the cancellation of any aid offered, and the possibility of legal action being taken by the U.S. Department of Education.**

Summer Financial Aid

Matriculated students planning to take courses over the summer at SUNY ESF may be eligible for limited amounts and types of financial aid through the following programs:

- Federal Direct Student and Parent Loans
- Private Student Loans
- Federal Pell Grants

Summer Planning

Students are highly encouraged to plan summer expenses prior to the end of the spring semester each year. Some students may have remaining unused aid available at that time, but no longer have that eligibility once the semester has ended. Only students meeting the minimum enrollment requirements can be considered for aid once the spring semester has ended.

Academic Year Structure

The summer term at SUNY ESF is the trailer to the academic year. This means that federal loan amounts will be limited to funds remaining within the annual limits for each program that were not used during the preceding fall and spring semesters. Summer courses are offered in what are called modules, or segments which do not span the entire length of the full summer term.

Year Round Pell Grants

Special regulations now allow for Pell-eligible students to receive more than 100% of a scheduled Pell Grant award for a single year if certain criteria have been met. For summer enrollment, these awards can be from either the academic year before or after the summer term, known as a "cross-over" period. When possible, the academic year used for the funds should be based on what is most beneficial for the student. This determination will be made by the Office of Financial Aid based on various criteria and considerations. Please note that a valid FAFSA is required for the school year used. If a student has only completed a FAFSA for one year, only that year can be considered for possible funding.

Students receiving summer Pell Grants should be sure to note in which academic year aid package the grant is awarded. Enrollment requirements are different for the period in which a student is receiving funding in excess of 100% of a scheduled award. In order to receive any Pell Grant funding in excess of 100% of the scheduled award, a student must be enrolled in at least 6 degree-applicable credits (half-time enrollment). If summer Pell is awarded from the preceding school year, a student may not qualify for funding in the following spring if the number of degree-applicable credits is less than 6. It is the student's responsibility to carefully plan their enrollment and notify the Office of Financial Aid if a summer Pell Grant award could cause difficulty with future eligibility within the same school year.

Example 1: A student receives Pell Grant funds from the 2018-2019 school year based on full-time enrollment for both the fall 2018 and spring 2019 semesters. This would use 100% of the student's scheduled award, 50% for each semester. Pell Grant funds from the 2018-2019 school year could also be awarded for the summer 2019 term as long as the student is enrolled at least half-time in degree-applicable courses (6 credits).

Example 2: A student receives Pell Grant funds from the 2018-2019 school year based on full-time enrollment for the summer 2018 and fall 2018 terms. This would use 100% of the student's scheduled award, 50% for each term. Pell Grant funds from the 2018-2019 school year could also be awarded for the Spring 2019 term as long as the student is enrolled at least half-time in degree-applicable courses (6 credits).

Enrollment Requirements

In order to potentially qualify for summer aid, students must meet minimum degree-applicable enrollment requirements as follows:

Loan/Grant	Enrollment
Federal Direct Student and Parent Loans	Half-time (typically 6 credits)
Private Student Loans	Determined by Lender
Federal Pell Grant (0-100% usage*)	Less-than-half-time (1-5 credits)
Federal Pell Grant (100 - 150% usage*)	Half-time (typically 6 credits)

*One term of Pell Grant eligibility at full-time enrollment uses 50% of a scheduled award. At lower enrollment levels that percentage is pro-rated: half-time enrollment uses 25% and so forth.

Application Process

Students seeking financial aid for summer enrollment should complete a Summer Financial Aid Application (available in the Financial Aid Office in Bray Hall) by the listed deadline and must have a valid FAFSA (Free Application for Federal Student Aid) on file. Please do not e-mail any personal information. Applications should be delivered in-person, mailed, faxed, or uploaded with the document exchange function available from the financial aid section of the MyESF portal (student accounts only).

Notification of Eligibility

Students will be notified of eligibility for federal aid sources with an amended financial aid package. Notifications of amendments are sent electronically to campus e-mail addresses and are viewable through the MyESF student portal. Students who are not eligible for federal aid will be notified either electronically or in writing. Students seeking funds from alternative student loans are responsible for working directly with the lender they have chosen.

Disbursement of Funds

Aid funds will only be disbursed to student accounts once the student has started enough courses in the summer to reach the minimum enrollment requirements. Note that summer aid funds may not be disbursed until after a bill is due in many cases.

Withdrawals and Return of Funds

Students who fail to begin each of their scheduled classes during the full summer term may be considered to have withdrawn from the term and could be required to return funds already received. This can occur in the following scenarios:

- After starting summer classes, a student completely ceases attendance prior to the end of those classes.
- Example: a student starts enrollment in two 3-credit courses in the first summer module, but stops attending those classes prior to the scheduled end date.
- After starting and finishing some summer courses, a student drops a later scheduled course while not currently attending any classes.
- Example: a student plans to take two 3-credit courses in the first summer module and one 3-credit course in the last summer module, with a break between the modules. The student completes the first two courses, and then drops the third course during the break.

In order to avoid complications in these scenarios, students are highly encouraged to do the following:

- Make summer course changes only while still attending classes in the first module of planned attendance.
- Avoid scheduling classes if there is any uncertainty that the student will actually enroll in those classes.

Study Abroad Financial Aid

Varying types and amounts of financial aid may be available to students who wish to travel abroad as part of their degree program. All students seeking financial aid for this purpose must be taking courses that specifically meet a degree requirement. Enrollment level for aid eligibility will be based only on the courses which meet this condition. Before any aid eligibility can be considered, students must have submitted an approved SUNY ESF Study Abroad Request Form, a fully completed Study Abroad Data Form, and additional paperwork as indicated in the following sections. Financial aid is only available for abroad study which is during an existing term at SUNY ESF. Students seeking financial aid must also meet all existing eligibility requirements for each individual source of funding.

SUNY ESF Students Participating in a SUNY Study Abroad Program

Students studying abroad through a program at another SUNY school may be eligible for the following types of financial aid:

- Federal Aid
- State Aid
- Institutional Aid

To be considered for financial aid, students in this category must submit the following:

- Approved Study Abroad Request Form
- Completed Study Abroad Data Form
- Completed Study Abroad Consortium Agreement Form

SUNY ESF Students Participating in a Non-SUNY Study Abroad Program

Students studying abroad through a program at a non-SUNY school which participates in the Federal Student Aid Programs may be eligible for the following types of financial aid:

- Federal Aid
- State Aid (Only if the host school is located within New York State)
- Institutional Aid

To be considered for financial aid, students in this category must submit the following:

- Approved Study Abroad Request Form
- Completed Study Abroad Data Form

- Completed Study Abroad Consortium Agreement Form
- Copy of the tuition bill from the New York State school, if applicable

SUNY ESF Students Participating in a Foreign School or Outside Organization Study Abroad Program

Students studying abroad through a program at a foreign school which does not participate in the Federal Student Aid Programs or through an outside organization acting on behalf of such an institution may be eligible for the following types of financial aid:

- Federal Aid
- Institutional Aid

To be considered for financial aid, students in this category must submit the following:

- Approved Study Abroad Request Form
- Completed Study Abroad Data Form
- Completed Study Abroad Consortium Agreement Form

SUNY ESF Students Participating in a Domestic Off-Campus Program

Students studying off-campus within the United States through a school which participates in the Federal Student Aid Programs may be eligible for the following types of financial aid:

- Federal Aid
- State Aid (Only if the host school is located within New York State)
- Institutional Aid

To be considered for financial aid, students in this category must submit the following:

- Approved Study Abroad Request Form
- Completed Study Abroad Data Form
- Completed Study Abroad Consortium Agreement Form
- Copy of the tuition bill from the New York State school, if applicable

Disbursement of Financial Aid Funds

All financial aid funds for study abroad will be scheduled for disbursement to SUNY ESF ten days prior to the students departure. Once disbursed, funds are processed through the Bursars Office. With the exception of tuition charges to any SUNY institution, all aid funds will be disbursed directly to the student or to the parent (if from a Parents Loan) once they are available through the Bursars Office. SUNY tuition charges will be collected by SUNY ESF and transferred to the host school. No other funds will be disbursed or paid to the host school or organization. **It is the students responsibility to make all necessary payment arrangements as necessary.**

Academic Credit Earned

All students studying abroad must ensure that an official transcript of all courses is submitted to SUNY ESF upon completion of the program. Students who do not submit an official transcript or who do not fully complete the approved program will be subject to the College's Withdrawal, Refund, and Satisfactory Academic Progress policies. This could result in a loss of eligibility for funds already received or a loss of eligibility for future financial aid.

Satisfactory Academic Progress

In order for students to receive federal, state, and institutional aid, they must be making "satisfactory academic progress" toward a degree. The rules for satisfactory academic process depend upon the type of aid involved **ESF College Aid, Federal Aid,** and **New York State Aid.**

ESF College Aid

Full-time undergraduate students receiving any of the following ESF awards are eligible to have their awards renewed in future years if they maintain an overall Grade Point Average (GPA) and enrollment level as indicated and complete the FAFSA by the February 1st priority deadline each year:

- ESF Transfer Scholarship - 2.50 GPA and Half-Time Enrollment (6 credits or more)
- ESF College Aid Grant (ESF College Scholarship) - 2.50 GPA and Half-Time Enrollment (6 credits or more)
- ESF Asimov Scholarship/ESF 1911 Scholarship - 2.50 GPA and Half-Time Enrollment (6 credits or more)
- ESF Renewal Grant - 2.50 GPA and Half-Time Enrollment (6 credits or more)
- ESF Presidential Scholarship - 3.00 GPA and Full-Time Enrollment (12 credits or more)
- ESF in the High School Scholarship - 3.00 GPA and Full-Time Enrollment (12 credits or more)
- ESF National Scholarship - 3.00 GPA and Full-Time Enrollment (12 credits or more). Must also be charged non-resident tuition rate.
- ESF Mighty Oaks Scholarship - 2.50 GPA and Full-Time Enrollment (12 credits or more). Must also be charged non-resident tuition rate.
- ESF Phi Theta Kappa Scholarship - 3.00 GPA and Full-Time Enrollment (12 credits or more)
- ESF Centennial Hall Scholarship - 2.50 GPA (student must also reside in Centennial Hall to remain eligible for this scholarship) and Half-Time Enrollment (6 credits or more)
- ESF OCC/ECC Transfer Scholarship - 3.00 GPA and Full-Time Enrollment (12 credits or more)
- ESF Legacy Scholarship - 2.50 GPA and Full-Time Enrollment (12 credits or more)
- ESF College Foundation Endowed Awards (Individually Named) - 2.50 GPA (unless specified otherwise for specific awards) and Half-Time Enrollment (6 credits or more)

Federal Student Aid

Undergraduate and graduate students must meet specified criteria in order to be eligible for Title IV Federal Student Assistance, which includes Federal Pell Grants, Federal Supplemental Educational Opportunity Grants, Federal Student Loans, the Federal College Work-Study Program, and the Federal Parent Loan for Undergraduate Students. The criteria that students must meet to be eligible for Title IV student aid are the same criteria all ESF students must adhere to in terms of institutional academic policies and, specifically, academic progress requirements.

The evaluation criteria are the following:

1. appropriate cumulative and term grade point averages to ensure satisfactory academic progress;
2. receipt of a degree within the prescribed time limit for the student's program;
3. successful accumulation of credits toward a degree.

1. Cumulative Grade Point Average

Undergraduate students enrolled in an approved degree program at the Syracuse Location

In order to remain eligible for Title IV Federal Student Assistance, a student must meet the cumulative and semester grade point average requirements of the Academic Performance Policy. A student will no longer be eligible for federal aid if the student’s cumulative grade point average and most recent term grade point average are below 2.0 or when the cumulative grade point average alone is less than the required limits in the chart below.

Total Hours applied Toward Degree (credit earned while matriculated at ESF, including SU courses)	Minimum Cumulative Grade Point Average (includes only courses taken while matriculated at ESF)
0-30	1.700
31-60	1.850
61-120 or more	2.000

Graduate students enrolled in an approved degree program at the Syracuse location

In order to remain eligible for Title IV Federal Student Assistance, a student must meet the minimum cumulative grade point average of 3.000 as indicated in the Academic Performance Policy.

Students enrolled in an approved degree program at the Wanakena location

In order to remain eligible for Title IV Federal Student Assistance, a student must meet the minimum cumulative grade point average of 2.000.

2. Maximum Timeframe

Students receiving federal student aid funds must make steady academic progress toward their degrees. While most students pursue their degrees on a full-time basis, others do not. In order to allow for maximum flexibility to complete a degree, federal regulations state that students' maximum timeframe to be eligible for federal aid shall not exceed 150 percent of the published length of time it takes to complete that degree on a full-time basis.

The following chart lists the maximum number of credit hours a student may take and still receive federal student aid. These figures are based on 150 percent of the credit hours required to complete each of the degrees offered by the College—regardless of the time it takes to complete that degree.

For any program not specifically listed, the maximum timeframe is 150% of the number of credits required to obtain the degree.

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for Federal Aid

Degree	Credit Hours Required	Maximum Hours Allowed
Associate in Applied Science		
Environmental and Natural Resources Conservation	64	96
Forest Technology	64	96
Land Surveying Technology	64	96
Bachelor of Science	125	187

Aquatic and Fisheries Science	126	189
Bioprocess Engineering	128	192
Biotechnology	123	184
Chemistry	121	181
Conservation Biology	126	189
Construction Management	124	186
Environmental Biology	126	189
Environmental Education and Interpretation	126	189
Environmental Health	126	189
Environmental Resources Engineering	128	192
Environmental Science	126	189
Environmental Studies	121-124	186
Forest Ecosystems Science	124	186
Forest Health	126	189
Forest Resources Management	125	187
Natural Resources Management	122	183
Paper Engineering	128	192
Paper Science	124	186
Sustainable Energy Management	120	180
Wildlife Science	126	189
Bachelor of Landscape Architecture	150	225
Bachelor of Landscape Architecture (Effective Fall 2016)	141	211
Bachelor of Landscape Architecture/Master of Science	141/30	211/225

Master of Forestry	37	55
Master of Landscape Architecture	70	105
Master of Professional Studies (unless otherwise noted)	30	45
Applied Ecology	36	54
Chemistry	33	49
Environmental and Forest Biology	42	63
Plant Biotechnology	36	54
Master of Science (unless otherwise noted)	30	45
Environmental Studies	37	55
Doctor of Philosophy	60	90

3. Pace of Progression

Federal student aid (Title IV) eligibility is also related to the successful completion of credit hours completed versus credit hours attempted. This component of eligibility is referred to as Pace of Progression or Pursuit of Program. Pursuit of Program is defined as: the cumulative number of credit hours completed divided by the cumulative number of credit hours attempted. This equation is tied back into the overall credits needed to be earned to graduate for any of our degrees. Generally, the cumulative number of credits a student must complete to remain fully eligible is 67 percent (.67) of the attempted credits. Percentages are rounded up for this calculation. For example, a student completing courses at a rate of 66.5 to 66.9 percent will be considered to be completing courses at a 67 percent rate. Students receiving federal student aid from Title IV programs must be making progress towards their degree at the cumulative rates of completion as follows:

- 50% cumulative rate of completion for undergraduate first-year students.
- 67% cumulative rate of completion for all other undergraduate class years.
- 67% cumulative rate of completion for all graduate class years.

An example of meeting the requirement is:

Cumulative Credits Attempted = 15
Cumulative Credits Completed = 12
Pace of Progression = 12 divided by 15 = .80

The completed credits exceed .67 and the student is eligible for continuing to receive Title IV aid by successfully meeting the Pace of Progression requirement.

An example of not meeting the requirement is:

Cumulative Credits Attempted = 15

Cumulative Credits Completed = 6
Pace of Progression = 6 divided by 15 = .40

The credits completed fall below the minimum requirements and therefore the student is not meeting the Pace of Progression requirement.

Treatment of Incomplete Grades, Withdrawals, Repeated Courses, Remedial Courses, Change of Major, and Transfer Credits

1. Incomplete grades

Incomplete grades do count as attempted credits, but grade point average will only be affected once the incomplete status has been resolved and a final grade assigned. The assigned grade and the attempted/completed credits will be included in the Satisfactory Academic Progress calculations during the next regular review.

Resolution of incomplete grades follows the “Incomplete and Missing Grades” College policy as follows:

Incomplete and missing grades

A temporary grade of I may be assigned by an instructor only when the student has nearly completed the course but because of significant circumstances beyond the student’s control the work is not completed. Grades of I should be resolved within one academic year. If the incomplete is not resolved within one year, it will be changed to a grade of I/F or I/U, depending on the grading basis for the course. No degree will be conferred until all grades of I have been resolved.

2. Withdrawals

Withdrawals from courses after the deadline to drop a course each semester (end of the 4th week) will be included in Satisfactory Academic Progress reviews based on the grades assigned according to the College’s “Withdrawal from ESF” policy. All courses dropped after the deadline to drop a course (end of the 4th week) will be considered attempted but not completed. Courses dropped by the deadline to drop a course will not be included in the Satisfactory Academic Progress reviews.

Withdrawal from ESF

Students who withdraw from matriculation at the College on or before the deadline to drop a class for a semester will have their records marked: “Withdrew on (date).” Courses will appear for that semester with the grade of W.

Students who withdraw after the **end of the 4th week of the semester**, but on or before the last class day before the final examination period, will have either WP (withdraw passing) or WF (withdraw failing) listed after each uncompleted course. Students who do not withdraw on or before the last class day will have a grade on a scale of A-F, an I (incomplete), or I/F (unresolved incomplete) assigned by the instructor for each registered course.

Students who wish to withdraw from ESF should schedule a meeting to review the withdrawal process and complete an exit interview in the Office of Student Affairs.

Withdrawal from Individual Courses

Students may drop individual courses up until the **last day to add** as set by the Registrar in the ESF Academic Calendar using an **add/drop form**. Dropped courses during this period will be completely removed from the transcript when dropped on or before this deadline.

Deadlines and actions to be taken after the last day to add deadline are:

- **Last day to add – Week 4**: After the **last day to add** (as per the academic calendar), students may drop a course without record of registration, until the end of the 4th week of classes.
- **Weeks 5-9**: A student who withdraws from a course after the last day of the **4th week and by the last day of the 9th week** will receive a W (Withdraw) grade on his or her permanent transcript, and the student will remain on the course roster. The W grade will not affect the GPA, and will not be replaced when the course is repeated.
- **Weeks 10-14**: A student who withdraws from a course after the last day of the **9th week and by the last day of the 14th week** will receive a W or a WF (withdraw failing) on his or her permanent transcript, and the student will remain on the course roster. The WF grade will not count in the student's GPA. W and WF grades are not replaceable. The W (when assigned after the last day of the 9th week) and WF grade will be assigned by the instructor at the end of the semester.

Precise deadline dates noting the official end of weeks above shall be listed on the ESF Academic Calendar found on the Registrar's webpage.

3. Repeated Courses

Repeated courses will be included in Satisfactory Academic Progress reviews according to the College's "Repeating Courses" policy:

Repeating Courses

Undergraduate students may repeat any course previously taken either to earn a higher grade or because of a previous failure. Courses taken at ESF or Syracuse University that contribute to the GPA may be repeated. Ability to repeat a course may be limited by space availability, providing priority for first time registrants.

Repeated courses will be reported as follows: a) the original and the repeated grade(s) appear on the transcript; b) only the higher (or highest) grade is included in the calculation of the cumulative grade point average. The highest grade will be marked with an "I" for included to show that it is included in the cumulative GPA. Any other grades will be marked with an "E" for excluded to show that it is excluded from the cumulative GPA.

When a student earns the same grade in a repeated course a) the grade is calculated once in the cumulative grade point average and b) the credits and quality points are applied to the most recent term or semester in which the grade was earned. Credit hours for the repeated course may be counted only once toward meeting graduation requirements.

For state-based financial aid, repeated courses in which students have received a passing grade will not count toward full time status. Students retaking courses may find their financial aid reduced if they fall below 12 credits when the retaken courses are not included. Students should contact the Financial Aid Office to determine the impact of retaking courses on their financial aid. Students receiving Federal Aid may repeat a previously passed course one time and still receive aid. Students may receive aid for previously failed courses that are repeated more than once. All repeated courses count as attempted credits for the purposes of measuring Satisfactory Academic Progress.

4. Remedial Courses

Eligible remedial courses will be included in the Satisfactory Progress review in all categories.

5. Change of Major

If a student changes major, courses previously taken which do not apply to the new major will not be considered as part of the Satisfactory Academic Progress Review.

6. Transfer Credits

For the purposes of Satisfactory Academic Progress reviews, all transfer credits that are accepted as meeting a degree requirement will be counted as both attempted and completed credit hours.

Title IV Aid: Satisfactory Academic Progress Review Process

Students receiving Federal Title IV aid will be reviewed for Satisfactory Academic Progress by the College at the end of each term of enrollment, including summer terms, in order to comply with our responsibility with the regulations. This review will monitor a student's status in each of the three evaluation criteria. Based on this review, each student will be determined to be in one of four eligibility categories as noted below. Students will be notified of any change in status which affects eligibility for Title IV aid.

1. Eligible - meeting Satisfactory Academic Progress Requirements and eligible for Title IV aid.
2. Financial Aid Warning - not meeting Satisfactory Academic Progress Requirements at the end of the previous term, but still eligible for Title IV aid.
3. Ineligible - Not meeting Satisfactory Academic Progress Requirements and not eligible for Title IV aid.
4. Financial Aid Probation - Not meeting Satisfactory Academic Progress Requirements but eligible for Title IV aid based on an approved appeal and an approved academic plan, if deemed necessary through the appeal process.

Eligible

Students will be determined to be in the eligible category when meeting the calculated Pace of Progression, Maximum Timeframe, and Grade Point Average requirements or when previously on Financial Aid Probation and currently working under and meeting all conditions of an approved academic plan.

Financial Aid Warning

Eligible students who are not meeting any of the Satisfactory Academic Progress Requirements at the end of a term will automatically be placed in a status of Financial Aid Warning. Students placed in this status will remain eligible for one additional semester of Title IV aid.

Ineligible

Students already in a status of Financial Aid Warning will be placed in the ineligible category if any of the following conditions are met at the time of review:

- The student is not meeting the Pace of Progression requirements.

- It has been determined that the student is no longer able to complete the degree requirements within the maximum timeframe. Note that this is not the point at which the student has attempted the maximum allowed credit hours.
- The student is not meeting the Grade Point Average Requirements.

Financial Aid Probation

Students in the Ineligible category may appeal that status based on extenuating circumstances such as the death of a relative, an injury or illness of the student, or other special circumstances. Appeals must be submitted in writing to the Director of Financial Aid and must include the following:

- Why the student failed to make progress toward the degree
- What has changed that will allow the student to make progress
- Documentation supporting the information included in the appeal. Such documentation could include, but is not limited to, communication from doctors, counselors, or other service providers, confirmation of use of academic support services, medical records, signed statements from third parties knowledgeable of the situation, etc.

If an appeal is approved, the student will be placed on Financial Aid Probation status and will regain eligibility for Title IV aid. Students on Financial Aid Probation may receive Title IV aid for one semester if it is determined that the student should be able to meet all Satisfactory Academic Progress requirements by the end of that semester. If it is determined that the student will not be able to meet all Satisfactory Academic Progress requirements by the end of one semester, an academic plan can be developed to allow for additional semesters of eligibility as indicated in that plan. Students without an approved academic plan who do not meet all Satisfactory Academic Progress requirements after one semester of Financial Aid Probation will be again placed in the Ineligible category. Additional appeals are allowed as long as the circumstances are not exactly the same as those that were used for a previous appeal.

Academic Plan

Students in Financial Aid Probation status who will not meet all Satisfactory Academic Progress requirements within one semester may regain Title IV aid eligibility by developing and following a specific academic plan. The need for an academic plan will be determined during the appeal process. Students in need of an academic plan will need to submit a plan proposal to the Financial Aid Office which specifies the following:

- The specific date or scheduled time when the plan will end and the student should be meeting all Satisfactory Academic Progress requirements.
- The cumulative GPA which must be reached or maintained each semester such that the cumulative GPA will be meeting the minimum progress requirements when the plan ends.
- Any changes made to the maximum number of credits which can be attempted.
- The percentage of attempted credits which must be successfully completed each semester such that the Pace of Progression will be meeting the minimum progress requirements (or the new requirements established in the plan) when the plan ends.
- Other requirements deemed necessary which are related to the circumstances of the student's successful appeal.

Students who are successfully following all conditions of an approved Academic Plan will be considered eligible for Title IV aid.

Title IV Aid : Degree Applicable Courses and Repeated Courses

Degree Applicable Courses : Students may only receive federal aid for courses which are required for degree completion. Students enrolled in credits beyond the number required for the degree or enrolled in courses that are not applicable to a degree requirement will have financial aid adjusted accordingly.

Repeated Courses : Students may repeat a previously passed course one time and still receive aid. Students may receive aid for previously failed courses that are repeated more than once. All repeated courses count as attempted credits for the purposes of measuring Satisfactory Academic Progress.

New York State Aid

All students who are awarded financial assistance will be required to maintain satisfactory academic progress each semester in order to keep their awards. Academic progress standards for all awards provided by New York are listed below. Recipients of a New York state award must adhere to the following state requirements:

- Academic Progress: Students must meet the minimum grade point average standards listed in the following charts to be eligible for an award the next semester.
- Program Pursuit: Students must meet the minimum number of credit hours listed in the following chart each semester based on a full-time course load of 12 credit hours.

Waivers for New York State Awards

Students who fall below the credit or grade point average requirements listed on the following charts may apply for a waiver to continue their eligibility for financial aid. Students are allowed only one waiver during undergraduate work and only one waiver during graduate work. A waiver will be granted only after the student and College officials agree that a waiver is in the best interest of the student. The waiver is *not* automatic. The waiver must be filed within the academic period it should cover. Requests are made through the director of Financial Aid and Scholarships.

Waivers for the cumulative grade point average requirement may be granted only when failure to meet this requirement is due to:

- the death of a relative of the student;
- the personal injury or illness of the student;
- other extenuating circumstances.

Requests for a waiver are made through the director of Financial Aid and Scholarships.

Standard of Satisfactory Academic Progress for Purpose of Determining Eligibility for New York State Student Aid

The following charts list the credit hours a student must complete and the grade point average a student must maintain to receive the award payment.

For students pursuing an associate degree program at ESF:

Payment	Credit Hours	Grade Point Average
#1	0	.000

#2	6	1.300
#3	15	1.500
#4	27	1.800
#5	39	2.000
#6	51	2.000

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

For students pursuing a bachelor's degree program at ESF:

Payment	Credit Hours	Grade Point Average
#1	0	.000
#2	6	1.500
#3	15	1.800
#4	27	1.800
#5	39	2.000
#6	51	2.000
#7	66	2.000
#8	81	2.000
#9	96	2.000
#10	111	2.000

Noncredit remedial instruction can be counted toward a full-time academic load as set forth in 145-2.1 of the Commissioner's Regulations. The number of credits in this chart refers to work completed toward the degree.

For students pursuing any graduate degree program at ESF:

Payment	Credit Hours	Grade Point Average
#1	0	.000
#2	6	2.000
#3	12	2.500
#4	21	2.750
#5	30	3.000

#6	45	3.000
#7	60	3.000
#8	75	3.000

Standard of Pursuit of Program for Purpose of Determining Eligibility for New York State Student Aid

The following chart lists the minimum number of credit hours a Bachelor's degree student must complete each semester.

Number of Payments	Must Receive a Grade For
Semester	
1,2	50% of minimum full-time requirement (6 credit hours on a semester calendar)
3,4	75% (9 credit hours)
5 or More	100% (12 credit hours)

New York State Aid : Degree Applicable Courses and Repeated Courses

Degree Applicable Courses : Students may only receive NY State aid for courses which are required for degree completion. Students enrolled in credits beyond the number required for the degree or enrolled in courses that are not applicable to a degree requirement will have financial aid adjusted accordingly. Students with remaining degree requirements less than 12 credits (typical full-time enrollment) may, in the final term of the degree program only, enroll in additional non-required credits to maintain full-time enrollment.

Repeated Courses : A student can repeat a course and have the course count as part of the minimum full-time or part-time course load for NY State financial aid purposes when the student did not previously earn credit for the course.

Types of Available Awards

NOTE: In the tables below, the term "Full-Time Undergraduate Student" in this chart means one taking at least 12 credit hours per semester in a degree/ certificate program; "Three-Quarter-Time Undergraduate Student" means one taking at least 9 credit hours per semester in a degree/ certificate program; "Half-Time Undergraduate Student" means one taking at least 6 credit hours per semester in a degree/certificate program. Graduate students not holding an assistantship are considered full-time if registered for 12 credit hours each semester. Graduate students holding an assistantship and/or tuition scholarship are full-time if registered for 9 credit hours each semester. This information is accurate as of 09/1/2024.

ESF Scholarships and Grants

Scholarship Program	Eligibility	Amount	Where to Apply
ESF Presidential Scholarships	Awarded to outstanding full-time students from NY State. Recipients are selected based on academic records, recommendations, and academic program requirements.	Up to $3,000 per year. Renewable with 3.0 cumulative GPA. Maximum award amounts may vary from year to year and may be impacted by other institutional aid awards.	All first-year and transfer applications submitted to ESF by February 1 will be reviewed for possible selection.
ESF National Scholarships	Awarded to outstanding full-time students from outside NY State. Recipients are selected based on academic records, recommendations, and academic program requirements.	Up to $8,000 per year. Renewable with 3.0 cumulative GPA. Maximum award amounts may vary from year to year and may be impacted by other institutional aid awards.	All first-year and transfer applications submitted by February 1 will be reviewed for possible selection.
ESF Mighty Oaks Scholarships	Awarded to outstanding students from outside NY State. Recipients are selected based on academic records, recommendations, and academic program requirements.	Up to $3,000 per year. Renewable. Maximum award amounts may vary from year to year and may be impacted by other institutional aid awards.	All first-year applications submitted by February 1 will be reviewed for possible selection.
ESF Asimov and ESF 1911 Scholarships	Awarded to students from NY State based on total family income.	Up to $3,000 per year. Renewable. Maximum award amounts may vary from year to year and may be impacted by other institutional awards.	All first-year and transfer applications submitted by February 1 will be reviewed for possible selection.
ESF College Aid Grant	Awarded to incoming first-year students based on financial need.	Up to $3,000 per year. Maximum award amounts may vary from year	Student must complete the FAFSA

		to year and may be impacted by other institutional aid awards. Renewable with a 2.5 cumulative GPA and FAFSA received annually by the priority deadline.	
ESF Transfer Grant	**Awarded to incoming transfer students based on financial need.**	**Up to $3,000 per year. Maximum award amounts may vary from year to year and may be impacted by other institutional aid availability. Renewable with a 2.5 cumulative GPA and FAFSA received annually by the priority deadline.**	**Student must complete the FAFSA**
ESF Renewal Grant	**Awarded to existing grant recipients based on financial need and established renewal requirements.**	**Up to $3,000 per year. Maximum award amounts may vary from year to year and may be impacted by other institutional aid awards. Renewable with a 2.5 cumulative GPA and FAFSA received annually by the priority deadline.**	**Student must complete the FAFSA**
Eustace B. Nifkin Scholarships	**Children or grandchildren of ESF alumni enrolled in full-time undergraduate study. Up to five winners selected each year.**	**$250 per semester for up to ten semesters. Renewable with cumulative GPA of 2.5 or higher.**	**Complete family question on ESF's Supplemental Application for Admission to be considered.**
Paper Science and Engineering Scholarships (Syracuse Pulp & Paper Foundation)	**United States citizens enrolled in or admitted to the Chemical Engineering or**	**Awarding rules are available at Chemical Engineering website**	**Application rules are available at Chemical Engineering website**

	other academic departments.		
ESF College Foundation Awards	Students with financial need or academic merit enrolled at least half-time.	Amounts for these awards vary based on financial need and other criteria.	Student must complete the FAFSA
Haudenosaunee Scholar Awards	Certified citizenship in Mohawk, Oneida, Onondaga, Cayuga, Seneca or Tuscarora nations.	$5,000 per year (full-time study only). Up to two scholarships awarded each year.	Application available on Office of Financial Aid and Scholarships website.
Phi Theta Kappa Scholarships	Community college transfer students who are members of PTK honor society.	$1,500 per year. Renewable with GPA of 3.00 or higher.	Proof of PTK membership submitted with application for admission.
National Merit, National Achievement, and National Hispanic Scholarships	Semifinalists or finalists in any of these three national scholarship programs.	Combined ESF Presidential and Merit Scholarships totaling up to $8,000 per year. Maximum award amounts may vary from year to year and may be impacted by other institutional aid awards. Renewable.	High school records provided for admission must indicate student's semifinalist or finalist selection.
Centennial Hall Scholarships	Students with financial need who reside on campus in Centennial Hall.	Amount varies based upon financial need and other institutional aid awards.	Students must complete the FAFSA.
Tuition Match Scholarships	Incoming first-year students from select states. Specific states and availability vary from year to year. Eligibility is dependent on SUNY approval and ESF participation in the program.	Award amounts vary and are contingent on the annual ESF non-resident tuition rate and the established tuition rates at identified flag-ship institutions in the students' home states. Amounts are also subject to change based on other institutional	All first-year applications submitted by February 1 will be reviewed for possible selection.

		aid a student may receive.	

State and Federal Government Grants

Scholarship or Grant	Eligibility	Amount	Where to Apply
Federal Pell Grant	Enrolled full-time, three-quarter-time, half-time, or less than half-time undergraduate students who demonstrate financial need.	From $7,395 for standard academic year. Award amounts may be subject to change based on federal aid regulations.	Students must submit the FAFSA
Federal Supplemental Educational Opportunity Grant (FSEOG)	Full-time, three-quarter-time, or half-time undergraduate students with exceptional need.	Varying, depending upon financial need and available funds.	Students must submit the FAFSA
New York State Tuition Assistance Program (TAP)	Full time students at any accredited college in New York State. Resident of New York State. Must demonstrate financial need.	$500 to $5,665 for undergraduates, depending on NYS net taxable income and dependency status.	Students must submit the FAFSA and the TAP Application
Part-Time New York State Tuition Assistance Program (TAP)	TAP eligible undergraduate students enrolled in 6-11 credit hours per semester.	Amounts based on a prorated percentage of the full-time TAP grant equivalent.	Students must complete the FAFSA and the TAP application.
Educational Opportunity Grant (EOP)	Undergraduate students. Resident of New York State. For educationally and economically disadvantaged students.	Varies according to individual need. Applicants must be accepted into the program through the admissions process.	Guidelines are in the SUNY Application for Admission. Submit the FAFSA.
New York State Science, Technology, Engineering and Mathematics Incentive (STEM)	Undergraduate students. Resident of New York State. Top 10% of high school class. Must enroll in STEM approved major, reside and work in	Up to full tuition, depending on eligibility for other New York State grants and scholarships. May affect eligibility for	Students must complete the NY STEM Scholarship application. Recipients must also sign a service contract.

	STEM related field in New York State for 5 years following graduation. 2.5 cumulative GPA each semester. • List of NY STEM approved SUNY ESF majors	SUNY-ESF grants and scholarships.	
New York State Excelsior Scholarship	Undergraduate students. Resident of New York State. Total familly Federal Adjusted Income not exceeding $125,000 (2022 Tax Information) for the 2024-2025 school year (2023 Tax Information) for the 2025-2026 school year.	Up to $5,500, depending on eligibility for other grants and scholarships. May affect eligibility for SUNY ESF grants and scholarships. An additional Excelsior Tuition Credit may also be awarded to students who have remaining tuition liability after the scholarship is applied.	Students must complete the Excelsior Scholarship application. Residents must also sign a residency contract and meet numerous other requirements. Details
New York State AIMS Scholarship	Undergraduate students. Resident of New York State.	$500 per year.	Students must complete the AIMS Scholarship application.

Federal Student Loans

Loan Program	Eligibility	Amount	Where to Apply
Federal Direct Loan NOTE: Repayment begins 6 months after you graduate or fall below half-time status. The default repayment length is ten years. There is a 1.057% origination fee (for the federal government) deducted proportionately from your loan	For all full-time, three- quarter-time, or half- time students. There are subsidized loans (interest-free while in school) and unsubsidized loans (student responsible for interest while in school). Students borrow from the Federal Government. Loans	Dependent Students: The maximum per year is $5,500 for freshmen, with no more than $3,500 subsidized; $6,500 for sophomores, with no more than $4,500 subsidized; $7,500 for juniors and seniors, with no more than $5,500 subsidized. The borrowing limit	Students must submit the Free Application for Federal Student Aid (FAFSA).

proceeds. The 2024-2025 interest rate is 6.53% for undergraduate student loans and 8.08% for graduate student loans.	are processed through the College. NOTE: Direct loans may be subsidized or unsubsidized or a combination. A subsidized loan is such that interest does not accrue while the borrower is in school. An unsubsidized loan is such that the borrower must make interest-only payments while in school or allow interest payments to be added to the principal.	for dependent undergraduate students is $31,000, with no more than $23,000 subsidized. Independent students or students whose parents cannot borrow under the Federal Direct PLUS Loan Program: The subsidized and unsubsidized maximum per year is $9,500 for freshmen, $10,500 for sophomores, and $12,500 for juniors and seniors. The borrowing limit for independent undergraduate students is $57,500, with no more than $23,000 subsidized. Graduate or Professional Students: The unsubsidized maximum is $20,500 per year (borrowing limit is $138,500 over lifetime in school). Interest subsidized loans will not be available to new graduate borrowers after 7/1/12.	
Federal Direct PLUS Loan	For parents or guardians of financially dependent undergraduate students. Graduate students may also borrow Direct PLUS loans.	The maximum is the cost of education at ESF minus any estimated financial aid. Borrowers must meet established credit criteria. Loan repayment begins 60 days after the loan is fully disbursed. The 2024-2025 interest rate is 9.08%. There	Students must submit the Free Application for Federal Student Aid (FAFSA).

		is a 4.228% loan origination fee.	

Student Employment

Employment Program	Eligibility	Amount	Where to Apply
Federal Work-Study	For full-time, three-quarter-time, or half-time students with financial need.	Opportunities for employment are offered during the academic year and/or summer. Students may work up to 20 hours per week when classes are in session or up to 40 hours per week during vacations. Hourly wages up to $15.00 per hour.	Students must submit the FAFSA application and the appropriate tax forms.
Job Location and Development Program	For all ESF students. Students are connected to job opportunities with local employers.	Wage and hours will vary according to job offers.	Apply by visiting the ESF job locator in the Financial Aid Office.

Graduate Student Assistantships

Assistantships	Eligibility	Amount	Where to Apply
Graduate Assistantships	Assistantships sponsored by N.Y. State and various research projects are available. Students assist with instruction, research, and support operations for an assigned program area.	Weekly hours of employment and award ranges are determined by the awarding department, and a tuition scholarship may also be provided. Financial need is not a criterion for qualification.	The application for admission serves as the application for graduate assistantships for beginning students. Continuing students should contact their department chair.

DEGREE PROGRAMS AND AREAS OF STUDY

Undergraduate Programs

- **Other Undergraduate Study Pages**
  - General Education
  - Minors
  - Special Academic Options

ESF is authorized by the New York State Department of Education to offer undergraduate and graduate degree programs as described in this catalog. A comprehensive list of degree programs is provided below.

The Higher Education General Information Survey (HEGIS) code is the number assigned to programs registered by the commissioner of the New York State Department of Education. The Classification of Instructional Programs (CIP) Code allows the U.S. Department of Education to track educational programs for financial aid eligibility. Enrollment in programs that are not registered or otherwise approved may jeopardize a student's eligibility for certain financial aid programs.

Associate in Applied Science (A.A.S.)

- Environmental and Natural Resources Conservation (HEGIS Code 5403, CIP Code 030101)
- Forest Technology (HEGIS Code 5403, CIP Code 030511)
- Land Surveying Technology (HEGIS Code 5309, CIP Code 151102)

Bachelor of Landscape Architecture (B.L.A.)

- Landscape Architecture (HEGIS Code 0204, CIP Code 040601)
  - B.L.A./M.S. Fast-Track (HEGIS Code 0204, CIP Code 040601)

Bachelor of Science (B.S.)

- Aquatic and Fisheries Science (HEGIS Code 0115, CIP Code 261304)
- Biochemistry (CIP Code 260202)
- Bioprocess Engineering (HEGIS Code 0905, CIP Code 140501)
- Biotechnology (HEGIS Code 0499, CIP Code 261201)
- Chemical Engineering (HEGIS Code 0906, CIP Code 140701)
- Chemistry(HEGIS Code 1905, CIP Code 400501) with options in biochemistry and organic chemistry of natural products, environmental chemistry, or natural and synthetic polymer chemistry.
- Conservation Biology (HEGIS Code 0420, CIP Code 261307)
- Construction Management (HEGIS Code 0599, CIP Code 522001) with elective concentration in sustainable construction and renewable materials.
- Environmental Biology (HEGIS Code 0420, CIP Code 261305)
- Environmental Education and Interpretation (HEGIS Code 0499, CIP Code 269999)
- Environmental Health (HEGIS Code 0420)
- Environmental Resources Engineering (HEGIS Code 0999, CIP Code 141401)
- Environmental Science (HEGIS Code 0420, CIP Code 030104) with options in renewable energy, environmental information and mapping, watershed science, health and the environment, earth and atmospheric systems science or environmental analysis.

- Environmental Studies (HEGIS Code 0420, CIP Code 030103) with options in biological science applications; environmental policy, planning and law; or environment, communication and society.
- Forest Ecosystem Science (HEGIS Codes 0114, CIP Code 261307)
- Forest Health (HEGIS Code 0114, CIP Code 030502)
- Forest Resources Management (HEGIS Code 0115, CIP Code 030501)
- Natural Resources Management (HEGIS Code 0115, CIP Code 030201)
- Paper Engineering (HEGIS Code 0999, CIP Code 144001)
- Renewable Materials Science (HEGIS Code 0999, CIP Code 144001)
- Sustainability Management (online, CIP Code 303301)
- Sustainable Energy Management (HEGIS Code 0115, CIP Code 030201)
- Undeclared Option (open to first-year students)
- Wildlife Science (HEGIS Code 0107, CIP Code 260709)

Graduate Programs

- Graduate Study: Degrees & Options

Chemical Engineering

(HEGIS Code 0999, CIP Code 144001)

M.S., M.P.S. and Ph.D. in Bioprocess Engineering

- Bioprocess Engineering (Biocatalysis and Bioreaction Engineering, Bioseparations Engineering, Bioprocess Design, Simulation and Control, Bioenvironmental Engineering, Renewable Energy and Biofuels, Biopharmaceuticals, Industrial Biological Processes, Bioprocess Engineering (M.P.S. only))

M.S. and Ph.D. in Paper and Biomaterials Engineering

- Paper and Biomaterials Engineering (Biocomposite Materials, Biopolymers, Bioactive Materials and Biosensors, Nanocomposites and Nanostructured Materials)

M.S., M.P.S. and Ph.D. in Paper Science and Engineering

- Paper Science and Engineering (Pulping and Bleaching Processes (M.S., Ph.D.), Colloidal Chemistry and Fiber Flocculation (M.S., Ph.D.), Fiber and Paper Physics (M.S., Ph.D.), Process and Environmental Systems Engineering (M.P.S., M.S., Ph.D.), Pulp and Paper Technology (M.P.S.))

M.P.S. in Sustainable Engineering Management

- Sustainable Engineering Management (Areas of Study include: Bioprocess Engineering, Paper Engineering)

M.S., M.P.S. and Ph.D. in Wood Science

- Wood Science (Topic Areas include: Engineered Wood Products and Structures (timber structure design), Tropical Timbers, Wood Anatomy and Ultrastructure, Wood Science and Technology, Wood Treatments)

Chemistry

(HEGIS Code 1905, CIP Code 400509)

M.S., M.P.S. and Ph.D. in Chemistry with areas of study in:

- Biochemistry

- Environmental Chemistry
- Organic Chemistry of Natural Products
- Polymer Chemistry

Environmental Biology

(HEGIS Code 0499, CIP Codes 261307)

M.S., M.P.S. and Ph.D. in Environmental Biology with areas of study in:

- Aquatic & Fisheries Science
- Chemical Ecology (with the Dept. of Chemistry)
- Conservation Biology
- Ecology and Evolution
- Entomology
- Environmental Biotechnology
- Indigenous Peoples & the Environment
- Microbiology
- Molecular Biology & Ecology
- Mycology & Forest Pathology
- Plant Science
- Wildlife Ecology & Management

Environmental Resources Engineering

(HEGIS Code 0999, CIP Code 141401)

M.E., M.S., M.P.S. and Ph.D. in Environmental Resources Engineering with areas of study in:

- Ecological Engineering
- Environmental Management
- Environmental Resources Engineering
- Geospatial Information Science and Engineering
- Water Resources Engineering

Environmental Science

(HEGIS Code 0420, CIP Code 030104)

M.S., M.P.S. and Ph.D. in Environmental Science with areas of study in:

- Climate and Energy
- Ecosystems: Land, Water and Air
- Policy, Planning, Communication and Society

Environmental Studies

(HEGIS Code 0420, CIP Code 030103)

M.S. and M.P.S. in Environmental Studies with areas of study in:

- Environmental Communication
- Environmental Policy
- General Environmental Studies

- Graduate Certificates
    - Environmental Decision Making
    - Environmental Justice and Inequality (online)
    - Environmental Leadership (online)
    - Science and Environmental Communication and Public Relations Management (online)
- *M.P.S. in:*
- Environmental Leadership, Justice, and Communication (online)

Landscape Architecture

(HEGIS Code 0204, CIP Code 040601)

Master of Landscape Architecture (M.L.A.) and M.S. in Landscape Architecture with areas of study in:

- Community Design and Planning
- Cultural Landscape Studies and Conservation
- Landscape and Urban Ecology

Sustainable Resources Management

(HEGIS Code 0115, CIP Code 030506)

M.S., M.P.S. and Ph.D. in Forest Resources Management with areas of study in:

- Ecology and Ecosystems
- Economics, Governance and Human Dimensions
- Forest Management & Silviculture
- Monitoring, Analysis and Modeling

M.S. , M.P.S. and Ph.D. in Natural Resources Management (CIP Code 3.0199)

- Natural Resources Management

M.S. , M.P.S. and Ph.D. in Sustainable Construction Management with areas of study in:(CIP Code 14.3301)

- Construction Management
- Sustainable Construction

M.S. , M.P.S. and Ph.D. in Sustainable Energy (CIP Code 30209)

- Sustainable Energy

Master of Forestry (M.F.)

- Forest Management and Operations

Graduate Certificate

- Climate Sustainability Leadership
- Graduation Rate for Undergraduate Students

Graduation rate and retention information are available on the ESF Student Consumer Information website. Graduation rate data is also published annually on the federal government's College Navigator website.

GENERAL EDUCATION

About General Education

The SUNY GE framework includes twelve categories of knowledge, skills and competencies—ten knowledge and skills areas expose students to different ways of knowing so that they can make reasoned judgements outside as well as inside their academic field, and enabling them to develop diverse perspectives and global understanding; and two core competencies that extend beyond discipline-specific knowledge and skills. The core of the curricula for all ESF undergraduate degree programs includes the mandatory knowledge and skills area for the natural science and scientific reasoning, communication (written and oral), mathematics and quantitative reasoning, and diversity, equity, inclusion, and social justice. For the remaining general education knowledge and skill area requirements, students must select courses chosen from at least three of the remaining knowledge and skill areas, or as specifically designated by their degree programs.

The courses listed below may be chosen to satisfy SUNY general education requirements in each of the knowledge and skill areas. Please note that more than 40 of these courses are taught in the College of Arts and Sciences at Syracuse University, including all courses in World Languages. General education courses listed with the prefix APM, EFB, EST, FCH, FOR, LSA, PSE, or SRE are taught at SUNY ESF and can be found in the Course Descriptions section of this catalog. Syracuse University courses descriptions.

General Education Requirements

*Mathematics and Quantitative Reasoning**

APM 103	Applied Algebra & Trigonometry	3
APM 104	College Algebra & PreCalculus	3
APM 105	Survey Of Calc & Appl I	4
APM 106	Survey Of Calc & Appl II	4
APM 115	Essential Calculus	4
APM 205	Calculus I:Science & Engr	4
APM 391	Intro/Probability&Stats	3

*Natural Sciences and Scientific Reasoning**

EFB 100	Survey of Biology	4
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1

EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 320	General Ecology	4
FCH 110	Survey of Chemical Principles	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 210	Elements Of Organic Chem	4
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223	Organic Chemistry II	3
FCH 224	Organic Chemistry Lab II	1
FOR 110	Environmental Physics	3
FOR 232	Natural Resources Ecology	3
PHY 211	General Physics I	3
PHY 221	General Physics I Laboratory	1
PHY 222	General Physics II Laboratory	1
SRE 225	Physics of Energy	3
Social Sciences		
EFB 120	The Global Envirnmnt & Society	3
EST 203	Introduction To Sociology	3
EST 221	Intro/American Government	3
EST 366	Environmental Ethics	3
EST 390	Social Processes & Envrn	3

FOR 207	Introduction To Economics	3
MAX 132	Global Community	3
PST 101	Intro to Analysis Pub Pol	3
PSC 123	Comparative Gov't & Politics	3
PSC 124	International Relations	3
PSC 125	Political Theory	3
PSY 205	Foundatns Human Behavior	3
SOC 248	Racial and Ethnic Inequalities	3
SOC 281	Sociology of Families	3

US History and Civic Engagement

EHS 150	US History & Envirnmntl Health	3
EST 201	Am Hist:Recnstructn to Present	3
EST 202	Am Hist:Discovery to Civil War	3
EST 361	History/Am Envrn Movement	3
HST 101	American History to 1865	3
HST 102	Amer. History Since 1865	3

World History and Global Awareness

AAS 241	African Religions: An Introducation	3
ANT 121	Peoples&Cultures of World	3
ANT 185	Global Encounters	3
ANT 324	Modern South Asian Cultures	3
ANT 326	Africa Through the Novel	3
EFB 217	Peoples, Plagues and Pests	3
EFB 305	Indigenous Issues&the Envrnmnt	3

EST 140	Int/Native People,Land,Cult	3
EST 200	Cultural Ecology	3
EST 204	Diversity&Knowledge of the Env	3
GEO 272	World Cultures	3
HOA 105	Arts & Ideas I	3
HOA 106	Arts & Ideas II	3
HST 111	Early Mod Eur:1350-1815	3
HST 210	The Ancient World	3
HST 211	Medieval Renaiss Europe	3
HST 320	Traditional China	3
HST 321	Modern China	3
JSP 114	Bible in History/Culture/Relig	3
LIT 203	Greek&Roman Epic in Eng Translation	3
LIT 211	Ancient Greek Drama	3
LSA 205	Art,Culture&Landscape I	3
LSA 206	Art,Culture&Landscape II	3
LSA 305	History/Landscape Arch I	3
PSC 125	Political Theory	3
PSE 201	Art &Early History/Papermaking	3
REL 101	Religions of the World	3
REL 114	Bible in History/Culture/Relig	3
REL 185	Hinduism	3
REL 186	Buddhism	3
REL 205	Ancient Greek Religion	3
REL 206	Greco-Roman Religion	3
SAS 324	Mdrn So. Asian Cultures	3

OR WGS 324		3

*Diversity: Equity, Inclusion and Social Justice**

EST 135	Intro to Climate Justice	3
EST 140	Int/Native People,Land,Cult	3
EST 204	Diversity&Knowledge of the Env	3
EST 205	Identity, Culture, & the Env	3
EWP 311	Urban Environmental Literature	3
LSA 212	Place/Culture/Design	3

Humanities

AAS 231	African Amer Lit to 1900:Intro	0 - 8
AAS 235	African American Drama	3
ENG 107	Living Writers	3
ENG 151	Interpretation of Poetry	3
ENG 153	Interpretation of Fiction	3
ENG 192	Gender & Literary Texts	3
EWP 290	Research Writing & Humanities	3
LIN 201	Nature&Study of Language	3
LIT 203	Greek&Roman Epic in English Translation	3
PHI 107	Theories/Knowldge&Reality	3
PHI 111	Plato's Republic	3
REL 135	Judaism	3
REL 156	Christianity	3
REL 217	The New Testament	3
REL 231	Judaic Literature	3
REL 252	Religious Ethics Social Issues	3

The Arts		
APH 261	Art Photography, Introduction	3
ENG 215	Introductory Poetry Workshop	3
ENG 217	Introductory Fiction Workshop	3
EWP 350	Eco-Cinema:Perspct&Pract	3
HOA 105	Arts & Ideas I	3
HOA 106	Arts & Ideas II	3
HOA 201	Masterpieces of Art	0 - 8
HOA 377	Nineteenth-Century American Art	3
HOM 125	Introductory Music Theory	3
HOM 165	Understanding Music I	3
LSA 182	Drawing Studio	3
LSA 201	Landscape Representation I	3
LSA 205	Art,Culture&Landscape I	3
LSA 206	Art,Culture&Landscape II	3
LSA 220	Intro/Landscape Architect	3
LSA 222	Photogrphy, Envirnmnt, & You	3
MTC 125	Introductory Music Theory	3
PSE 201	Art &Early History/Papermaking	3

*Communication (written and oral)**		
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3

*Denotes required category
**Fulfills both written and oral communication
$^+$Fulfills oral communication only
SU^ Syracuse University course

MINORS

Minors

Undergraduate Study

In addition to academic majors available at ESF, many departments offer academic "minors" for undergraduate students to build an area of additional breadth outside their major program of study. Admission to undergraduate minors for ESF students is via petition, with additional application requirements as noted in the descriptions of the minors below, along with a minimum cumulative GPA of 2.7. Successful completion of a minor will be noted on the transcript of each student.

Applied Statistics Minor

Coordinator: Eddie Bevilacqua

This minor provides students with an opportunity to extend their understanding of and ability to apply statistical methods beyond the basic techniques presented in introductory courses. The minor is intended to provide students with a strong background in statistical design (both sampling design and experimental design) and analysis. The 12-credit minor consists of two required courses (6 credits), APM 391 (or APM 395) and FOR 323 and 6 credits of directed electives of advanced courses, independent study, or teaching experience related to applied statistics.

Courses:
This minor requires 12 credits and includes the required courses (6 credits) and directed electives (6 credits) listed below. Other applied statistics courses may be substituted by petition for any course in the directed elective list with the approval of the FNRM Undergraduate Education Committee.

Required Courses (6 credits):

Course		Credits
APM 391 **OR** APM 395	Introduction to Probability and Statistics Introduction to Statistics in Engineering	3 (cannot use both)
FOR 323	Forest Biometrics	3

Directed Electives (6 credits):

Course		Credits
APM 620	Experimental Design and Analysis of Variance	3

APM 625	Sampling Methods	3
FOR 495	Undergraduate Teaching Assistance (must be in association with APM 391 or FOR 323)	1
FOR 498	Independent Study (under guidance of instructor of APM applied statistics courses)	2-3

Eligibility requirements:
Students from all programs at ESF are eligible for this minor if they have a cumulative grade point average of 2.70 or better after one semester at ESF (or as a transfer student with same standing).

Bioprocess Science Minor

Coordinator: Dr. Gary Scott

The bioprocess science minor gives students an understanding of the rapidly developing bioprocessing industry, which uses the chemical, physical and biological processes developed by living organisms or their cellular components in a type of advanced manufacturing of specialty commercial products. Bioprocess science will influence diverse fields as it becomes widely used, such as for producing energy from sustainable sources.

The bioprocess science minor is available to all ESF undergraduate students (**except students in the bioprocess engineering program)** who maintain a minimum cumulative grade point average of 2.70, and who desire to develop greater knowledge of bioprocess science and its related fields. Interested students must submit a petition and application form, with courses listed, to their academic advisor and the chair of their department, with final approval from the dean of Instruction and Graduate Studies. Students should declare the minor by the end of the sophomore year, but may petition to their home department for enrollment at any time after that. Successful completion of the minor will be noted on the student's transcript.

Eighteen credit hours (6 courses) are required to satisfy the minor. Specified courses: PSE 370 Principles of Mass and Energy Balance (3); BPE 310 Colloid and Interface Science (3); BPE 420 Bioseparations (3); and at least three directed elective courses available from both ESF and Syracuse University including biology, forestry, chemical engineering, chemistry, paper science and engineering, bioprocess engineering, and environmental and biological engineering. Students are required to complete at least one course from a list of biological and chemistry electives and at least one course from a list of engineering electives. The complete list of courses is available from faculty advisors.

Biotechnology Minor

Coordinator: Dr. Christopher Whipps

The minor in biotechnology is for students who wish to add knowledge of biotechnology theories and methodologies to the experiences and qualifications gained from their undergraduate program. Required courses develop a basis for understanding biotechnology, both at the theoretical and practical levels. Directed electives allow students to focus on an area of interest in the field. The minor is available to all ESF undergraduate students except those in the biotechnology major. Admission is via petition and requires a minimum cumulative GPA of 2.7.

Nineteen credit hours of coursework are required for completion of the minor. Sixteen credits of specified courses include EFB 307 Principles of Genetics (3); EFB 308 Principles of Genetics Lab (1); BTC 401 Molecular Biology Techniques (3); EFB 325 Cell Biology (3); FCH 430 Biochemistry I (3); and FCH 432 Biochemistry II (3). One directed elective course (for a minimum of three credits) must be selected from the following list. Other courses may be applicable with petition but cannot include BTC 420, 495, 498. A maximum of eight credits can count toward both major and minor requirements; overlap in excess of this number must be offset by taking additional courses from the directed elective list.

- BTC 425 Plant Biotechnology (3)
- BTC 426 Plant Tissue Culture Methods (3)
- EFB 303 Introductory Environmental Microbiology (4)
- FCH 431 Biochemistry Lab (3)
- FCH 584 Spectro ID/Organic Compounds (3)
- MCR 484 Scanning Electron Microscopy (3)
- MCR 485 Transmission Electron Microscopy (3)
- BIO 440 (M001): Applied Genomics (3) (SU)
- BIO 446 Epigenetics of Human Health and Disease (3) (SU)
- BIO 447 Basic Immunology (3) (SU)
- BIO 448 Evolutionary Medicine (3) (SU)
- BIO 462: Molecular Genetics (3) (SU)
- BIO 464 Applied Biotechnology (4) (SU)
- BIO 468 Microbiomes Biotech & Medicine (3) (SU)
- BIO 473 Pharmaceuticals & Cells (3) (SU)
- MEDT 439 Applied Techniques in Medical Biotechnology (2) (SUNY Upstate)

Chemistry Minor

Coordinator: Ted Dibble

The Minor in Chemistry is open to all undergraduates at SUNY ESF. Admission to the Chemistry minor requires sophomore, or higher, status, students to have completed one year of General Chemistry (I and II) with lab (8 credits) and one year of Organic Chemistry (I and II) with lab (8 credits).

To enroll in the Chemistry Minor, fill out the form How to Declare a Minor in Chemistry and the ESF Minor Enrollment Form and bring them to the Coordinator of the Chemistry Minor

Fifteen credit hours of upper division chemistry credits (300 level or above) are required from a list of suggested courses, including:

Required Courses

Course Number	Course	Codes *	Credits
FCH 325	Organic Chemistry III		4
FCH 360	Physical Chemistry I		3
FCH 361	Physical Chemistry II		3

FCH 380	Analytical Chemistry I		2
FCH 382	Analytical Chemistry I Lab		1
FCH 381	Analytical Chemistry II		3
FCH 410	Inorganic Chemistry		3
FCH 430 **OR** FCH 530	Biochemistry I Biochemistry I		3 3
FCH 431 **OR** FCH 531	Biochemistry Laboratory Biochemistry Laboratory		3 3
FCH 432 **OR** FCH 532	Biochemistry II Biochemistry II		3 3
FCH 510	Environmental Chemistry I		3
FCH 511	Atmospheric Chemistry		3
FCH 515	Meth/Envrn Chem Analysis		3
FCH 550	Polymer Sci:Synth&Mech		3
FCH 551	Polymer Techniques		3
FCH 552	Polymer Sci:Prop&Tech		3
FCH 584	Spectro ID/Organic Compounds		3

Computer and Information Technology Minor

Coordinator: Dr. Gary Scott

The computer and information technology minor is available to all ESF undergraduates who want to develop greater skill in computer science and information technology applications. By understanding the basic principles behind software development, students can more effectively use these tools in their chosen fields. To be eligible for this minor, a student must have a cumulative grade point average of 2.700 or better by the end of the sophomore year. Interested students must submit a minor enrollment form to their academic advisor and the minor coordinator for approval

Seventeen credit hours (6 courses) in computer science courses, information technology courses, and other strongly computer-based and analysis courses are required to complete the minor.

Required Courses (11 credits)

- Choose One:
  - GNE 160 Computing Methods for Engineers and Physical Scientists (3)
  - ERE 335 Numerical and Computing Methods (3)
  - CIS 151 Fundamentals of Computing and Programming
  - CPS 196 Introduction to Computer Programming
- ESF 200 Information Literacy (1)
- CIS 252 Introduction to Computer Science (4)
- CIS 351 Data Structures (3)

Elective Courses (6 credits)

ERE 445 Hydrologic Modeling (3)
ERE 530 Numerical and Computing Methods (3)
ERE 551 GIS for Engineers (3)
ERE 533 Ecological Modeling (3)
ERE 622 Digital Image Analysis (3)
ESF 300 Introduction to Geospatial Information Technologies (3)
CIS 3xx/4xx/5xx Any CIS course offered at the 300, 400, and 500 level
CPS 234 - Introduction to Computational Thinking
CPS 333 - UNIX Operating System and Internet
CPS 335 - JAVA programming for the Internet
CPS 504 - Introduction to C++
CPS 506 - Introduction to C
CPS 551 - Computer Organization & Operating System Design
CSE 261 - Digital Logic Design
CSE 262 - Digital Logic Design Laboratory
CSE 283 - Introduction to Object-Oriented Design
CSE 381 - Computer Architecture
CSE 382 - Algorithms & Data Structures
CSE 384 - Systems and Network Programming
CSE 389 - Web System Architecture and Programming
CSE 398 - Embedded and Mobile Systems Laboratory
CSE 418 - Deep Learning
CSE 444 - Mobile Application Programming
CSE 458 - Data Networks: Basic Principles
CSE 464 - Introduction to VLSI Design
CSE 483 - C# and Windows Programming
CSE 484 - Introduction to Computer and Network Security
CSE 486 - Design of Operating Systems
CSE 487 - Access Control, Security and Trust
CSE 488 - Introduction to Internet Security
CSE 561 - Digital Machine Design
CSE 581 - Introduction to Database Management Systems

Construction Management Minor

Coordinator: Dr. Paul Crovella

The construction management minor is available to all ESF undergraduates (except students in construction management) and prepares students for management careers in the construction industry. Admission to the minor requires sophomore status, with a cumulative grade point average of 2.70 or higher.

Eighteen credit hours (6 courses) are required to complete the minor. Four courses are specified, with an additional two courses selected from the list of six courses given below. A cumulative grade point average of 2.000 or higher is required for the construction management courses.

Specified Courses

Course Number	Course	Codes *	Credits
CME 255	Plan Interpn&Quantity Takeoff		3
CME 434			
CME 453	Construct Plan/ Scheduling		3
CME 454	Construction Project Mgt		3

Two additional courses are chosen from the following

Course Number	Course	Codes *	Credits
CME 331	Construction Safety		3
CME 335	Cost Engineering		3
CME 444	Materials Marketing		3
CME 455	Construct Contracts/ Specs		3

Economics Minor

Coordinator: Dr. John Wagner

Economics analyzes how people with limited resources make choices and provides the fundamentals for good decision-making. The minor in economics provides students with common microeconomic models and tools that can be used to analyze optimal management and policy decisions in natural resources management.

The Economics minor totals 15 credits.

Required Courses

Course Number	Course	Codes *	Credits

FOR 207	Introduction To Economics		3
ECN 301	Intermediate Microeconomics		3
ECN 311	Intermediate Mathemat. Micro		3

In addition, students must choose from the following directed electives (a minimum of 9 credits)

Directed Electives

Course Number	Course	Codes *	Credits
FOR 333	Natural Resrc Managerial Econ		3
SRE 454	Sustainble Energy Fin&Analysis		3
FOR 495	Undergrad Teaching Assistance		1 - 3
FOR 670	Resource & Envrn Economics		3
ESC 422	Energy Markets and Regulation		3
ERE 430	Engr Decision Analysis		3

It is the responsibility of the student to meet any prerequisites associated with courses in the minor.

Admission to the minor requires students to have a cumulative grade point average of 2.70 or better after one semester at ESF (or as a transfer student with the same standing).

Environmental Biology Minor

Coordinator: Dr. Greg McGee

This minor provides students the opportunity to explore fundamentals of molecular, cellular and organismal biology and ecology, and to develop laboratory and field proficiencies in the discipline. The minor is open all ESF undergraduate students who maintain a GPA of at least 2.70 after completing at least one semester at ESF and who have completed EFB 101/102 & 103/104 General Biology (8 cr) or their equivalents, and one semester of introductory chemistry with laboratory (4 cr).

Eighteen credit hours of biology courses are required to satisfy the minor, including: EFB320 General Ecology (4 cr); EFB307/308 Principles of Genetics w/ laboratory (4 cr); EFB311 Principles of Evolution (3 cr); 7 cr of directed biology electives that may include: EFB202, either EFB 210 or 211, and any 300+ level EFB course except EFB 420, 495, 498.

A maximum 6 of 18 credits may count toward both major and minor degree requirements, including directed electives; overlap in excess of 6 credits must be offset by taking additional 300+ biology courses.

Environmental Health Minor

Coordinator: Dr. Lee Newman

The Environmental Health minor will introduce students to environmental health with a core context of epidemiology and toxicology; the minor requires 15-17 credit hours. There are 3 required courses (7 credit hours): EHS250 Foundations of Environmental Health(1), EFB360 Epidemiology(3), and EFB400 Toxic Health Hazards(3). Students will have the flexibility to explore a variety of components by selecting an additional three courses (8-10 credit hours) from among the following: EHS440 Occupational Health and Safety(3), EHS350 Environmental Health Management(3), EHS320 Disease Prevention(2), FST102 Food fights: Contemporary Food Issues(3), FCH399 Introduction to Atmospheric Science(3), ENS470 Environmental Risk Assessment(3), EST245 Foundations of Environmental Communication(3), EHS480 Hazardous Waste Management(3), EFB303 Introductory Environmental Microbiology(4).

The Environmental Health minor will be available to students in all majors (except Environmental Health) who want to increase their knowledge of the impact of the physical environment on human health.

Some of the courses have additional pre-requisites, and students should investigate this before selecting courses to fulfill the minor requirements.

Students must have a minimum GPA of 2.7 to apply. Interested students should submit the minor enrollment form accompanied by a list of courses to fulfill the minor requirements to their faculty advisor and the Environmental Health minor coordinator, with final approval from the Dean of Instruction and Graduate Studies.

Environmental Policy and Communication Minor

Coordinator: Dr. Andrea Feldpausch-Parker

The minor in Environmental Policy and Communication is designed to provide students with the knowledge and skills to navigate the environmental policy process, to effectively communicate with diverse stakeholders in public and private spheres, and to critically reflect on and elucidate the interactions between scientific knowledge, social processes, and environmental problem-solving.

The Environmental Policy and Communication Minor is available to all ESF undergraduates.

Twelve credit hours are required. All students must take a course on the Fundamentals of Environmental Policy (typically EST 321, Government and the Environment). Additionally, to complete the minor, students must take a course in Environmental Communication; an Upper Level Course in Environmental Policy, Leadership, or Decision Making; and a course in Critical

Perspectives on Environment & Society. Admission to the minor requires sophomore status with a cumulative GPA of 2.70 or better.

Students in the Environmental Studies department pursuing the Options in either Environment, Communication and Society or Environmental Policy, Planning and Law should work with their advisor and the Environmental Policy and Communication Program Lead to ensure that the minor is complementary rather than redundant with their option. No more than 6 credits may be double-counted for both the Minor and an Option.

Required Courses (12 credits total):

1) A Course in the Fundamentals of Environmental Policy (3 Credits)

- Government and the Environment (EST 321)

2) A Course in Environmental or Science Communication (3 Credits)

- Public Communication of Science & Technology (EST 395)
- Environmental Communication Workshop (EST 493)

3) An Upper Level Course in Environmental Policy or Decision Making (3 Credits)

- Community Planning & Sustainability (EST 426)
- Environmental & Energy Auditing (EST 427)
- Land Use Law (EST 460)
- Environmental Impact Analysis (EST 550)
- Comprehensive Land Planning (LSA 451)

4) A Course on Critical Perspectives on Environment & Society (3 Credits)

- Environmental Justice (EST 415)
- Attitudes, Values & The Environment (EST 366)
- Social Processes of the Environment (EST 390)
- Indigenous Issues and the Environment (EFB 305)

Additional relevant 300 and 400-level courses (from ESF or SU) may be acceptable

Environmental Writing and Rhetoric Minor

Contact: Jacob Gedetsis

The Writing Program at ESF is a space where artistic and humanistic insights can find

creative ways to address our ecological crisis. The Environmental Writing minor creates a path to develop the expertise of environmentally-minded humanists and artists to make sense of, represent, and respond holistically to the natural world. Students in the minor engage in audience-centered approaches to writing, reading, and communicating across genres and contexts. They develop skills in environmental storytelling, digital literacies, and presentation to better prepare them to be active participants in academic, professional, and civic life. Why add this minor? Our students find that there are often multiple skill sets that careers demand of them and increasing one's exposure to, and practice of, writing can help with job placement and security. The minor also provides the ability to flex already existing interests in the creative world, all while exploring how writing functions in public spheres. Whether you love to read or write, the minor provides an opportunity to engage with wide-ranging composition skills, including criticism, creative writing, journalism, publishing, editing, and tutoring.
Prerequisites (6 Credits)

EWP 190: Writing and the Environment

EWP 290: Research Writing and Humanities (also offered in the summer; covers General Education Humanities)
Or equivalent courses from AP or transfer credit
Coursework (12 credits total):

Required Core Course (3 Credits)

- **EWP 300: Survey of Environmental Writing**

Choose Two Upper Division EWP Courses (6 credits)

- **EWP 311: Urban Environmental Literature**
- **EWP 350: Eco-Cinema: Perspectives and Practices**
- **EWP 390: Literature of Nature**
- **EWP 394: Art of Storytelling**
- **EWP 407: Writing for Environmental & Science Professionals**
- **EWP 420: Advance Public Presentation Skills**
- **EWP 490: Contemporary Literature of Nature**
- **EWP 494: Creative Non-Fiction in the Sciences**
- **EWP 495: Environmental Journalism**

Directed Electives (3 Credits)

- **EWP 401 Capstone Experience (with permission of instructor) or**

Another 3 credit, upper division EWP course (300, 400)

Additional relevant 300 and 400-level courses (from ESF or SU) may be acceptable.

Food Studies Minor

Coordinator: Dr. Lee Newman (not accepting new students)

The food studies minor will be available to students in all majors who want to increase their knowledge of the impact of food production systems, food security and food systems on human society and individual human health.

Some of the directed elective courses have additional pre-requisites, and students must investigate this before making up their proposed course plan.

Interested students (GPA 2.7 required in order to apply) must submit a petition, with a list of potential courses to fulfill the minor requirements to (a) their faculty advisor, (b) the undergraduate curriculum coordinator of their home department and (c) the food studies minor coordinator, with final approval from the Dean of Instruction and Graduate Studies.

Many of these courses are offered at Syracuse University. Students pursuing this minor may incur additional fees as required for exceeding their SU accessory instruction allocation.

Requirements
For the Minor, all students must take 6 courses distributed as follows among 3 categories:

Two required lower division courses:

- FST 102 Food Fights: Contemporary Food Issues (3)

- FST 202 Agroecology (3)

Select one among the following courses:

- EFB 337 Field Ethnobotany (3)
- EFB 437 Plant Propagation (3)
- EST 361 History of the American Environmental Movement (3)

Select three among the following courses:

- FST 204: Food, identity and Power (3)
- FST 303 Food Movements (3)
- FST 304 Farm to Fork (4)
- FST 306 Food Cooperatives (3)
- FST 307 Feeding the World: Global Agri-food Governance (3)
- FST 309 Philosophy and Practice of Locavorism (3)
- FST 310 Will Work for Food: Labor Across the Food System (3)
- FST 312 Emergency Food Systems (3) ***Note: This course is not offered each year.
- FST 402 Feeding the City: Urban Food Systems (3)
- FST 403 The Human Right to Adequate Food and Nutrition (3)
- FST 421 Morality of a Meal: Food Ethics (3)
- FST 423 Food in History (3)
- NSD 555 Food, Culture and Environment (3)

NOTE This has prerequisites that will add to SU credits.

Forestry Minor

Coordinator: Dr. Rene Germain

The minor in forestry draws from the biological, physical, social, and managerial sciences. The curriculum aids in understanding the biological complexities of the forest and the interactions between the forest and social and economic demands. The minor is designed to provide students with an appreciation of forest resources management. Course themes include forest measurements, forest ecology, forest management and silviculture, and forest policy and economics.

Admission to the minor requires students to have a cumulative grade point average of 2.70 or better after one semester at ESF (or as a transfer student with same standing).

The minor in Forestry requires 17 credits. It is the responsibility of the student to meet any prerequisites associated with courses in the minor. **Required courses:**

- FOR 322 Natural Resources Measurements and Sampling (3) (prerequisites: FOR 304 or equivalent and APM391 or equivalent)
- FOR 332 Forest Ecology (4) (prerequisites: FOR 232 or EFB 320 or equivalent)
- FOR 334 Silviculture (4)
- FOR 370 Forest Management Decision Making and Planning (3) (prerequisites: FOR 322 and FOR 334) or FOR 373 Forest Operations (3) (prerequisites: FOR 322 or FOR 334 or permission of instructor)
- FOR 333 Natural Resource Managerial Economics (3) (prerequisite: FOR 207 or equivalent) or FOR 465 Natural Resources Policy (3)

Information Management and Technology Minor

Coordinator: Zora Thomova

In collaboration with the Syracuse University School of Information Studies (the i-School), ESF also offers an undergraduate minor in Information Management and Technology for ESF students. This minor is designed to give students knowledge of information technology and an understanding of information and communications problems. It complements many majors because all organizations need people who understand information resources and information technology. To be eligible for this minor, students must have a cumulative grade point average of 2.70 or better and apply for the minor after completing at least one semester at ESF, but as soon after that as possible to ensure all courses can be completed. It is preferable students begin the minor during their sophomore year.

The following 18 credits of courses are required: ITS 195 Information Technologies (3); 9 credits of ITS elective coursework; and one course from each of the following two general areas of study:

Technology:

- IST 233 Introduction to Computer Networking (3)
- IST 352 Applications of Information Systems (3)
- IST 459 Introduction to Database Management Systems (3)

Management:

- IST 335 Introduction to Information-based Organizations (3)
- IST 352 Information Analysis of Organizational Systems (3)
- IST 445 Managing Information Systems Projects (3)

For questions regarding the selection of elective coursework, please contact Elaine Morgan with the i-School at 443-1830 or emmorgan@syr.edu

Landscape Architecture Studies

The minor in Landscape Architecture Studies provides an understanding of the natural and human factors and the role of design in shaping our physical environment. This minor is available to SU and ESF students. To complete this minor, students must complete 15 credit hours (5 courses) with a cumulative grade point average of 2.5. One course is specified, with an additional four courses to be selected from the list of seven approved courses listed below.

Admission to the minor requires a cumulative grade point average of 2.7 or higher and permission (ESF petition) of the Landscape Architecture Undergraduate Curriculum Director (331 Marshall Hall).

Required Courses (3 Credits)

- LSA 220 - Introduction to Landscape Architecture

Approved Courses (3 Credits each)

- LSA 311 - Natural Processes in Planning and Design
- LSA 312 - Place/Culture/Design
- LSA 305 - History of Landscape Architecture I (meets Gen Ed)
- LSA 306 - History of Landscape Architecture II
- LSA 321 - Ecological Applications in Planning and Design
- LSA 451 - Comprehensive Land Planning
- LSA 497 - Contemporary Issues in Landscape Architecture

Total credits required: 15

Management Minor

Coordinator: Rene Germain

The management minor is available to all ESF undergraduate students who want to develop greater skills and knowledge of business fundamentals. In addition to understanding basic financial and managerial accounting principles, students can further develop focus in their minor through coursework in entrepreneurship, finance, marketing, human resources, and other topics.

Admission to the minor requires sophomore status, a cumulative grade point average of 2.70 or better and permission (via the ESF Minor Enrollment Form) of the Coordinator of the minor. Normally, students are allowed to take only one management course at Syracuse University's Whitman School per semester, so careful planning is required.

The management minor requires fifteen (15) credits, six (6) credits from a required course and nine (9) credits of elective courses. It is the responsibility of the student to meet any prerequisites associated with any courses in the minor.

Required Courses (6 credits)

Course Number	Course	Codes *	Credits
FOR 360 **AND** FOR 205 **OR** CME 151	Principles of Mgmt/ Envrn Prof Principles of Accounting Intro to Financial Accounting		3 3 3

Elective Courses (9 credits)

Course Number	Course	Codes *	Credits
CME 252	Intro to Managerial Accounting		3
CME 444	Materials Marketing		3
EST 450	Sustainable Enterprise		3
FOR 485	Business and Managerial Law		3
SRE 422	Energy Markets and Regulation		3
SRE 454	Sustainble Energy Fin&Analysis		3
ERE 519	Green Entrepreneurship		3

PSE 456	Management in Industry		3

SU courses

Course Number	Course	Codes *	Credits
EEE 370	Intro To EEE		3
EEE 375	Entreprenrl. Family Bus. Mgmt.		3
EEE 382	Entrepreneurial Marketing		3
EEE 442	Emerging Enterprise Law		3
EEE 443	Emerging Enterprise Consulting		3
FIN 301	Essentials of Finance		3
MAR 301	Essentials of Marketing		3
SHR 247	Introduction to Strategic Mgmt.		3

*Students in the Sustainable Energy Management major may not use ENS 422 and FOR 454 to satisfy the requirements in the Management minor.

Marine Science Minor

Coordinator: Dr. Kim Schulz

The marine science minor is available to students in all majors who want to increase their knowledge of marine systems. Prior to admission students must have completed one year of General Biology (EFB 101/102 and EFB 103/104) and one year of General Chemistry (FCH 150/151), or equivalent, and have earned a cumulative GPA of 2.70. Some of the directed elective courses have additional pre-requisites, which will not count toward the minor.

Courses:

This minor requires at least 12 credits from the list below, with no more than 3 courses taken from any one department, and no more than 3 credit hours of lower division credits counted. Other marine science courses may be substituted by petition for any course in the directed elective list with approval of the marine science curriculum coordinator.

Although not required, all participants in the marine science minor are encouraged to incorporate a field or hands-on component in their choice of courses. Such courses may include the Sea Education Association courses, approved field courses from other marine stations or institutions, an approved internship (e.g., EFB 420) or approved independent research (e.g., EFB 498, ENS 498, FCH 498) opportunities related to marine topics (must be approved in advance by the marine science minor coordinator) or other marine field courses approved by the minor coordinator.

Directed Electives

Course Number	Course	Codes *	Credits
EFB 355	Invertebrate Zoology		4
EFB 423	Marine Ecology		4
EFB 486	Ichthyology		3
EFB 487	Fisheries Science & Mgt		3
FCH 520	Marine Biogeochemistry		3
FCH 525	Oceanography		3
BIO 100	Ocean Life		3
EAR 117	Oceanography		3
EAR 205	Water & Our Environment		3
EAR 210	Hist of Earth and Life		3
EAR 325	Introduction to Paleobiology		4
EAR 429	Topics in Paleobiology		3
EAR 432	Seafloor Spreading&Oceanographic Lithosphere		3
EAR 544	Quaternary Environment&Climate Change		3
GEO 327	Geography of Coastal Environments		3

In addition, the following Sea Education Association courses would count toward the minor without petition, and not subject to the lower division requirement described above (221 Oceanography, 224 Practical Oceanographic Research, 225 Practical Oceanography I, 226 Practical Oceanography II, 320 Ocean Science and Public Policy, 321 Oceans in the Global Carbon Cycle, 324 Advanced Oceanographic Field Methods, 325 Directed Oceanographic Research, 326 The Ocean and Global Change, 327 Toward a Sustainable Ocean: Conservation and Management, 450 Advanced Topics in Biological Oceanography: Biodiversity).

Mathematics Minor

Coordinator: Dr. Gary Scott

The mathematics minor is available to all ESF undergraduates who have an interest in developing greater knowledge in the field of mathematics. To be eligible for this minor, a student must have a cumulative grade point average of 2.700 or better by the end of the sophomore year. Interested students must submit a minor enrollment form to their academic advisor and the minor coordinator. Twenty one credit hours (6 courses) in mathematics courses are required to complete the minor. Admission to the mathematics minor requires students to have completed Calculus I and Calculus II.

Required Courses: (15 credits)

- APM 205: Calculus for Science and Engineering (4)
- APM 206: Calculus for Science and Engineering II (4)
- APM 307: Multivariable Calculus (4)
- Choice of:
    - APM 485: Differential Equations for Engineers and Scientists (3)
    - MAT 331: First Course in Linear Algebra (3)

Elective Courses: (6 credits)

- ERE 465: Environmental Systems Engineering (3)
- ERE 533 Ecological Modeling (3)
- APM 391 Introduction to Probability and Statistics (3)
- APM 395 Probability and Statistics for Engineers (3)
- APM 485 Differential Equations for Engineers and Scientists (3)
- APM 510 Statistical Analysis (3)
- APM 585 Partial Differential Equations for Engineers and Scientists (3)
- APM 595 Probability and Statistics for Engineers (3)
- APM 620 Experimental Design and ANOVA (3)
- APM 625 Sampling Methods (3)
- APM 630 Regression Analysis (3)
- APM 635 Multivariate Statistical Methods (3)
- APM 645 Nonparametric Statistics and Categorical Data Analysis (3)
- APM 730 Adv Regression Modeling Methods (3)
- MAT 3xx/4xx/MAT 5xx Any MAT course numbered 300 or above (3)

Microscopy Minor

Coordinator:

The microscopy minor is available to all undergraduates at ESF and Syracuse University, who desire knowledge of methods and applications of light and electron microscopes for research and industry. The minor will prepare students to use a variety of microscopes for applications in biology, nanotechnology, environmental medicine, chemistry, materials science, engineering, pulp and paper and others.

Admission requires junior status and GPA 2.75. To enroll in the minor, students must submit a petition to their advisor, the undergraduate curriculum coordinator in their home department, and the minor coordinator in the NC Brown Center for Ultrastructure Studies in the SCME department with final approval by the Dean of Instruction.

The minor requires 12 credits of coursework:

Required courses

Course Number	Course	Codes *	Credits
MCR 480	Fundamentals of Microscopy		3
MCR 484	Scanning Electron Microscopy		3
MCR 485	Trans Electron Microscopy		3
MCR 585	Light Microscopy/ Rsrch Appl		3

Native Peoples and the Environment Minor

Coordinator: Dr. Madeline Nyblade

The Native Peoples and the Environment minor is available to all ESF undergraduates. The interdisciplinary suite of courses provides students with a cohesive introduction to Indigenous cultures, worldviews and knowledge systems and their application to environmental thought. The minor creates a conceptual framework for integrating traditional ecological knowledge with western scientific approaches in service to the science of sustainability. Through the breadth of courses and experiences, students will gain an appreciation for both the global nature and the local context of indigenous issues and the environment. The minor includes a required team taught seminar which enhances opportunities for interdisciplinary and cross-cultural integration.

Fourteen credit hours (5 courses) taken in residence are required to complete the minor. Two courses are specified, with an additional two or three courses selected from the list below. An internship may be used to fulfill a course requirement, if focused on Native peoples and the environment

Admission to the minor requires sophomore status with a cumulative GPA of 2.70 or better. Fourteen credit hours of courses are required.

Required Courses (6 credits)

Course Number	Course	Codes *	Credits
EST 140	Int/Native People,Land,Cult		3
EFB 305	Indigenous Issues&the Envrnmnt		3

Two or three courses (8 credits) selected from the following list

Courses

Course Number	Course	Codes *	Credits

EFB 306	Wildlife Field Techniques		3
EFB 337	Field Ethnobotany		3
EST 390	Social Processes & Envrn		3
EST 497	Onondaga Land Rights&our common Future		3
SOC 444	Contemporary Native American Movements		3
NAT 142	Native American Religion		3
NAT 400	Selected Topics		3
EFB 420	Prof Internship/Envrn Biology		1 - 5
EFB 496	Topics/Envrn&Forest Bio		1 - 3
EFB 496	Topics/Envrn&Forest Bio		1 - 3
EFB 496	Topics/Envrn&Forest Bio		1 - 3

Relevant 496 and 497 courses may be acceptable for inclusion in the minor, by petition to the minor coordinator.

Paper Science Minor

Coordinator:Dr. Gary Scott

The paper and related industries (including pulp, mineral, chemical and machinery suppliers) continually seek knowledgeable and skilled employees. Each year, companies hire numerous graduates of chemical, mechanical and environmental engineering programs as well as chemists and other environmental professionals in addition to paper science and engineering graduates. Salaries for new hires are among the highest for all fields of study at the bachelor's degree level. This minor gives students a basic understanding of the paper industry that will allow them to apply their major field of study to this growth industry. The paper science minor is available to all ESF undergraduate students (except students in paper engineering programs) who maintain a minimum cumulative grade point average of 2.70. Waivers to prerequisites of courses will be favorably considered in increase access to the minor across campus. Fifteen credit hours in paper science courses are required.

Required courses (4 credits)

- PSE 200 Introduction to Papermaking (3)

- PSE 202 Pulp and Paper Laboratory Skills (1)

Directed Electives Courses (11 Credits) </p?

- ECH 202 Principles of Mass and Energy Balance (3)
- PSE 201 The Art and Early History of Papermaking (3)
- PSE 223 Introduction to Lignocellulosics (4)
- PSE 304 Professional Internship (1)
- PSE 305 Professional Co-op (1)
- PSE 306 Professional Synthesis (1)
- PSE 350 Fiber Processing (3)
- PSE 436 Pulp and Paper Unit Operations (3);
- PSE 437 Equipment Troubleshooting and Maintenance (3)
- PSE 438 Biorenewable fibrous and nonfibrous products (3)
- PSE 450 Pulping and Bleaching Processes (3)
- PSE 456 Management in Industry (3)
- PSE 462 Papermaking Processes I (3)
- PSE 465 Fiber and Paper Properties (4)
- PSE 466 Paper Pigment and Barrier Coating (3)
- PSE 467 Papermaking Wet End Chemistry (3)
- PSE 469 Functional and Nano Additives (3)
- PSE 478 Papermaking Processes II (2)
- PSE 481 Engineering Design (3)
- PSE 552 Fiber Materials Recycling and Processing (3)
- RMS 200 Renewable Materials and Composites from Lignocellulosics (3)
- RMS 335 Transport Properties of Materials (3)
- RMS 388 Wood and Fiber Identification Laboratory (2)
- RMS 465 Renewable Materials and Surfaces: Testing (3)

Physics Minor

Coordinator: Dr. Gary Scott

The physics minor is available to all ESF undergraduates who have an interest in developing greater knowledge in the field of physics. To be eligible for this minor, a student must have a cumulative grade point average of 2.7000 or better by the end of the sophomore year. Interested students must submit a minor enrollment form to their academic advisor and the minor coordinator for approval.

Twenty hours (8 courses) in physics courses are required to complete the minor. Admission to the physics minor requires students to have completed General Physics I (with lab).

Required Courses: (8 credits)

PHY 211 General Physics I (3) or PHY 215 General Physics I for Scientists (3)
PHY 212 General Physics II (3) or PHY 216: General Physics II for Scientists (3)
PHY 221 General Physics I Laboratory (1)
PHY 222 General Physics Laboratory II (1)

Elective Courses: (12 credits)

Any PHY courses numbered 300 or above

Public Health Minor

Coordinator: Dr. Lee Newman

The Public Health minor will be available to students in all majors who want to increase their knowledge of the impact of public health issues and administration on human and human population health. Some of the directed elective courses have additional pre-requisites, and students must investigate this before making up their proposed course plan.

Interested students (GPA 2.7 required in order to apply) must submit a petition, with a list of potential courses to fulfill the minor requirements to (a) their faculty advisor, (b) the undergraduate curriculum coordinator of their home department and (c) the public health minor coordinator, with final approval from the Dean of Instruction and Graduate Studies. Many of these courses are offered at Syracuse University.

Three Required Courses

Course Number	Course	Codes *	Credits
EFB 360	Epidemiology		3
PHP 221	Community Health Promotion		3
PHP 309	Health Disparities		3

Select three among the following courses

Course Number	Course	Codes *	Credits
EHS 350	Environmental Health Managemnt		3
FST 403	Right to Food and Nutrition		3
PHP 302	Influencing Healthy Behavior		3
PHP 305	Community Mental Health		3
PHP 313	Issues Challenges Healthcare		3
PHP 306	Understanding Health Systems		3
PHP 414	Ethics & Law Hlthcare Adm		3
PHP 415	Public Health Ethics		3
PHP 436	Ethics in Addiction Services		3
PHP 437	LGBTQ Health and Well Being		3

PHP 438	Native American Health Promotion		3
PHP 462	Culture&Reprod Health&Med		3
PHP 463	Global Health		3

Recreation Resource and Protected Area Management Minor

Coordinator: Danielle Kloster

This minor provides students with the opportunity to combine visitor management with protected area management. Understanding the need to balance the opportunity for visitor experiences with protecting and stewarding protected areas provides professional insight into planning and managing those areas for limited visitor access. Understanding the motivations, preferences, and behavior of recreational users is necessary to integrate the human dimensions into protected area management with consideration of the social and environmental factors related to such management. Protected area managers need to be able to manage both the resource itself as well as a wide variety of users, such as campers, hikers, bird watchers, boaters, nature photographers and others who enjoy nature-based experiences in extensive protected area environments owned by public agencies, private landowners, or NGOs.

Students from all programs at ESF are eligible for this minor if they have completed a general ecology course and have a cumulative grade point average of 2.70 or better in their major program of study after one semester at ESF (or as a transfer student with same standing). Overlap between the minor and both one required course and one directed elective for a student's major is permitted; other courses taken for the minor can not overlap with the major.

This interdisciplinary minor requires 15 credits and includes the following courses taught at ESF in the Departments of Forest and Natural Resources Management and Environmental and Forest Biology:

Required Courses (9 credits)

Course Number	Course	Codes *	Credits
EST 370	Intro/Pers Env Interp Methods		3
FOR 372	Fund/Outdoor Recreation		3
FOR 475	Recreation Behavior &Managemnt		3

Required independent study or internship (3 credits)

Course Number	Course	Codes *	Credits
FOR 498 SECTION 20 **OR**			3 3

FOR 499 SECTION 20			

One of the following management/protected area courses (3 credits)

Management/Protected Area Courses (3 credits)

Course Number	Course	Codes *	Credits
EFB 413	Intro To Conservation Bio		3
FOR 404	Ecotourism Abroad		3
FOR 476	Ecotourism and Nature Tourism		3
FOR 478	Wilderness & Wildlands Mgt		3
FOR 523	Tropical Ecology		3

Renewable Energy Minor

Coordinator: Dr. Tim Volk

The development of sustainable sources of energy has become a critical national and global issue due to concerns about the quality and quantity of the different potential resources, energy security, and potential impacts of each on the environment and human health. It is essential that our society and energy professionals understand the production and conversion of different forms of energy, their current and future supplies, the markets and policy mechanisms that regulate their supply, and the associated impacts on the environment for each fuel. In the past both traditional and renewable energy sources have been studied one resource at a time and usually from the perspective of a single discipline. This minor provides students an opportunity to examine different sources of traditional and renewable energy simultaneously in the context of our total energy use using a systems perspective. Students are exposed to views from a variety of disciplines which allows them to consider a wide array of issues related to current and future energy supply and use.

The Renewable Energy minor is available to all ESF and Syracuse University undergraduate students (except students who are in the Sustainable Energy Management Major and Environmental Science's Renewable Energy option) who have a GPA of 2.70 or better by the end of their sophomore year. The minor requires a minimum of 15 credits, 12 of which are required courses. The remaining 3 credits can be selected from a list of suggested courses.

Required Courses

Course Number	Course	Codes *	Credits
SRE 325	Energy Systems		3
SRE 337	Energy Resources Assessment		3

SRE 479	Life Cycle Assessment		3
CME 305 **OR** SRE 441	Sustainable Energy Sys/Bldgs Biomass Energy		3 3

Suggested Courses

(other courses may be used to meet this requirement with approval of minor coordinator)

Course Number	**Course**	**Codes ***	**Credits**
CME 305 OR SRE 441	Sustainable Energy Sys/Bldgs Biomass Energy		3 3
ECH 202	Principles of Mass and Energy Balance		3
ECH 212	Engineering Thermodynamics		3
ERE 380	Energy Systems Engineering		3
EST 427	Environmental and Energy Auditing		3
FCH 360	Physical Chemistry I		3
SRE 416	Sustainable Energy Policy		3
SRE 422	Energy Markets and Regulation		3
SRE 454	Sustainble Energy Fin&Analysis		3
SRE 481	Advanced Life Cycle Assessment		3

Sustainable Construction Minor

Coordinators: Dr. Paul Crovella

The sustainable construction minor is available to all ESF undergraduates (except students in construction management) and prepares students for careers related to sustainable construction. The objective of the minor is to provide a fundamental understanding of the concepts and methods used to take a design into the field and build a quality sustainable structure in the most efficient and effective manner with minimal environmental impact. Admission to the minor requires sophomore status and a cumulative grade point average of 2.70 or higher.

A cumulative grade point average of 2.000 or higher is required for the sustainable construction management courses in order to obtain the minor.

Fifteen credit hours are required to complete satisfy the minor. Choose 5 courses (15 credits) from the following:

Course Number	Course	Codes *	Credits
CME 215	Sustainable Construction		3
CME 305	Sustainable Energy Sys/Bldgs		3
CME 306	Engr Materials/ Sustainble Cons		3
CME 304	Envrn Perform Measures/Bldgs		3
CME 343	Construction Estimating		3
CME 405	Bldg Info Modelng/ Cons Mgt		3
CME 565	Sustainable Innovatns/Res Cons		3
CME 444	Materials Marketing		3
CME 453	Construct Plan/ Scheduling		3
CME 454	Construction Project Mgt		3
EST 426	Community Plng&Sustainability		3
EST 427	Environmental &Energy Auditing		3
EST 460	Land Use Law		3
EST 550	Envrn Impact Analysis		3
RMS 387	Renewable Mat/ Sustainable Cons		3
RMS 422	Composite Mat/ Sustainable Cons		3

Urban Environmental Science Minor

Coordinator: Dr. Margaret Bryant

Twelve credit hours (4 courses) of urban concentration courses are required to satisfy the minor: 6 credits of required courses and 6 credits of electives outside the student's major. Entry into the minor requires a minimum cumulative GPA of 2.70 in residence at ESF.

Core Course Requirements

To satisfy the Minor in Urban Environmental Science, the student must take the following core courses:

Core courses

Course Number	Course	Expected time of completion (Semester/Year)	Credits
EST 220 **OR** EFB 220	Urban Ecology Urban Ecology	offered Autum	3 3

and three credits of a "Capstone" project accomplished from among the following:

Capstone

Course Number	Course	Codes *	Credits
XXX 496	Approved 'experimental' course		3
XXX 498	Approved Independent Research Project		3
XXX 499	Approved Internship		3
ESTABLISHED COURSE	Approved Course		3

A student enrolled in the minor, will present to the advisory committee in the sixth week of the semester prior to engagement in the learning endeavor, a plan for a “capstone” experience, which will be undertaken working in conjunction with a faculty member(s) who will oversee an off-campus internship (courses numbered 499), independent-study project (courses numbered 498), or completion of a final project undertaken in a special topic (courses numbered 496) or established 3-credit course. All students will present their completed projects to the advisory committee and their peers in the last week of classes, depending on the semester of completion (fall or spring). All students currently enrolled in the minor are expected to attend capstone presentations.

Elective Course Requirements

Outside the student's Major, 6 additional credits selected from the list of approved courses, which are offered in a faculty other than that of the student's major, and which are above and beyond those courses being used to satisfy a student's major, general education or professional requirements.

Urban Forestry Minor

Coordinator: Dr. Eddie Bevilacqua

The Urban Forestry minor will provide students with the opportunity to better understand complex human-dominated ecosystems where trees and people coexist in close proximity. Understanding and attempting to manage this complexity requires a basic knowledge of plant physiology, nutrition, and tending at the individual tree level (arboriculture). In addition, the urban forester also must understand the changing dynamic of groups of trees and the effects of those trees on numerous ecosystem services and human health and well-being in a city (urban forestry). Because human activity is so dominant in the urban ecosystem, it is essential that the urban forester have some understanding of ecological interactions and human motivations for sustaining and maintaining existing trees (urban ecology). The courses listed below will provide the professional knowledge required for careers in these and related fields.

Fifteen credit hours are required:

Courses

Course Number	Course	Codes *	Credits
ESF 300	Intro/Geospatial Info Tech		3
EST 220	Urban Ecology		3
FOR 480	Urban Forestry		3
FOR 481	Introduction to Arboriculture		3
LSA 480	Seminar:Urban Design		3

The interdisciplinary minor includes courses taught in the Departments of Forest and Natural Resources Management, Environmental Studies, and Landscape Architecture. Admission to this minor requires students to have (1) completed a general ecology course (e.g. EFB 320 General Ecology), (2) a cumulative grade point average of 2.70 or greater after one semester at ESF (or as a transfer student with the same GPA).

Water Resources Minor

Coordinators: Dr. Kim Schulz (EB) and Dr. Chuck Kroll (ERE)

Water resources is a multi-disciplinary field that integrates the physical, geochemical and biological processes of the water cycle and their application to management of water resources, water policy, and human dimensions of water quality and quantity. The interdisciplinary minor in water resources is designed as a flexible program for undergraduate students to study and integrate principles of physical hydrology, geochemistry, aquatic and terrestrial ecology, natural resources management, and environmental policy. The minor can include courses in the Departments of Forest and Natural Resources Management, Environmental Resources Engineering, Environmental and Forest Biology, Chemistry, and Environmental Studies, as well as relevant courses at Syracuse University. The minor comprises 15 credit hours total that must be distributed across three departments at minimum (i.e., course numbers with three separate prefixes), with the intent of covering a breadth of disciplines. These courses must include at least one foundation course, either FOR 442 Watershed Ecology and Management, or EFB 424 Limnology: Study of Inland Waters. Courses taken for the minor can also count toward students' majors or other academic requirements, subject to those other program guidelines. Students are responsible for meeting the prerequisite requirements for individual courses, as applicable.

Admission to this minor requires that a student from any ESF program has a cumulative grade point average of 2.70 or better after one semester at ESF (or as a transfer student with same GPA).

Required foundation course; students must take at least one of these:

Required Courses

Course Number	Course	Codes *	Credits
FOR 442	Watershed Ecology & Management		3
EFB 424	Limnology:Study Inland Waters		3

Approved elective courses that count toward the minor include the following, subject to availability and pre-requisite requirements. Other relevant courses may be petitioned. Note that some ERE elective courses may require prerequisites, such as calculus, chemistry, and programming; students who are interested in these courses should consider taking the engineering sections of their calculus sequence.

Fall Courses

Course Number	Course	Codes *	Credits
EFB 487	Fisheries Science & Mgt		3
EFB 488	Fisheries Science Practicum		1
EFB 496	Topics/Envrn&Forest Bio		1 - 3
EFB 500	Forest Biology Field Trip		1 - 3
EFB 525	Limnology Practicum		2

EFB 681	Aquatc Ecosys Restore/Enhance		2
ENS 601	Water Resources Mgt		3
ENS 607	Wetland Practicum		2 - 3
ERE 412	River Form and Process		3
ERE 475	Ecological Engr/Water Quality		3
ERE 527	Stormwater Management		3
EST 625	Wetland Management Policy		3
FCH 515	Meth/Envrn Chem Analysis		3
FOR 338	Meteorology		3

Spring Courses

Course Number	Course	Codes *	Credits
EFB 423	Marine Ecology		4
EFB 486	Ichthyology		3
EFB 492	Sr Synthesis/ Aquatic&Fish Sci		1
EFB 542	Freshwater Wetland Ecosys		3
EFB 692	Ecol And Mgt Of Waterfowl		3
ERE 340	Engr Hydrology&Hydraulics		4
ERE 440	Water and Wastewater Treatment		3
ERE 445	Hydrologic Modeling		3
ERE 508	Water-An Incredible Journey		3
ERE 570	Hydrology in a Chng Climate		3

FCH 510	Environmental Chemistry I		3
FCH 525	Oceanography		3
FOR 340	Watershed Hydrology		3

Approved Syracuse University courses

Course Number	Course	Codes *	Credits
CIE 352	Water Resources Engineering		3
CIE 457	Biogeochemistry		3
EAR 400	Selected Topics		3
EAR 400	Selected Topics		3
EAR 401 **OR** EAR 601	Hydrogeology Hydrogeology		3 3
EAR 612	Water-Energy Seminar		3
GEO 316	River Environments		3
GEO 422	Water: Env, Soc & Po		3

SPECIAL ACADEMIC OPTIONS

Honors Programs

At SUNY College of Environmental Science and Forestry, the Honors program helps students build relationships and is an excellent way to enhance the college experience. The Honors Program provides students in all academic majors with value-added educational experiences. Academic components of the program strengthen exploration and communication skills. Students complete intensive scholarship with faculty through their Honors Thesis.

Honors Students share their Honors Program experience with each other through Honors seminars and social events. They translate their academic skills into leadership roles in student government, clubs, or community service. Honors Students receive early registration privileges and access to honors sections of courses offered at Syracuse University and ESF.

Students who successfully complete all requirements of the Honors Program receive honors medals that are worn to the College's Commencement ceremonies and recognition on their college transcript that they graduated with Honors.

Admissions to the Honors Program

Admission to the program is extremely selective. Primary consideration is given to a student's academic record with a high school grade point average of 95% or higher, and high school class rank in the top 10% (where rankings are available). Honors Students are expected to be well-rounded with considerable contribution to extra-curricular activities and community service. Please note that these are minimum requirements and that the typical student admitted to Honors exceeds these requirements. The College generally admits no more than 40 first-year students to the program each year. As a result, qualified students may not receive an initial invitation but will be invited, or may apply, later in their college careers.

Exceptionally qualified students who have completed one year at ESF may receive an invitation to join the Honors Program. Any student with a GPA of greater than 3.5 who is completing research with a faculty mentor may apply to the Honors Program. Eligible and interested students may also contact the Directors of the Honors Program or their department's representative to the Honors Program Advisor Council to apply to the Honors Program.

Program Requirements

Honors Students must complete the following coursework:

- ESF 109 or ESF 209 Honors Program Seminar
- Two courses that contribute directly to the Honors thesis. These courses must be at the 400 level or above. Students in the ESF Honors Program may enroll in 600 level with permission of the instructor.
- A total of 6 credits of honors thesis credit (ESF 499) with a grade of B or better or similar research credits that are department specific (e.g., EFB 498).

Honors Students must supplement their work with a presentation of their research at a scholarly venue. This presentation could be at the ESF Spotlight on Student Research. Many students satisfy this requirement through presentations at regional, national or international scientific meetings.

Honors students are expected to maintain a cumulative GPA of 3.2 or higher.

The Honors Thesis

The Honors Program provides the opportunity for students to complete intensive research and creative projects under the guidance of ESF's world-class faculty. This scholarship emphasizes and encourages holistic and multidisciplinary awareness of the problems and opportunities in studying and working with the natural and built environments. The subject matter and type of thesis is left open to the students and their advisors.

All ESF Honors Theses are uploaded to the Experts at ESF where they become available throughout the world. Many Honors Students publish their work in scholarly journals.

Honors Students are eligible for thesis enhancement grants (up to $1000) to support their Honors thesis work.

Honors Program Advisory Council

The Honors Advisory Council (HPAC) recommends policies and serve as advocates for the Honors Program to prospective students and the college, provide oversight for thesis and program standards, and make recommendations for admission to the Honors Program.

Education and Study Abroad

SUNY ESF is committed to enhancing the internationalization of ESF students' academic experiences. ESF believes strongly that international experiences provide students with the opportunity to develop the skills necessary to be informed, active, responsible, and culturally-sensitive global citizens.

International programs range from short-term opportunities (1-2 weeks) to longer-term opportunities (1-2 semesters). Students are also eligible to study and/or research abroad on every continent and in 100+ countries. The Office of International Education is equally determined to make study abroad accessible to all despite financial, academic, or other person concerns. There is a program for everyone at ESF. For more information, check out the Education Abroad website or email OIE at oie@esf.edu.

Pre-professional Advising

Medical and Health Professions (medicine, dentistry, optometry & veterinary medicine)

ESF students interested in medicine (MD, MD/ PhD, Physician's Assistant, Nurse Practitioner or Registered Nurse), dentistry, optometry, physical therapy, and veterinary medicine are encouraged to identify themselves to the ESF Pre-Health Coordinator who can then assist them in exploring these pathways, including choosing the right major while at ESF, advising them on academic qualifications and preparing for the application process.

Entering ESF students interested in the health professions may participate in the Pre-Health sessions offered during Open House events, which allows them to meet with current Pre-Health students and helps incoming students to decide on the right major for their career path. Depending on the chosen path, suitable majors might be Environmental Biology, Biotechnology, Biochemistry, Environmental Science or Environmental Health. Once students select their major, they will be paired with academic advisors who have expertise in advising Pre-Health students.

Law

ESF offers pre-professional advising to students interested in pursuing law as a profession.

Unlike some other professional programs, law schools do not require or recommend a specific program of study or specific coursework. Instead, the Law School Admissions Council advises students who are interested in the legal profession to pursue undergraduate education that demonstrates success in intellectually challenging curricula that enhance students' critical thinking skills.

Combined Degree Program with Upstate Medical University

SUNY Upstate Medical University (UMU) and ESF partner on a program providing access to a health-related combined degree.

The 3+3 Early Assurance for the Doctor of Physical Therapy (DPT) program allows students to complete both their undergraduate degree at ESF and their physical therapy doctoral degree at UMU in SIX years rather than seven years. The first year at UMU counts for both the fourth year of the bachelor's degree and the first year of the DPT.

This program is only available to first year applicants and has strict application deadlines. Applications to both ESF and UMU must be completed during the fall of the senior year. Visit each college's website for more information on this program.

GRADUATE STUDY: DEGREES AND OPTIONS

Graduate academic programs at ESF share a foundation of rigorous science and dedication to wise use of natural resources. ESF offers advanced degrees in six program areas. Each program provides a unique opportunity for you to further your education with professors who are dedicated to both their teaching and research endeavors.

Ecosystems all over the world benefit from the professionalism and expertise of ESF graduates and the faculty members at the College of Environmental Science and Forestry. You will study with professors whose work improves and sustains the environment from the Yucatan Peninsula to Alaska and whose expertise is sought by government and corporations. That same faculty will be personally concerned with your progress. The professors' cutting-edge research will become part of your classes, and your classes will merge with the world beyond the College.

Degree Programs

ESF is authorized by the New York State Department of Education to offer undergraduate and graduate degree programs as described in this catalog. The Higher Education General Information Survey (HEGIS) code is the number assigned to programs registered by the commissioner of the New York State Department of Education. The Classification of Instructional Programs (CIP) Code allows the U.S. Department of Education to track educational programs for financial aid eligibility. Enrollment in programs that are not registered or otherwise approved may jeopardize a student’s eligibility for certain financial aid programs.

Areas of Study

The general area of study for each master’s or doctoral student is implied by the title of the program in which the degree is awarded. Areas of study may be established within degree programs by individual departments that further define the student’s area of specialization. The student’s area of study is listed on the student’s transcript if identified on the study plan.

Additionally, each department may offer minors identifying ancillary areas of study that may be appropriate for the degree program. A minor is equivalent to 12 or more graduate credits earned in the minor area. Courses in a minor area must be taken outside of the student’s area of study. A minor is identified on the student’s transcript. A minor professor must be appointed to the student’s steering committee for each minor elected, in addition to the minimum complement of steering committee members. Each minor professor can replace an additional examiner.

Graduate Degrees

Ph.D., M.S., M.P.S., M.L.A. & M.F.

Four master’s degrees are offered at ESF—master of science, master of forestry, master of landscape architecture, and master of professional studies—as well as the doctor of philosophy degree. The following section describes the requirements for graduate degree programs offered by the College.

Master of Forestry (M.F.)

The Master of Forestry (MF) graduate degree program enables students to integrate knowledge and expertise drawn from both the natural and social sciences, and to apply their knowledge to solve practical forest management problems.

The primary focus of the program is to provide an opportunity for graduates coming from diverse academic backgrounds with non-forestry baccalaureates to gain a professional education in forestry. As such, the program is designed to be the first professional degree in forestry attained by a student. Graduates will successfully function as professional foresters on multi-disciplinary forest management teams and respond to the challenges related to the sustainable management of local, regional, and global forest resources.

The degree requires 37 graduate credits of coursework, of which at least 24 must be taken in residence at ESF. The degree accredited as a professional forestry program by the Society of American Foresters under Forestry.

The program is open to both students with some prior background in forestry and natural resources, and for those without such background. More than four (4) semesters may be required for students from non-science backgrounds who need additional basic undergraduate coursework as part of their degree program. The MF program is designed for May admission to accommodate a 4-week summer field course.

Master of Landscape Architecture (M.L.A.)

Graduate studies in landscape architecture attract a broad range of people. Those with undergraduate degrees in landscape architecture may seek specialization within the profession, advanced exploration or an academic career. Others, with degrees in related fields such as architecture, city and regional planning, and environmental design, enter the program to broaden or redirect their design and planning skills. Some students with degrees in fields less closely related (such as humanities or arts and sciences) seek new career options or to focus prior interests through a licensed design and planning profession.

The degree is accredited by the Landscape Architectural Accreditation Board (LAAB).

A three-year program for applicants who have no design or planning background leads to the fully accredited professional degree of master of landscape architecture (M.L.A.). This program is for students who intend to complete coursework full time. Applicants with a related design or planning degree may enter the three-year program with advanced standing.

The M.L.A. program, for the student seeking a first professional degree in landscape architecture, is a more tightly structured curriculum because it leads to the prerequisite work experience that qualifies the graduate for the Landscape Architecture Registration Examination (L.A.R.E.).

Master of Professional Studies (M.P.S.)

www.esf.edu/graduate/programs/mps.php
The Master of Professional Studies (M.P.S.) degree is intended to be a terminal degree. The M.P.S. is offered in the following degree programs: chemistry, environmental and forest biology, forest resources management, environmental resources engineering, environmental science, and environmental studies.

This degree requires the successful completion of a minimum of 30 credits at the graduate level, of which at least 24 must be in course work. The student's program of study must be approved by the major professor, steering committee and Department Chairperson.

In addition, individual programs may require an integrative experience such as an internship, team project and/or comprehensive examination. If an examination is required, it is developed and managed by the department responsible for the program.

Master of Science (M.S.)

The master of science (M.S.) degree is an academic degree offered in the following programs: environmental and forest chemistry, environmental and forest biology, environmental studies, forest resources management, environmental resources engineering, environmental science, and landscape architecture.

To complete this degree, in addition to completion of necessary coursework, students must investigate a problem that initiates, expands, or clarifies knowledge in the field and prepare a thesis based on this study. Students are required to define an appropriate problem for investigation; review relevant information; develop a study plan incorporating investigative techniques appropriate to the problem; implement the plan; and relate the results to theory or a body of knowledge in the field.

The minimum credit-hour requirement is the successful completion of 30 graduate credits distributed between coursework and thesis. The applicable distributions will be determined by individual departments to suit program objectives, with the understanding that a minimum of 18 credits is awarded for graduate-level coursework and a minimum of six credits is awarded for the thesis. All steering committee members should sign the student's study plan (Form 3B) before the end of the last year of the student's program. The student must successfully defend the thesis for degree completion. The thesis is prepared and bound according to college standards and submitted to Digital Commons.

Doctor of Philosophy (Ph.D.)

The doctor of philosophy (Ph.D.) degree is an academic degree offered in the following degree programs: environmental and forest chemistry, environmental and forest biology, forest resources management, environmental resources engineering, and environmental science. The doctor of philosophy degree requires a minimum of 60 graduate credits, of which 30 to 48 credits are for coursework and 12 to 30 credits are awarded for dissertation. Individual departments will determine the applicable credit hour requirements within these ranges to reflect individual program requirements and emphases. The graduate credits earned for a master's degree that are applicable to a student's doctoral study plan (Form 3B) are determined on an individual basis by the steering committee. All steering committee members should sign the 3B form before the end of the last year of the student's program. Students may not use master's thesis credits to fulfill doctoral program coursework requirements.

Students must pass the doctoral candidacy examination covering selected fields of study at least one year prior to dissertation defense and successfully defend the dissertation. The dissertation must be prepared according to college standards and submitted to Digital Commons.

Advanced (Graduate) Certificates

In addition to degree programs for matriculated students, ESF offers study towards the earning of advanced certificates for professionals in:

- Climate Sustainability Leadership
- Environmental Decision Making
- Environmental Leadership (online)
- Environmental Justice and Inequality (online)
- Science & Environmental Communication and Public Relations Management (online)

Concurrent Programs

Concurrent Programs for Syracuse University Students

The joint Juris Doctor (J.D.) and Forest and Natural Resources Management (FNRM) Master of Professional Studies (M.P.S.) degree is designed for Syracuse University students who are interested in legal careers involved with forest, natural, and environmental resources. As human demands on the environment increase, society needs attorneys who understand the economic, demographic, social, and political issues that drive resource use allocation. Students learn the complexities of managing both resources and people recognizing that resource and environmental decisions involve value-driven conflicts. The degree provides a comprehensive foundation in forest, natural, and environmental resources issues and an understanding of both biophysical and social science.

Students enrolled in the joint J.D./FNRM degree program must earn a minimum of ninety-six (96) credits at both the College of Law and ESF. The J.D. normally requires eighty-seven (87) credits, but joint-degree students must take at least seventy-two (72) Law School credits. Students can transfer fifteen (15) credits from ESF to the College of Law. The M.P.S. degree requires thirty (30) credits, a minimum of twenty-four (24) of which must be ESF courses and six (6) of which may be applied by transfer from coursework at the College of Law.

Students can apply to the joint J.D./FNRM degree program at two points: 1) simultaneously, before entering the College of Law, or 2) after completing the fall semester of study at the College of Law. Applicants applying simultaneously must complete a College of Law application and an ESF graduate application. Applicants applying after enrolling at the College of Law must complete an "internal" College of Law application and ESF graduate application.

Intra-ESF Concurrent Degree Programs

ESF graduate students may pursue formal concurrent graduate degrees in two different departments or academic units within the College.

Concurrent degrees magnify the strengths of academic program offerings within ESF. Pairing an academic degree (Ph.D. or M.S.) with a professional degree (M.L.A., M.P.S., M.F.), or pairing two professional degrees (M.L.A., M.P.S., M.F.) are attractive choices for ESF students. Please consult with individual departments for details regarding specific degree or program combinations. Concurrent degrees require a minimum of 80 percent of the credit hour requirements of each of the paired degrees. Students may apply for admission to both degrees at matriculation, or they may apply to add the second degree following completion of at least 12 credit hours of coursework with a minimum GPA of 3.5. Graduate students interested in these opportunities should contact the ESF Office of Instruction and Graduate Studies.

DEPARTMENT OF CHEMICAL ENGINEERING

Bandaru Ramarao
205 Walters Hall
315-470-6513
315-470-6945 (fax)

The academic programs in the Department of Chemical Engineering (CHE) emphasize fundamental engineering science and engineering skills pertaining to chemical engineering with specialization in the pulp, paper and allied industries, and the bioprocess and chemical industries. Programs include courses in traditional areas of applied chemistry, industrial bioprocessing/ biotechnology, chemical engineering, and pulp and paper technology.

The department's educational programs at both the undergraduate and graduate levels are committed to preparing students for leadership roles in the paper and bioproducts industries. The department comprises nine distinguished faculty members who maintain research programs in a wide range of areas including biopulping, wood pulping and bleaching chemistry, paper physics and papermaking, chemical and process engineering, materials science, and surface and colloid science, among others.

BACHELOR OF SCIENCE IN BIOPROCESS ENGINEERING

The bioprocess engineering program prepares students for careers as engineers in the bioprocess or biotechnology industry filling positions that are typically filled by chemical engineers with additional training. The bioprocess engineering program seeks to educate engineers versed in the chemical engineering fields in biologics / biopharmaceutical, bioprocess, biotechnology, biochemical and bioenergy, with a focus on developing products from sustainable sources in a sustainable manner or through the applications of green chemistry. The bioprocess engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org following the criteria of Chemical, Biochemical, Biomolecular and Similarly Named Engineering Programs since 2012 (https://www.aiche.org/abet-accredited-universities).

Students gain valuable experience through a capstone-design experience in which they work on significant problems in the design and implementation of new technologies. In addition, a summer internship is required of all students during which they gain valuable skills and experience in terms of technical knowledge and professional development. Both of these experiences serve to integrate the knowledge gained in their coursework with real-world work experiences commonly seen in their first positions after graduation.

The curriculum consists of a number of categories of courses. The general education component, which is required of all ESF students, broadens the students' perspectives on global and societal issues, an important component of any education. Students also take a number of courses in math and the basic sciences—chemistry, physics, and biology—to provide the background for the courses that prepare students for engineering practice. The engineering courses cover a variety of topics that are traditional for a chemical engineering program, supplemented with courses specific to bioprocess engineering. The moderate requirement of 128 credits hour allows room for students to supplement more courses at their own desire (no limitation on free electives).

Students may be admitted to the bioprocess engineering program as first-year students with appropriate science backgrounds from their high school or as transfer students at any level with accommodations for coursework requirements. Students who have the associate degree in engineering science, chemical technology, biological sciences, or general science and mathematics are encouraged to apply as transfer students.

Lower Division Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
APM 307	Multivariable Calculus	4
APM 485	Diff Equat/Engr&Scientist	3
ECH 132	Orientatn&Intro to Chem Eng I	1
ECH 133	Orientatn&Intro to Chem Eng II	1
BPE 300	Intro/Industrial Bioprocessing	3
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FOR 207	Introduction To Economics	3
GNE 160	Comp Methods/Engrs&Scientists	3
PHY 211	General Physics I	3
PHY 221	General Physics I Laboratory	1
PHY 212	General Physics II	3

PHY 222	General Physics II Laboratory	1
ECH 202	Prin Mass/Energy Balance	3
ECH 212	Engr Thermodynamics	3

General Education Electives

Course Name	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

APM 395	Probability & Stats/Engr	3
	Professional Experience: BPE 498	
	BPE 304 + BPE 306	
ECH 312	Chemical Engrn Thermodynamics	3
ECH 322	Fluid Mechanics	3
BPE 321	Biomolecular Kinetics	3
ECH 323	Transport Phenomena	3
BPE 420	Bioseparations	3
BPE 421	Bioprocess EngineerofReactions	3
BPE 440	Bioproc Kinetics&Sys Engr Lab	3
BPE 450	Chemical&BPE Product Design	3
BPE 481	Bioprocess Eng Design	3
ESF 200	Information Literacy	1
EWP 444	Prof Writing/Paper&Bioproc Eng	2

ECH 324	Unit Operations Laboratory	3
ECH 355	Engr Design Economics	3
ECH 371	Process Control	3
EFB 325	Cell Biology	3

*Professional experience: BPE304 must be taken in the summer + BPE306 in the after right after, while BPE498 can be taken in any semester.

Directed Electives

13 credits out of the following.

Course Name	Codes*	Credits
Science Electives		3 - 6
Junior or higher Biology, Biochemistry, or Engineering Electives		7 - 10

The list of directed elective courses is available in the student handbook and from the student's advisor. Students are encouraged to select elective courses to focus on one concentration area from among the following: biomolecular engineering, biochemical engineering, biopolymer engineering, bioenergy engineering, biomaterials, environmental engineering, industrial engineering or paper engineering.

Internships, Co-ops, and Research Experiences

Bioprocess engineering students enjoy the advantage of hands-on learning in the bioprocess and allied industries through faculty-guided internships and cooperative education (co-op) assignments. All students are required to complete an internship, co- op or research experience in the industry or in a research setting. Internships provide students with valuable experience and financial benefits. There is a two credit course following the Bioprocess Engineering experience to summarize the experience with a report and a presentation for completion of the internship.

Total Minimum Credits For Degree: 128

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

Bachelor of Science in Chemical Engineering

Chemical engineering is a versatile program and one of the most broadly-based engineering disciplines. Its field of practice covers the development, design, and control of processes and products that involve molecular change, both chemical and biological, and the operation of such processes. Because many of the products that sustain and improve life are produced by carefully designed and controlled molecular changes, the chemical engineer serves in a wide variety of industries. These industries range from chemical and energy companies to producers of all types of consumer and specialty products including pharmaceuticals, textiles, pulp and paper, polymers, advanced materials, and solid-state and biomedical devices.

Careers are available in industry, government, consulting, and education. Areas of professional work include research and development, operations, technical service, product development, process and plant design, market analysis and development, process control, and pollution abatement.

The chemical engineering degree program prepares students for professional practice in chemically related careers. Chemical engineering graduates are expected to attain the following capabilities at or within a few years of graduation: apply the fundamentals of science and engineering to solve important chemical engineering problems in industry, government or academic settings; communicate effectively and demonstrate the interpersonal skills required to lead and/or participate in interdisciplinary projects; apply life-long learning to meet professional and personal goals of their chosen profession, including graduate study; articulate and practice professional, ethical, environmental and societal responsibilities, and value different global and cultural perspectives.

The curriculum consists of a number of categories of courses. The general education component, which is required of all ESF students, broadens the students' perspectives on global and societal issues, an important component of any education. Students also take a number of courses in math and the basic sciences—chemistry and physics, (and biology)—to provide the background for the courses that prepare students for engineering practice. The engineering courses cover a variety of topics in chemical engineering. Some selective courses have been placed in the curriculum as elective for students wishing to enter into the pulp and paper industry. The moderate requirement of 127 credits hour allows room for students to supplement more courses at their own desire (no limitation on free electives).

Students may be admitted to the chemical engineering program as first-year students with appropriate science backgrounds from their high school or as transfer students at any level with accommodations for coursework requirements. Students who have the associate degree in engineering science, chemical technology, or general science and mathematics are encouraged to apply as transfer students.

Lower Division Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4

APM 307	Multivariable Calculus	4
APM 485	Diff Equat/Engr&Scientist	3
ECH 132	Orientatn&Intro to Chem Eng I	1
ECH 133	Orientatn&Intro to Chem Eng II	1
ECH 202	Prin Mass/Energy Balance	3
ECH 212	Engr Thermodynamics	3
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223 AND	Organic Chemistry II	3
FCH 224 OR	Organic Chemistry Lab II	1
PSE 223	Intro to Lignocellulosics	4
FOR 207	Introduction To Economics	3
GNE 160	Comp Methods/Engrs&Scientists	3
PHY 211	General Physics I	0 - 8
PHY 221	General Physics I Laboratory	0 - 8
PHY 212	General Physics II	0 - 8
PHY 222	General Physics II Laboratory	0 - 8

General Education Electives

Course	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

APM 395	Probability & Stats/Engr	3
	Professional Experience: ECH 498	2
	ECH 304 + ECH 306	
ECH 312	Chemical Engrn Thermodynamics	3
ECH 322	Fluid Mechanics	3
ECH 323	Transport Phenomena	3
ECH 324	Unit Operations Laboratory	3
ECH 341	Chem Reaction Engnrng Kinetics	3
ECH 355	Engr Design Economics	3
ECH 371	Process Control	3
ECH 422	Unit Process Operations	3
ECH 442	Chem Reaction Eng&Prcss Safety	3
ECH 454	Product Design in Chem Eng	3
ECH 455	Capstone Chemical Engnrng Lab	3
ECH 457	Chemical Engnrng Plant Design	3
ESF 200	Information Literacy	1

EWP 444	Prof Writing/Paper&Bioproc Eng	2

*Professional experience: ECH 304 must be taken in the summer and ECH 306 in the Fall semester immediately after, while ECH 498 can be taken in any semester.

Directed Electives

14 credits out of the following directed electives.

Course	Codes*	Credits
Junior or higher engineering directed electives		5 - 14
Science Electives		3 - 9

Total Minimum Credits For Degree: 127

BACHELOR OF SCIENCE IN PAPER ENGINEERING

The paper engineering program is a chemical engineering-based curriculum designed to provide greater depth in fiber and paper processing for students preparing for an engineering career in the pulp, paper and allied industries.

The pulp and paper industry is at the forefront of the renewable resources industry. It represents the first industry that uses biomass in large quantities to produce commodity and specialized products. Graduates are well prepared to move into assignments in the engineering field and advance quickly to positions of responsibility in the analysis and design of processes and equipment. The paper engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Lower Division Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
APM 307	Multivariable Calculus	4
APM 485	Diff Equat/Engr&Scientist	3
ECH 132	Orientatn&Intro to Chem Eng I	1
ECH 133	Orientatn&Intro to Chem Eng II	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223 AND	Organic Chemistry II	3
FCH 224 OR	Organic Chemistry Lab II	1
PSE 223	Intro to Lignocellulosics	4

FOR 207	Introduction To Economics	3
GNE 160	Comp Methods/Engrs&Scientists	3
PHY 211	General Physics I	0 - 8
PHY 212	General Physics II	0 - 8
PHY 221	General Physics I Laboratory	0 - 8
PHY 222	General Physics II Laboratory	0 - 8
PSE 200	Intro to Papermaking	3
PSE 201	Art &Early History/Papermaking	3
PSE 202	Pulp&Paper Lab Skills	1
ECH 202	Prin Mass/Energy Balance	3
ECH 212	Engr Thermodynamics	3

General Education Elective

Course Name	Codes*	Credits
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

APM 395	Probability & Stats/Engr	3
ECH 322	Fluid Mechanics	3
ECH 323	Transport Phenomena	3
ECH 324	Unit Operations Laboratory	3
ECH 355	Engr Design Economics	3
ECH 371	Process Control	3
ESF 200	Information Literacy	1
EWP 444	Prof Writing/Paper&Bioproc Eng	2
PSE 304	Professional Internship	1

PSE 306	Professional Synthesis	1
PSE 350	Fiber Processing	3
PSE 450	Pulping & Bleaching Processes	3
PSE 462	Papermaking Processing I	3
PSE 467	Papermaking Wetend Chem	3
PSE 478	Papermaking Processing II	2
PSE 481	Engineering Design	3

EWP 200 and EWP 407 are to be taken in the same semester *in the same time block.* Please consult your advisor if you have question.

Directed Electives

ENGINEERING DIRECTED ELECTIVES	9 - 12
SCIENCE ELECTIVES	3 - 6

The list of directed elective courses is available in the student handbook and from the student's advisor. Some courses are available in an exchange program with Germany.

Total Minimum Credits For Degree: 128

BACHELOR OF SCIENCE IN RENEWABLE MATERIALS SCIENCE

The renewable materials science program educates students in the science of materials and products made from renewable resources. The program provides an in-depth knowledge of materials such as wood, paper, modern packaging materials, natural fiber materials and advanced materials emphasizing sustainability, environmental consciousness and minimizing environmental footprint.

Students can explore a variety of careers in modern packaging, natural products and renewable materials industries, focused on technical, scientific and managerial tracks. The program will have the following options: paper, wood and polymer science. The third option is conducted with the Department of Chemistry.

Paper Science Option

Lower Division Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
EFB 336	Dendrology I	3
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 360	Physical Chemistry I	3
FOR 207	Introduction To Economics	3
GNE 160	Comp Methods/Engrs&Scientists	3
GNE 271	Statics	3

PHY 211	General Physics I	0 - 8
PHY 212	General Physics II	0 - 8
PHY 221	General Physics I Laboratory	0 - 8
PHY 222	General Physics II Laboratory	0 - 8
PSE 201	Art &Early History/Papermaking	3
PSE 223	Intro to Lignocellulosics	4
RMS 132	Intro/Renewable Mat Science I	1
RMS 133	Intro/Renewable Mat Science II	1
RMS 200	Renewable Mat&Comp/Lignocell	3
ECH 202	Prin Mass/Energy Balance	3
ECH 212	Engr Thermodynamics	3

General Education Course

Students are required to take one General Education in the following category as well as taking a total of 30 credit hours of General Education coursework in total.

Course Name	Codes*	Credits
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

APM 391	Intro/Probability&Stats	3
BPE 310	Colloid and Interface Science	3
ESF 200	Information Literacy	1
EWP 444	Prof Writing/Paper&Bioproc Eng	2
GNE 273	Mechanics of Materials	3
PSE 456	Management in Industry	3

RMS 335	Trsprt Properties of Materials	3
RMS 387	Renewable Mat/Sustainable Cons	3
RMS 388	Wood and Fiber Ident Lab	2
RMS 422	Composite Mat/Sustainable Cons	3
RMS 465	Renewable Materials & Surfaces	3
RMS 468	Product Design:Timber or Paper	3
RMS 481	Capstone Project/Senior Thesis	3

ESF 200 and EWP 444 are to be taken in the same semester in the same time block. Please consult your advisor if you have questions.

Students are required to take 4 Paper Science directed electives (12 credits).

Directed Electives

Course Name	Codes*	Credits
Science electives		3-6
Junior or higher Paper Science engineering electives		12

Total Minimum Credits For Degree: 124

WOOD SCIENCE OPTION

Lower Division Required Courses

PSE 201	Art &Early History/Papermaking	3
APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
EFB 336	Dendrology I	3
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 360	Physical Chemistry I	3
GNE 160	Comp Methods/Engrs&Scientists	3
GNE 271	Statics	3
FOR 207	Introduction To Economics	3
PHY 211	General Physics I	0 - 8
PHY 222	General Physics II Laboratory	0 - 8
PSE 223	Intro to Lignocellulosics	4
RMS 132	Intro/Renewable Mat Science I	1
RMS 133	Intro/Renewable Mat Science II	1
RMS 200	Renewable Mat&Comp/Lignocell	3

General Education Course

Students are required to take one General Education in the following category as well as taking a total of 30 credit hours of General Education coursework in total.

Course Name	Codes*	Credits
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

ECH 212	Engr Thermodynamics	3
APM 391	Intro/Probability&Stats	3
BPE 310	Colloid and Interface Science	3
ESF 200	Information Literacy	1
EWP 444	Prof Writing/Paper&Bioproc Eng	2
GNE 273	Mechanics of Materials	3
PSE 456	Management in Industry	3
RMS 322	Wood Machining	3
RMS 335	Trsprt Properties of Materials	3
RMS 387	Renewable Mat/Sustainable Cons	3
RMS 388	Wood and Fiber Ident Lab	2
RMS 422	Composite Mat/Sustainable Cons	3
RMS 465	Renewable Materials & Surfaces	3
RMS 468	Product Design:Timber or Paper	3
RMS 481	Capstone Project/Senior Thesis	3

ESF 200 and EWP 444 are to be taken in the same semester in the same time block. Please consult your advisor if you have questions.

Students are required to take 4 Wood Science electives, selected from the following (12 credits).

Wood Science Electives

CME 326		
CME 330	Building Code/New York State	3
CME 404	Applied Structures	3
CME 410		
MCR 480	Fundamentals of Microscopy	3
MCR 580	Microtechnique of Wood	3
PSE 438	Biorenew Fibrous&Nonfibrs Prod	3

Total Minimum Credits For Degree: 124

POLYMER SCIENCE OPTION

Lower Division Required Courses		
PSE 201	Art &Early History/Papermaking	3
APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223	Organic Chemistry II	3
FCH 224	Organic Chemistry Lab II	1
FOR 207	Introduction To Economics	3
GNE 160	Comp Methods/Engrs&Scientists	3
GNE 271	Statics	3
PHY 211	General Physics I	0 - 8
PHY 212	General Physics II	0 - 8
PHY 221	General Physics I Laboratory	0 - 8
PHY 222	General Physics II Laboratory	0 - 8
RMS 132	Intro/Renewable Mat Science I	1
RMS 133	Intro/Renewable Mat Science II	1

RMS 200	Renewable Mat&Comp/Lignocell	3

General Education Course

Students are required to take one General Education in the following category as well as taking a total of 30 credit hours of General Education coursework in total.

Course Name	Codes*	Credits
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

APM 391	Intro/Probability&Stats	3
BPE 310	Colloid and Interface Science	3
ESF 200	Information Literacy	1
EWP 444	Prof Writing/Paper&Bioproc Eng	2
FCH 360	Physical Chemistry I	3
FCH 361	Physical Chemistry II	3
FCH 380	Analytical Chemistry I	2
FCH 381	Analytical Chemistry II	3
FCH 497	Undergraduate Seminar	1
FCH 550	Polymer Sci:Synth&Mech	3
FCH 551	Polymer Techniques	3
FCH 552	Polymer Sci:Prop&Tech	3
GNE 273	Mechanics of Materials	3
PSE 456	Management in Industry	3
MCR 480	Fundamentals of Microscopy	3
RMS 387	Renewable Mat/Sustainable Cons	3
RMS 388	Wood and Fiber Ident Lab	2
RMS 422	Composite Mat/Sustainable Cons	3

RMS 465	Renewable Materials & Surfaces	3

Electives

Course	Codes*	Credits
Polymer Science Electives		9

Total Minimum Credits For Degree: 124

GRADUATE PROGRAM IN CHEMICAL ENGINEERING

The department participates in graduate education leading to the master of professional studies (M.P.S.), master of science (M.S.) and doctor of philosophy (Ph.D.) degrees in Paper and Bioprocess Engineering. Four options are available within this program:

- Paper Science and Engineering (PSE)
- Bioprocess Engineering (BPE)
- Biomaterials Engineering (BME)
- Sustainable Engineering Management (SEM)

The graduate program allows students to investigate a diverse range of topics in the area of pulp and paper design, process and product development, and manufacturing, as well as the production of chemicals, energy and other products from sustainable raw material sources using both chemical and biological methods. The overall objective of the option is to educate students at the M.P.S., M.S. and Ph.D. level in the development of new processes and products that can be produced in an ecologically sound and sustainable manner.

Options

Paper Science and Engineering Option

The PSE program offers these areas of study:

- Pulping and Bleaching Processes (M.S., Ph.D.)
- Colloidal Chemistry and Fiber Flocculation (M.S., Ph.D.)
- Fiber and Paper Physics (M.S., Ph.D.)
- Process and Environmental Systems Engineering (M.P.S., M.S., Ph.D.)
- Pulp and Paper Technology (M.P.S.)

Bioprocess Engineering Option

Projects conducted in the department under this option develop fundamental knowledge of biorefinery processes for application in the production of a wide spectrum of industrial products and fuels from bioresources, primarily lignocellulosics.

Research is also supported by various U.S. federal and N.Y. state governmental agencies, sometimes in conjunction with private industrial partners.

The BPE program offers areas of study in:

- Biocatalysis and Bioreaction Engineering (M.S., Ph.D.)
- Bioseparations Engineering (M.S., Ph.D.)
- Bioprocess Design, Simulation and Control (M.S., Ph.D.)
- Bioenvironmental Engineering (M.S., Ph.D.)
- Renewable Energy and Biofuels (M.S., Ph.D.)
- Biopharmaceuticals (M.S., Ph.D.)
- Industrial Biological Processes (M.S., Ph.D.)
- Bioprocess Engineering (M.P.S.)

Biomaterials Engineering (BME) Option

The BME option in the Paper and Bioprocess Engineering program offers areas of study in:

- Biocomposite Materials, Biopolymers (M.S., Ph.D.)
- Bioactive Materials and Biosensors (M.S., Ph.D.)
- Nanocomposites and Nanostructured Materials (M.S., Ph.D.)

Sustainable Engineering Management (SEM) Option

The program in Sustainable Engineering Management allows students to investigate a variety of science and engineering topics together with courses in business, management, policy, law and other fields to form a Professional Science Master's program (PSM) recognized by the Council of Graduate Schools.

Students in this program must complete a total of 36 credit hours. The topical core of the program consists of 21 credit hours of courses in their technical field. An additional 12 credits of courses in business, management, policy, law and other areas constitute the "plus" courses in the degree. An integrative experience (3 credit hours) in the form of an internship or research experience is also required. The selection of the "plus" courses as well as technical electives allows students to develop study programs tailored to their individual interests and strengths.

The M.P.S. program in Sustainable Engineering Management is intended for students who:

- have a B.S. degree in an appropriate STEM field and wish to extend their technical knowledge in this area together with obtaining professional skills characterized by the "plus" courses
- have worked in the industry and wish to return for a professional degree that incorporates business skills into the program.

Students entering the M.P.S. program should have a B.S. degree in a science- or engineering-related field. In terms of coursework, students should have the necessary prerequisites to take the courses that are required for the degree or be prepared to take these courses prior to taking the required courses. In general, students should have taken as part of their undergraduate program at least two semesters of calculus, two semesters of general chemistry, a semester of physics and a semester of biology. Additional chemistry, biology, and computer science courses, while not required, would be helpful.

The SEM M.P.S. offers areas of study in:

- Bioprocess Engineering
- Paper Engineering

Wood Science Options

Ph.D. and M.S. Options in Wood Science

Applicants for the M.S. or Ph.D. degrees in the wood science option are required to have a bachelor's degree in science, engineering or related degree. Applicants must have completed at least one semester of coursework in chemistry, biology, physics and calculus.

Areas of study in Wood Science include: Wood drying, wood anatomy and ultrastructure, wood durability and decay, tropical timbers, wood preservation. Applicants must have the appropriate undergraduate degree for the area of study they pursue.

M. P. S. Options in Wood Science

The M.P.S. in Wood Science is open to students with a demonstrated interest in wood science or the wood products industry. A bachelor's degree in science or engineering is strongly recommended. Applicants to the M.P.S. in wood science and technology should have completed at least one semester of coursework in chemistry, biology, physics, and calculus.

Two coursework options are available:

M. P. S. Coursework

Core courses (12-21 credits), construction management courses (3-9 credits), application electives (3-9 credits), professional experience/synthesis (3-6 credits). Courses are selected in consultation with and with approval of the steering committee.

Core courses (12-21 credits):

Construction Management courses: (3 to 9 credits) (or others with committee approval)

Required Courses		
CME 587		
CME 596		
CME 682		
CME 686	Wood-Water Relationships	3
CME 770	Biodegradation of Wood	3
MCR 580	Microtechnique of Wood	3
MCR 680	Fundamentals of Microscopy	3
Required Courses		
CME 543	Construction Estimating	3
CME 653	Construct Plan/Scheduling	3
CME 654	Construction Project Mgt	3

Application Electives: (3-9 credits) (courses selected with committee approval)

Professional Experience/Synthesis (3-6 credits):

Required Courses		
CME 898	Prof Experience/Synthesis	1 - 6

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.) **G** = General Education Course (GenEd), **E** = Engineering, **ES** = Engineering Sciences, **M** = Mathematic, **NS** = Natural Sciences, **PE** = Professional Education, **S** = Summer-only*

DEPARTMENT OF CHEMISTRY

Lee Newman, Chair
117 Jahn Laboratory
315-470-4937

ESF's Department of Chemistry is uniquely organized around the interdisciplinary areas of biochemistry and natural products chemistry, environmental chemistry, and polymer chemistry. The department's 71,000-square-foot Edwin C. Jahn Laboratory is a state-of-the-art facility, fully equipped for modern chemical research and teaching.

Chemistry students gain a strong foundation in the traditional areas of analytical, inorganic, organic, and physical chemistry, but also in the integration of these areas into specialties aligned with the needs of the 21st century. All Chemistry majors participate in research, gaining familiarity with the actual practice of chemistry.

BACHELOR OF SCIENCE IN BIOCHEMISTRY

In pursuing the Bachelor of Science in Biochemistry, students will first build a strong foundation in general chemistry, general biology, physical, and organic chemistry prior to choosing directed and professional electives that will allow them the flexibility to pursue topics that will be relevant to their future career tracks in biochemistry, biotechnology, chemistry or health.

Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
ESF 200	Information Literacy	1
FCH 132	Orientation Seminar:FCH	1
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223	Organic Chemistry II	3
FCH 224	Organic Chemistry Lab II	1
FCH 232	Career Skills for Chemists	1
PHY 211	General Physics I	0 - 8

PHY 212	General Physics II	0 - 8
PHY 221	General Physics I Laboratory	0 - 8
PHY 222	General Physics II Laboratory	0 - 8

Elective

Course Name	Codes*	Credits
Math Elective (Calculus III [APM307] or Statistics [APM391])		3
Free Elective		9
General Education Course in two of the following categories: US History & Civic Engagement, The Arts, Social Sciences, World History and Global Awareness, World Languages		6
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

EFB 307	Principles Of Genetics	3
EWP 407	Writing/Env & Sci Professionls	3
FCH 360	Physical Chemistry I	3
FCH 361	Physical Chemistry II	3
FCH 380	Analytical Chemistry I	2
FCH 382	Analytical Chemistry I Lab	1
FCH 430 OR	Biochemistry I	3
FCH 530	Biochemistry I	3
FCH 431 OR	Biochemistry Laboratory	3

FCH 531	Biochemistry Laboratory	3
FCH 432 OR FCH 532	Biochemistry II Biochemistry II	3 3
FCH 495	Intro/Professional Chem	1
FCH 497	Undergraduate Seminar	1

Upper Division Electives

Students will take 24 credits of Professional Electives.

1. At least one Professional Elective must have a laboratory component. This course can also count as a Biochemistry-focused Elective if chosen from one of the laboratory courses listed below.
2. At least one Professional Elective must be a biology (EFB or BIO) course and at least one Professional Elective must be a chemistry (FCH or CHE) course. These courses can also count as biochemistry- focused professional electives if chosen from the list below.
3. Of the 24 credits of Professional Electives, at least 12 credits must be chosen from the following short list of biochemistry-focused professional electives.

Coursework suitable for meeting the biochemistry-focused professional electives:

BIO 409	General Microbiology	0 - 8
BTC 401	Molecular Biol Techniques	3
EFB 303	Intro Envrn Microbiology	4
EFB 308	Prin Of Genetics Lab	1
EFB 325	Cell Biology	3
EFB 400	Toxic Health Hazards	3
EFB 462	Animal Physiol:Envrn&Ecol	4
FCH 325	Organic Chemistry III	4
FCH 390	Drugs From The Wild	3
FCH 410	Inorganic Chemistry	3
FCH 420		
FCH 498	Introduction To Research	1 - 5
FCH 524	Topics Nat Product Chem	3
FCH 535		

FCH 584	Spectro ID/Organic Compounds	3
CHE 412	Metals in Medicine	0 - 8
CHE 414	Intro to Medicinal Chemistry	0 - 8
CHE 427	Org Chem of Biological Molecul	0 - 8
CHE 474	Structural&Physical Biochem	0 - 8
CHE OR BCH 477		

(list not exhaustive; any science, math, or engineering course at least 300-level counts as PE)

Suggested other Professional Electives (PEs) not considered as a biochemistry-focused electives:

BIO 355	General Physiology	0 - 8
BIO 422	Bioinformatics for Life Scient	0 - 8
BIO 464	Applied Biotechnology	0 - 8
BTC 425	Plant Biotechnology	3
BTC 426	Plant Tissue Culture Methods	3
BPE 300	Intro/Industrial Bioprocessing	3
BPE 420	Bioseparations	3
BPE 421	Bioprocess EngineerofReactions	3
BPE 430		
BPE 440	Bioproc Kinetics&Sys Engr Lab	3
BPE 481	Bioprocess Eng Design	3
EFB 303	Intro Envrn Microbiology	4
EFB 311	Principles of Evolution	3
EFB 320	General Ecology	4
EFB 400	Toxic Health Hazards	3
EFB 415		
EFB 435	Flowering Plnts:Div,Evol&Systm	3

EFB 462	Animal Physiol:Envrn&Ecol	4
EFB 505		
EFB 570	Insect Physiology	3
EFB 530		
FCH 296	Special Topics in Chemistry	1 - 3
FCH 381	Analytical Chemistry II	3
FCH 496	Special Problems In Chem	1 - 3
FCH 510	Environmental Chemistry I	3
FCH 511	Atmospheric Chemistry	3
FCH 515	Meth/Envrn Chem Analysis	3
FCH 520	Marine Biogeochemistry	3
FCH 525	Oceanography	3
FCH 550	Polymer Sci:Synth&Mech	3
FCH 551	Polymer Techniques	3
FCH 552	Polymer Sci:Prop&Tech	3
FCH 560	Chromatog/Separation Tech	3
PSE 223	Intro to Lignocellulosics	4

Total Minimum Credits For Degree: 120

BACHELOR OF SCIENCE IN CHEMISTRY

In pursuing a Bachelor of Science in Chemistry, students first receive a strong foundation in analytical, physical, organic and inorganic chemistry before selecting one of three options leading to the degree: biochemistry and natural products, environmental chemistry, and natural and synthetic polymer chemistry.

Each option offers an advanced course of studies beyond the basic courses of the classical undergraduate chemistry curriculum. All options are excellent grounding for professional work at the B.S. level or for advanced graduate study.

Biochemistry and Organic Chemistry of Natural Products

This option stresses a chemical approach to problems in the life and health sciences. Students take advanced courses in natural products chemistry, chemical analysis, and biochemistry. Professional electives in physiology, chemical ecology, genetics and molecular biology strengthen connections in the life and health sciences.

Research areas include the elucidation of chemical signals by which organisms communicate with each other, the role of trace metals in the growth of microorganisms, the origin and function of biologically active natural compounds, and synthetic biology and metabolic engineering for the production of value-added products and antimicrobial compounds.

Environmental Chemistry

Environmental chemistry stresses applications of fundamental chemical principles to describe and predict behavior of chemicals in the environment. After obtaining a strong foundation in analytical, physical and organic chemistry, students pursue advanced study in air and water chemistry:

- FCH 510 Environmental Chemistry I - Aquatic Chemistry
- FCH 511 Environmental Chemistry II - Atmospheric Chemistry
- FCH 515 Methods of Environmental Chemical Analysis

Professional Elective provide students exposure to environmental topics in health, engineering, biology and sustainability. The senior year culminates in a senior research project undertaken under the supervision of one of the chemistry faculty. This give students the opportunity to experience research ranging from laboratory work to field-intensive studies.

Natural and Synthetic Polymer Chemistry

Students take advanced courses in mechanisms of polymerization and polymer synthesis, physical properties and characterization of polymers, and laboratory techniques of polymer synthesis and characterization. Special topics courses in contemporary polymer and material science are available as electives. In addition, courses in carbohydrate chemistry provide a solid background for chemists planning careers in paper, plastic, high-tech, energy, membranes, and related areas. Biochemistry is an appropriate elective for students interested in the growth of biotechnologies while environmental chemistry complements this program for students interested in working on problems of biodegradation.

Lower Division Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 132	Orientation Seminar:FCH	1
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223	Organic Chemistry II	3
FCH 224	Organic Chemistry Lab II	1
PHY 211	General Physics I	0 - 8
PHY 212	General Physics II	0 - 8
PHY 221	General Physics I Laboratory	0 - 8
PHY 222	General Physics II Laboratory	0 - 8

Lower Division Electives

Course	Codes*	Credits
Math Elective (Calculus III [APM307] OR Statistics [APM391])		

Free Elective		
General Education Course in two of the following categories: US History & Civic Engagement, The Arts, Social Sciences, World History and Global Awareness, World Languages	G	6
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

EWP 407	Writing/Env & Sci Professionls	3
FCH 325	Organic Chemistry III	4
FCH 360	Physical Chemistry I	3
FCH 361	Physical Chemistry II	3
FCH 380	Analytical Chemistry I	2
FCH 381	Analytical Chemistry II	3
FCH 382	Analytical Chemistry I Lab	1
FCH 410	Inorganic Chemistry	3
FCH 495	Intro/Professional Chem	1
FCH 497	Undergraduate Seminar	1
FCH 498	Introduction To Research	1 - 5

Note: 5 credits of FCH 498 are required

Upper Division Required Courses

Course	Codes*	Credits
Professional Electives allow students to explore interests in a wide range of areas, including biology, chemistry, ecology, forestry, environmental		

law, mathematics, geology, physics, biophysics, and various engineering disciplines. Professional elective are typically 300-level and above.		
Electives		

Other Courses

Biochemistry and Natural Products Option		
FCH 430	Biochemistry I	3
OR		
FCH 530	Biochemistry I	3
FCH 431	Biochemistry Laboratory	3
OR		
FCH 531	Biochemistry Laboratory	3
FCH 432	Biochemistry II	3
OR		
FCH 532	Biochemistry II	3
Environmental Chemistry Option		
FCH 510	Environmental Chemistry I	3
FCH 511	Atmospheric Chemistry	3
FCH 515	Meth/Envrn Chem Analysis	3
Natural and Synthetic Polymer Chemistry Option		
FCH 550	Polymer Sci:Synth&Mech	3
FCH 551	Polymer Techniques	3
FCH 552	Polymer Sci:Prop&Tech	3

Total Minimum Credits for Degree: 121

GRADUATE PROGRAMS CHEMISTRY

The Department of Chemistry at ESF is unique in that it is structured around four areas of application:

- Biochemistry
- Environmental Chemistry

- Organic Chemistry of Natural Products
- Polymer Chemistry

Faculty members in the department are internationally recognized experts and are well funded by federal agencies (NSF, DOE, NASA, etc.), industry, government, and NGOs. Graduate students commonly receive national fellowships. The environment for graduate students is challenging but supportive, as faculty are invested in student success.

Graduate degrees require an appropriate program of courses at ESF and Syracuse University. Master of Science and doctoral students must complete a minimum of 18 credit hours and 30 credit hours of graduate level coursework, respectively. In addition, doctoral students must pass a doctoral candidacy examination.

Current research projects encompass natural and synthetic polymer chemistry, biochemistry and microbiology; organic chemistry of natural products and chemical ecology; chemistry of air and water; climate change.

Masters in Professional Studies (M.P.S.) Degree

The Masters in Professional Studies is a coursework-based program intended for students who need additional courses in Chemistry, but who are not planning on pursuing a research career in the field. M.P.S. students take courses in anyof the subject areas of the department: Biochemistry, Environmental Chemistry, Inorganic Chemistry, Natural Products/Organic Chemistry and Polymer Chemistry. The curriculum is sufficiently flexible to allow a student interested in specializing in one of these areas to take the core sequence in that area, although this is not required. Students who have taken any of these courses as undergraduates may not repeat them for graduate credit.

All students entering graduate programs at ESF are expected to be proficient in communication skills, including technical writing and library skills. This requirement can be met by completing at least one course in technical writing and one course in library usage, either as an undergraduate or as a graduate student. Alternatively, graduate students can meet the requirement by demonstrating the equivalent in experience in writing and library skills, as determined by the steering committee.

In addition to the formal coursework, the M.P.S. program also requires an integrative experience that allows the student to synthesize their knowledge. This can be a detailed analysis of one particular area of chemistry, an independent study, internship with industry, or work in a research laboratory. The integrative experience should be approved by the student's steering committee prior to starting. The student will be expected to present a written final report on the integrative experience.

M.P.S. Program Requirements

The Master of Professional Studies (M.P.S.) degree requires a total of 30 credits (minimum) in the following configuration:

Area	Credits
Chemistry	15
Other sciences, engineering and mathematics	6
Seminars	3

Integrative experience (internship or independent study)	3
Elective coursework, seminars, internships or research experience	3
Total (minimum)	30

- **15 credits of graduate chemistry courses**, including chemistry courses are available at ESF and Syracuse University.
- **6 credits of graduate coursework in Science, Mathematics or Engineering**. These may include graduate courses offered at ESF or Syracuse University in physical or biological sciences, mathematics (including statistical analysis), or any area of engineering. Courses must be approved by the student's steering committee.
- **3 credits of seminar**: Either FCH 797 Graduate Seminar may be repeated, or students may choose seminars offered in other departments with approval of the advisor.
- **3 credits for an integrative experience** as FCH 898, Professional Experience/Synthesis in Chemistry.
- **3 credits of additional graduate coursework**: These remaining three credits may be drawn from additional graduate level coursework, seminars, internships and research experience as approved by the student’s steering committee.

M.S. & Ph.D. Degrees

The Biochemistry, Environmental Chemistry, and Polymer Chemistry options each have a core sequence of courses that are required for all graduate students in that option. All graduate students must present a public department seminar through FCH 797 plus a capstone seminar.

General Requirements

Steering committee and program of study: By the end of their first year of study, all graduate students must formally identify the two faculty who, in addition to their major professor, will provide guidance for their graduate school career. These two faculty and the major professor constitute the steering committee. These faculty must approve the student's program of study: the list of courses the student will take for their degree. This approval must also occur by the end of the first year. Forms are available online at students' MyESF page.

M.S. Program Requirements

M.S. students are required to take at least 18 credits of coursework or non-thesis research; some options require additional credits. While a certain number of research credits are required, successful completion of an M.S. thesis project is determined by effort and effectiveness, not by credits.

Ph.D. Program Requirements

Ph.D. students are required to take at least 30 credits of coursework or non-dissertation research; some options require additional credits. While a certain number of research credits are required, successful completion of a Ph.D. dissertation project is determined by effort and effectiveness, not by credits.

The candidacy exam at ESF has three formats, but Chemistry usually uses format 2 (research report) or format 3 (the thesis proposal). After authoring the document, students defend it orally in front of their steering committee and one or two examiners.

Areas of Study

There are five graduate areas of study in Chemistry:

Biochemistry (M.P.S., M.S., Ph.D.)

Graduate studies in biochemistry reflect the College's interests in microbial, insect, bio-based fuel, and plant biochemistry.

After completing a one-year sequence in general biochemistry, students select advanced courses from a range of offerings in chemistry, organismal biology and molecular biology. Advanced courses in biochemistry are available both at ESF and Syracuse University.

Environmental Chemistry (M.P.S., M.S., Ph.D.)

The ESF program offering M.S. and Ph.D. degrees in chemistry with an emphasis in environmental chemistry is one of the few doctoral programs of its type within a chemistry department in the United States. The nine core faculty and two participating faculty make it one of the largest such programs in the world.

Students take three core courses in environmental chemistry and one course in biochemistry. Subsequent coursework is carefully selected from regularly offered courses on oceanography, biogeochemistry, analytical methods, sustainability,environmental health and basic areas of chemistry. Coursework is also available in ecology, biology, geology, math and engineering.

Research in environmental chemistry spans a wide range, from fieldwork to laboratory work to computer modeling. Areas of research include global climate change, coral reef ecosystems, biogeochemistry, atmospheric chemistry, regional and global air quality, and transient and persistent organic pollutants. The program avoids a "pollutant of the week" approach that would leave graduates unprepared for future developments. Instead, it emphasizes a framework wherein students can incorporate new knowledge as it becomes available and deal with new problems as they are discovered.

Organic Chemistry of Natural Products (M.P.S., M.S., Ph.D.)

Graduate students in organic chemistry of natural products take a one-year course sequence in mechanistic organic chemistry and another in synthetic organic chemistry. Additionally, one-semester courses are required in physical chemistry and the organic chemistry of natural products.

Courses in biochemistry, inorganic chemistry, statistics and specialized courses in chemistry or biology may be arranged and selected by the student in consultation with faculty.

Research in the field of organic chemistry of natural products takes three paths. These paths are the isolation and characterization of new natural substances; the synthesis of new or improved syntheses of better-known natural substances; and the study of the relation of molecular structure to biological response. Chemical research in each of these areas is coupled with biological testing. Research involving isolation and synthetic chemistry requires the student to develop expertise in separation techniques, such as the several methods of chromatography and spectrometric identification of molecules. Successful investigation in structure/activity relationships requires the student to become familiar with statistical methods of analysis.

Polymer Chemistry (M.P.S., M.S., Ph.D.)

Graduate students in polymer chemistry select their courses from a range of offerings in chemistry, chemical engineering, mathematics, physics, and other appropriate areas. These courses include the one-year sequence in the physical and organic chemistry of polymers and such additional courses as the student and advisor consider necessary.

Special topics in a spectrum of polymer fields are offered or can be arranged in consultation with the faculty.

Chemical Ecology (M.S., M.P.S., Ph.D.)

Chemical ecologists study organismal interactions, both intra- and interspecific, mediated by chemical substances. These interactions occur among microbes, plants, and animals. Study of such interactions typically involves joint efforts of biologists and chemists in basic and applied research in the laboratory and field. The application of chemical ecology has contributed significantly to reduced pesticide use and improved yields in forestry and agriculture while protecting the environment from harmful contaminants.

The study of chemical ecology is offered through collaboration between the Department of Environmental Biology and the Department of Chemistry. Interested students should apply to the department of major interest. Faculty from both areas contribute to the development of a plan of study enabling each student to acquire advanced skills in either biology or chemistry and an ample understanding of the other field to grapple with problems requiring an understanding of both.

DEPARTMENT OF ENVIRONMENTAL BIOLOGY

Stephen Teale, Chair
242 Illick Hall
315-470-6760
315-470-6934 (fax)

The critical importance of natural resources and environmental quality in society demands that aspiring biologists understand natural ecosystems and learn to solve problems effectively. The Department of Environmental Biology (EB) is committed to ensuring these educational outcomes.

The department offers a dynamic array of opportunities in biology via course work enriched by an active program of research. Through a suite of electives in addition to a required core, undergraduate students may customize their studies in a particular field of interest. Graduate students may pursue master's or doctoral degrees within several areas of study.

Undergraduate Programs

EB offers six undergraduate majors. Environmental Biology is the broadest major and the degree program to which most students apply. The other six are specialized and are recommended for students with more focused educational goals. They are Aquatic and Fisheries Science, Biotechnology, eConservation Biology, Forest Health, and Wildlife Science. For the first year or two the requirements of these programs are similar to those of Environmental Biology and internal transfer among them is straightforward.

Field Study and Training

A hallmark of the EB curriculum is its emphasis on field study and training. All majors offered by the Department of Environmental Biology are hands-on programs that emphasize laboratory and field experience in addition to classroom studies. To this end, every student in each major except Biotechnology is required to complete at least six credit-hours of approved field-based instruction in biology. Three of these six credits are associated with a required core course, EFB 202 (Ecological Monitoring and Biodiversity Assessment), which is offered each summer at the Cranberry Lake Biological Station (CLBS) in the Adirondack Mountains. We recommend students enroll in EFB 202 during the summer between freshman and sophomore years, or as early as possible if you are a transfer student.

The remaining three credit hours of Field Experience are elective and can be satisfied in multiple ways. The following lists identify recent course offerings that satisfy the EB field elective requirement. Be aware that some of these courses may not be offered every year.

Courses offered at CLBS during summer session:

- Field Ethnobotany (EFB337)
- Fungal Diversity and Ecology (EFB342)
- Field Herpetology (EFB384)
- Adirondack Fishes (EFB388)
- Wildlife Techniques (EFB496)
- Ecology of Adirondack Aquatic Ecosystems (EFB496)
- Wetland Plants and Communities of the Adirondacks (EFB496)

- Ecology of Adirondack Insects (EFB496)

Courses offered at the Adirondack Ecological Center and Ranger School:

- Mammalian Winter Ecology (EFB484)
- Forest Technology (FTC204/210/211/236)

Courses offered during Maymester at the Syracuse or regional campuses:

- Forest Health Monitoring (EFB439)
- Field Ornithology (EFB496)
- Flora of Central New York (EFB496)
- Interpreting Field Biology (EFB500)

Other courses offered by ESF faculty:

- Forest Health Senior Synthesis (EFB425)
- Ecosystem Restoration Design (EFB434, 4-cr)
- Periodic field trips courses (EFB500) to locations such as Costa Rica, Ireland, Russia, New Zealand, Australia
- Tropical Ecology (EFB 523)
- Limnology Practicum (EFB525 - 2 cr)
- Ecological Engineering in the Tropics (ERE311)

Field courses, approved by petition, from another accredited university, including but not limited to the following affiliated programs:

- Sea Education Association SEA (through Boston University)
  Note: 'Semester at Sea' is different than 'SEA Semester.' EFB WILL NOT ACCEPT any 'Semester at Sea' courses for upper-division biology or field credits.
- The School for Field Studies (through University of Minnesota)

An independent research project (EFB 498) or internship (EFB 420) that has received prior departmental approval via petition, and that meets the following departmental criteria.

- At least 50% of student effort (including contact time with instructor and self-directed study) must be conducted in the field (out-of-classroom, out-of-laboratory, out-of-clinic, out-of-captivity).
- Student must demonstrate learning gains in organismal biology, ecological theory, and/or application of field methodologies to study populations, ecological communities or ecosystem processes.
- Students must complete a research or professional product for evaluation.
- 40 hours of effort will garner 1 academic credit-hour.

BACHELOR OF SCIENCE IN AQUATIC AND FISHERIES SCIENCE

Aquatic and fisheries science is the study of aquatic ecosystems to increase scientific understanding and to apply this knowledge to their management and conservation, thereby sustaining them for multiple uses.

Aquatic ecosystems are complex and found within myriad wetlands, streams, lakes, estuaries, and oceans that support life on earth. Professional aquatic scientists and managers work to conserve and restore biodiversity, habitats, and ecological function while supporting services including fisheries, water resources, transportation, energy, recreation and human connections to nature. Career opportunities for students with a B.S. in aquatic and fisheries science include fisheries science, wetland science, limnology, marine biology and oceanography, and numerous conservation-related fields. Typical employment is with federal and state agencies, universities, research institutions, management authorities, and private consulting firms, as well as local, regional, and international non-governmental organizations.

Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 132	Orientation Seminar:EFB	1
EFB 202	Ecol Monitor&Bio Assessmnt	3
EFB 210	Diversity of Life I	3
EFB 211	Diversity of Life II	3
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1
EFB 311	Principles of Evolution	3
EFB 320	General Ecology	4

EFB 325	Cell Biology	3
EFB 424	Limnology:Study Inland Waters	3
EFB 486	Ichthyology	3
EFB 492	Sr Synthesis/Aquatic&Fish Sci	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 210	Elements Of Organic Chem	4
FOR 207	Introduction To Economics	3
FOR 110	Environmental Physics	3
PHY 102 OR	Major Concepts of Physics II	0 - 8
FCH 223 AND	Organic Chemistry II	3
FCH 224 OR	Organic Chemistry Lab II	1
APM 106	Survey Of Calc & Appl II	4

Electives

Course Name	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		27

Open Electives		16

Directed Electives

To ensure both strength and breadth of knowledge, 27 elective credit hours must be obtained through courses in the following subject areas (S=spring semester, F=fall semester).

1. **Field Experience Elective**
   At least three elective credits must come from an approved field course in biology (this is in addition to the core field course, EFB 202). These credits may be obtained through an elective course at our Cranberry Lake Biological Station, an approved internship (EFB 420) or field trip course (EFB 500). Winter Mammalian Ecology (EFB 484) and Tropical Ecology (EFB 523) meet this requirement, as can approved field courses from other institutions.
2. **Structure and Function**
   At least 3 credit hours must be in the subject area of organism-level physiology, anatomy, or development. The list of allowable courses below may vary slightly from year to year.
   - EFB 385—Comparative Vertebrate Anatomy (4 cr.) S
   - EFB 427—Plant Anatomy and Development (3 cr.) F
   - EFB 462—Animal Physiology: Environmental and Ecological (3 cr.) S
   - EFB 429—Plant Physiology (3 cr.) S
   - BIO 447—Immunology (3 cr.) S
   - BIO 503—Developmental Biology (3 cr.) S
3. **Organismal Diversity**
   To encourage breadth in organism-level biology, students must complete (in addition to the core requirement of EFB 486 or EFB 388) at least 3 credit hours in each of the following two categories:
   a. **Plants and Microbes:**
      - EFB 303—Introductory Environmental Microbiology (4 cr.) F
      - EFB 326—Plant Evolution, Diversification and Conservation (3 cr.) S
      - EFB 327- Adirondack FLora (3 cr.) CLBS
      - EFB 336—Dendrology (3 cr.) F
      - EFB 340—Forest and Shade Tree Pathology (3 cr.) S
      - EFB 350- Microbial Consortium (3 cr.) F even years
      - EFB 435—Flowering Plants: Diversity, Evolution, and Systematics (3 cr.) F
      - EFB 440—Mycology (3 cr.) F
      - EFB 446—Ecology of Mosses (3 cr.) S
      - EFB 496 - Wetland Plants & Communities of Adirondacks (3 cr.) **CLBS**
      - EFB 496 - Flora of Central NY (3 cr.) **Maymester**
   b. **Invertebrate and Vertebrate Animals:**
      - EFB 351—Forest Entomology (3 cr.) F, odd years
      - EFB 352—Entomology (3 cr.) F, even years
      - EFB 355—Invertebrate Zoology (4 cr.) S
      - EFB 388—Ecology of Adirondack Fishes (3 cr.) **CLBS**
      - EFB 453—Parasitology (3 cr.) F
      - EFB 482—Ornithology (4 cr.) S
      - EFB 483—Mammal Diversity (4 cr.) F
      - EFB 485—Herpetology (3 cr.) F
      - EFB 554—Aquatic Entomology (3 cr.) F
      - EFB 566 - Systematic Entomology (3 cr.) S, even years

4. **Physical/Chemical Environment**
   To encourage understanding and familiarity with the aquatic habitat, students must complete at least 3 credit hours from one of the following courses:
   - EST 231—Environmental Geology (3 cr.) S
   - FCH 510—Environmental Chemistry I (3 cr.) S
   - FCH 515—Methods of Environmental Chemical Analysis (3 cr.) F
   - FOR 338—Meteorology (3 cr.) S
   - FOR 340—Watershed Hydrology (3 cr.) S
   - FOR 345—Introduction to Soils (3 cr.) F
   - EAR 101—Dynamic Earth (3 cr.) F
   - EAR 105—Earth Science (3 cr.) S
5. **Environmental Systems Science**
   To further promote understanding of the systems approach to aquatic ecosystems and an integration of environmental and biological factors, students must complete at least 3 credit hours from one of the following courses.
   - EFB 423—Marine Ecology (4 cr.) S, even years
   - EFB 516—Ecosystems (3 cr.) S
   - EFB 518—Systems Ecology (4 cr.) F
   - EFB 523—Tropical Ecology (3 cr.) S
   - EFB 542—Freshwater Wetland Ecosystems (3 cr.) S
   - ERE 275—Ecological Engineering I (3 cr.) S
6. **Management**
   At least 3 credit hours in resource or ecosystem management must be obtained through a course in the following list.
   - EFB 370- Population Biology & Management (3 cr.) S
   - EFB 390- Wildlife Ecology & Management (4 cr.) F
   - EFB 438- Ecology & Management of Waterfowl (3 cr.) F
   - EFB 487—Fisheries Science and Management (3 cr.) F
   - FOR 360—Principles of Management (3 cr.) F
   - FOR 372—Fundamentals of Outdoor Rec. (3 cr.) F,S
   - FOR 442—Watershed Ecology & Management (3 cr.) F
7. **Analytical Tools**
   To increase the breadth of practical skills and knowledge students must complete at least 3 credit hours, obtained through one of the following courses:
   - BTC 401—Molecular Biology Techniques (3 cr.) F
   - EFB 488—Fisheries Science Practicum (1 cr.) F
   - EFB 519—Geographic Modeling (3 cr.) S
   - EFB 525—Limnology Practicum (2 cr.) F
   - ERE 445—Hydrological Modeling (3 cr.) F
   - ESF 300—Introduction to Geospatial Information Technologies (3 cr.) F,S
8. **Communications**
   Students must complete at least 3 credit hours from one of the following communication or interpretation courses.
   - EST 370—Introduction to Personal Environmental Interpretation Methods (3 cr.) F
   - EST 471- Non-personal Environmental Interpretation Methods (3 cr.) S
   - EWP 220—Public Presentation Skills for Environmental Professionals (3 cr.) F,S
   - EWP 407—Writing for Environmental and Science Professionals (3 cr.) F

Total Minimum Credits For Degree: 126

BACHELOR OF SCIENCE IN BIOTECHNOLOGY

What is Biotechnology?

Biotechnology is the application of biological organisms, cells, or molecules to produce a product or service for the betterment of humankind. This area of study includes aspects of molecular biology, microbiology, cell biology, biochemistry, and genetic engineering, among other related disciplines.

The Biotechnology Curriculum

The curriculum builds on introductory courses in the sciences including biology, chemistry, calculus, and physics, creating a strong foundation for more advanced upper-level courses. This degree program prepares students to use molecular and biochemical approaches to tackle environmental, natural resource, agricultural, or medical questions, and provides sufficient breadth for students interested in careers veterinary and human medicine. Students who complete this major will be qualified to enter the growing biotechnology job market or continue their studies in graduate or professional school.

The Biotechnology curriculum requires a minimum of 126 total credits. The core requirements are listed in the typical schedule. There are also 12 credits of directed electives that can be chosen from a list of approved courses. Twenty open elective credits can be selected depending on a student's individual interests. There are also many courses offered at Syracuse University or the SUNY Upstate Medical University that could be used to fill these electives and open electives.

Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 106	Survey Of Calc & Appl II	4
APM 391	Intro/Probability&Stats	3
BTC 132	Orientation Seminar:BTC	1
BTC 401	Molecular Biol Techniques	3
BTC 420 OR	Internship in Biotechnology	1 - 5
BTC 498	Resrch Prob/Biotechnology	1 - 9
BTC 497	Research Dsgn&Prof Develop	1
BTC 499	Senior Project Synthesis	1
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3

EFB 104	General Biology II Laboratory	1
EFB 303	Intro Envrn Microbiology	4
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1
EFB 311	Principles of Evolution	3
EFB 320	General Ecology	4
EFB 325	Cell Biology	3
EWP 190	Writing And The Envrnment	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223	Organic Chemistry II	3
FCH 224	Organic Chemistry Lab II	1
FCH 430	Biochemistry I	3
FCH 432	Biochemistry II	3
PHY 101	Major Concepts of Physics I	0 - 8
PHY 100		

NOTE: BTC 420 (Internship in Biotechnology) is typically done in the summer.

NOTE: 5 credits of BTC 498 or BTC 420 are required.

Electives

Course Name	Code*	Credit
General Education Course in two of the following categories: US History	G	6

& Civic Engagement, The Arts, Social Sciences, World History and Global Awareness, World Languages		
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		12
Open Electives		23

Directed Electives - Biotechnology

A minimum of 12 credits of directed elective courses required. Courses numbered 420, 495, and 498 cannot count as directed electives.

Although any combination of courses below may satisfy the minimum 12 credits required, the following list has been categorized into 4 of the most common subject areas of interest to BTC students, as well as those courses that would be suitable for multiple subject areas of interest. These groupings of elective courses are guidelines. Probably no two students in the biotechnology program have exactly the same career goals or interests. Consult your advisor if your subject interests vary.

Courses that fit multiple areas of interest

- FCH 380 Analytical Chemistry I (2 cr.) F
- FCH 381 Analytical Chemistry II (3 cr.) S
- FCH 510 Environmental Chemistry (3 cr.) S
- FCH 431 Biotechnology lab (3 cr.) F
- FCH 531 Biochemistry lab (3 cr.) F
- FCH 584 Spectro ID/Organic Compounds (3 cr.)
- MCR 480 Fundamentals of Microscopy (3 cr.) F
- MCR 484 Scanning Electron Microscopy (3 cr.) F
- MCR 485 Transmission Electron Microscopy (3 cr.) S
- BIO 422 Bioinformatics for Life Scientists (3 cr.) – SU course
- BIO 440 Applied Genomics (3 cr.) – SU course
- BIO 442 Seminar in Model Organism Genetics (3 cr.) – SU course
- BIO 443 Seminar in Epigenetics (3 cr.) – SU course
- BIO 450 Seminar in Evolutionary Genetics (3 cr.) – SU course
- BIO 463 Molecular Genetics (4 cr.) – SU course
- BIO 463 Molecular Biotechnology (4 cr.) – SU course
- BIO 464 Applied Biotechnology (4 cr.) – SU course
- BCM 477 Proteins and Nucleic Acids Lab (3 cr.) – SU course
- BCM 484 Biomolecular Modeling (3 cr.) – SU course
- BEN 541 Principles of Tissue Engineering (3 cr.) – SU course

Pre-health (Pre-Veterinary, Pre-Medical, etc.)

- EFB 360 Epidemiology (3 cr.) F

- EFB 385 Comparative Vertebrate Anatomy (4 cr.) S
- EFB 400 Toxic Health Hazards (3 cr.) F
- EFB 453 Parasitology (3 cr.) F
- EFB 462 Animal Physiology: Environmental & Ecological (4 cr.) F
- EFB 463 Ecotoxicology (3 cr.) S
- EHS 320 Disease Prevention (3 cr.) S
- FCH 390 Drugs from the Wild (3 cr.) F
- BIO 211 Introduction to Neuroscience (3 cr.) S – SU course
- BIO 216 Anatomy and Physiology I (4 cr.) F – SU course
- BIO 217 Anatomy and Physiology II (4 cr.) S – SU course
- BIO 316 Anatomy & Physiology I for Biology Majors (4 cr.) – SU course
- BIO 317 Anatomy & Physiology II for Biology Majors (4 cr.) – SU course
- BIO 355 General Physiology (3 cr.) S – SU course
- BIO 396 Stem Cells and Society (3 cr.) – SU course
- BIO 441 Seminar in Infectious Diseases (3 cr.) S – SU course
- BIO 446 Epigenetics of Human Health and Diseases (3 cr.) – SU course
- BIO 447 Basic Immunology (3 cr.) – SU course
- BIO 448 Evolutionary Medicine (3 cr.) – SU course
- BIO 468 Microbiomes Biotech & Medicine (3 cr.) – SU course
- BIO 473 Pharmaceuticals & Cells (3 cr.) – SU course
- BIO 501 Biology of Cancer (3 cr.) – SU course
- BIO 503 Developmental Biology (3 cr.) – SU course

Plant Biotechnology

- BTC 425 Plant Biotechnology (3 cr.) S
- BTC 426 Intro. Plant Tissue Culture (3 cr.) F
- EFB 427 Plant Anatomy and Development (3 cr.) F
- EFB 530 Plant Physiology (3 cr.) S
- EFB 531 Plant Physiology Lab (2 cr.) S
- FCH 630 Plant Biochemistry (3 cr.) S

Microbial Biotechnology

- EFB 340 Forest & Shade tree Pathology (3 cr.) S
- EFB 440 Mycology (3 cr.) F
- EFB 505 Microbial Ecology (2 cr.) S

Bioprocess Engineering

- PSE 200 Introduction to Papermaking (3 cr.)*
- PSE 202 Pulp and Paper Laboratory Skills (1 cr.)*
- PSE 223 Introduction to Lignocellulosics (4 cr.)*
- PSE 361 Engineering Thermodynamics (3 cr.)*
- PSE 370/570 Principles of Mass and Energy Balance (3 cr.)**
- PSE 371 Fluid Mechanics (3 cr.)*
- BPE 300 Introduction to Industrial Bioprocessing (3 cr.)*
- PSE 350/550 Fiber Processing (3 cr.)**
- PSE 450/650 Pulping and Bleaching Processes (3 cr.)**
- PSE 465/665 Fiber and Paper Properties (3 cr.)**
- PSE 438/638 Biorenewable Fibrous and Nonfibrous products (3 cr.)**
- BPE 310 Colloid and Interface Science (3 cr.)*
- BPE 420/620 Bioseparations (3 cr.)**
- BPE 438/638 Introduction to Biorefinery Processes (3 cr.)**
- BPE 510 Introduction to Polymer Coatings (3 cr.)

- BPE 536 Radiation Curing of Polymer Technologies (3 cr.)
- BPE 658 Advanced Biocatalysis (3 cr.)
- BEN 364/664 Quantitative Physiology (4 cr.) – SU course**
- BEN 421/621 Biochemical Engineering (3 cr.) – SU course**
- BEN 433/633 Drug Delivery (3 cr.) – SU course**
- BEN 462/662 Biofuels, Bioproducts, and Biorefining (3 cr.) – SU course**
- BEN 468/668 Biomaterials & Medical Devices (3 cr.) – SU course**
- BEN 473/673 Biomanufacturing (3 cr.) – SU course**
- BEN 481 Bioinstrumentation (3 cr.) – SU course
- BEN 561 Polymer Science & Engineering (3 cr.) – SU course

*Useful background and prerequisite courses if you are planning on entering the MPS program in Paper and Bioprocess Engineering.

**The graduate level course may be applicable to the MPS program in Paper and Bioprocess Engineering.

Total Minimum Credits For Degree: 126

BACHELOR OF SCIENCE IN CONSERVATION BIOLOGY

Conservation biology is the application of science to conserve the earth's imperiled species and ecosystems.

The field is growing rapidly and ever increasing in importance in response to the biodiversity crisis, perhaps the most critical environmental issue of our time. Conservation biologists view all of nature's diversity as important and having inherent value. This diversity spans the biological hierarchy and includes variation at the level of genes, populations, communities, ecosystems, and biomes.

Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 132	Orientation Seminar:EFB	1
EFB 202	Ecol Monitor&Bio Assessmnt	3
EFB 210	Diversity of Life I	3
EFB 211	Diversity of Life II	3
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1
EFB 311	Principles of Evolution	3
EFB 320	General Ecology	4
EFB 370	Population Ecology & Managemnt	3
EFB 414	Senior Synth/Cons Biol	3
EFB 420 OR	Prof Internship/Envrn Biology	1 - 5

EFB 498	Independent Research/Envrn Bio	1 - 5
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FOR 110	Environmental Physics	3

Electives

Course Name	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		30
Open Electives		22

Directed Electives

To ensure that Conservation Biology undergraduates obtain both strength and breadth of knowledge, 30 elective credit hours must be distributed in a way that satisfies seven requirements (A-F, below).

1. **Field Experience Elective**
   At least three elective credits from an approved field course in biology (in addition to the core field course, EFB 202). These credits are typically obtained through an elective course at our Cranberry Lake Biological Station, an approved internship (EFB 420) or field trip course (EFB 500). Approved field courses from other institutions can also fulfill this requirement. No single class may be used to fulfill directed elective requirements of A and B.
2. **Biodiversity Specialization (at least three courses from the following list)**

The availability of courses that satisfy this requirement varies. The suggestions below are pre-approved courses that are typically taken - consult with your advisor or the curriculum coordinator about other possibilities. Many other courses can potentially substitute (by petition) for those listed. No single class may be used to fulfill directed elective requirements of A and B.

- EFB 303 Introductory Environmental Microbiology (4 cr.) F
- EFB 326 Plant Evolution, Diversification and Conservation (3 cr.) S
- EFB 327 Adirondack Flora (3 cr.) CLBS
- EFB 336 Dendrology (3 cr.) F
- EFB 340 Forest and Shade Tree Pathology (3 cr.) S
- EFB 342 Fungal Diversity and Ecology (3 cr.) **CLBS**
- EFB 350 Microbial Consortia (3 cr.) S
- EFB 351 Forest Entomology (3 cr.) **F, even years**
- EFB 352 Entomology (3 cr.) **F, odd years**
- EFB 355 Invertebrate Zoology (4 cr.) S
- EFB 388 Ecology of Adirondack Fisheries (3 cr.) **CLBS**
- EFB 435 Flowering Plants: Diversity, Evolution, and Systematics (3 cr.) F
- EFB 440 Mycology (3 cr.) F
- EFB 446 Ecology of Mosses (3 cr.) S
- EFB 453 Parasitology (3 cr.) F
- EFB 479 Field Ornithology (3 cr.) **CLBS**
- EFB 482 Ornithology (4 cr.) S
- EFB 483 Mammal Diversity (4 cr.) F
- EFB 485 Herpetology (3 cr.) F
- EFB 486 Ichthyology (3 cr.) S
- EFB 496 Wetland Plants & Communities of Adirondacks (3 cr.) **CLBS**
- EFB 496 Flora of Central NY (3 cr.) **Maymester**
- EFB 554 Aquatic Entomology (3 cr.) F
- EFB 566 Systematic Entomology (3 cr.) S, even years

3. **Applied Conservation Biology (at least 6 credits)**
    - EFB 305 Indigenous Issues in the Environment (3 cr.) S
    - EFB 390 Wildlife Ecology and Management (4 cr.) F
    - EFB 423 Marine Ecology (4 cr.) S, even years
    - EFB 424 Limnology (3 cr.) F
    - EFB 438 Ecology and Management of Waterfowl (3 cr.) F
    - EFB 444 Biodiversity and Geography of Nature (3 cr.) F
    - EFB 449 Wetlands Habitat Management for Wildlife (3 cr.) S
    - EFB 463 Ecotoxicolgy (3 cr.) S
    - EFB 480 Animal Behavior (3 cr) F
    - EFB 487 Fisheries Science & Management (3 cr.) F
    - EFB 493 Management of Wildlife Habitats & Populations (3 cr.) F
    - EFB 502 Ecology and Management of Invasive Species (3 cr.) S
    - EFB 504 Plant- Herbivore Interactions (3 cr.) F, odd years
    - EFB 542 Freshwater Wetland Ecosystems (3 cr.) S
    - FOR 332 Forest Ecology (3 cr.) F
    - FOR 442 Watershed Ecology and Management (3 cr.) F

4. **Human Dimensions (at least 3 credits)**
    - EST 312 Sociology of Natural Resources (3 cr.) S
    - EST 353 Behavior Change and the Environment (3 cr.) F
    - EST 366 Attitudes, Values, & Env. (3 cr.) S
    - EST 390 Social Processes and Environment (3 cr.) S
    - EST 460 Land Use Law (3 cr.) S
    - EST 472 Nat Hist Museums and Modern Sci (3 cr.) **Maymester**
    - EWP 390 Intro to Literature of Nature (3 cr.) F
    - FOR 360 Principles of Management (3 cr.) F
    - FOR 465 Natural Resources and Environ. Policy (3 cr.) F
    - FOR 487 Environmental Law and Policy (3cr.) F
    - FOR 489 Natural Resources Law and Policy (3cr.) S
5. **Communications and Interpretation (at least 3 credits)**
    - EST 370 Introduction to Personal Environmental Interpretation Methods (3 cr.) F
    - EST 471 Non-Personal Environmental Interpretation Methods (3 cr.) S
    - EST 472 Advanced Interpretation and Environmental Education (3 cr.) S
    - EWP 220 Public Presentation Skills (3 cr.) F,S
    - EWP 407 Writing for Environmental and Science Professionals (3 cr.) F,S
6. **Technical Skills (at least 3 credits)**
    - BTC 401 Molecular Biol. Techniques (3 cr.) F
    - BTC 425 Plant Biotechnology (3 cr.) S
    - BTC 426 Plant Tissue Culture Methods (3 cr.) F
    - EFB 518 System Ecology (4 cr.) F
    - ERE 365 Principles of Remote Sensing (4 cr.) S
    - ERE 445 Hydrological Modeling (3 cr.) F
    - ESF 300 Introduction to Geospatial Information Technologies (3 cr.) F,S
    - MCR 484 Scanning Electron Microscopy (3 cr.) F
    - MCR 485 Transmission Electron Microscopy (3 cr.) S
    - MCR 585 Light Microscopy for Research Applications (3 cr.) S

Total Minimum Credits For Degree: 126

BACHELOR OF SCIENCE IN ENVIRONMENTAL BIOLOGY

The curriculum for the bachelor of science degree in environmental biology is built around a core of required courses that provides a general education, a background in the principles of biological and physical science, and an orientation to natural resources and other environmental concerns.

From this common foundation, the large number of elective credits allows each student to develop a unique plan of study, with the help of an assigned advisor who is expert in the student's general area of interest. In keeping with the hands-on, field orientation of our curriculum, students also must complete six credit hours of field experience.

Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 132	Orientation Seminar:EFB	1
EFB 202	Ecol Monitor&Bio Assessmnt	3
EFB 210	Diversity of Life I	3
EFB 211	Diversity of Life II	3
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1
EFB 311	Principles of Evolution	3
EFB 320	General Ecology	4
EFB 325	Cell Biology	3
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3

FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 210	Elements Of Organic Chem	4
FOR 110	Environmental Physics	3
PHY 102 OR	Major Concepts of Physics II	0 - 8
FCH 223 AND	Organic Chemistry II	3
FCH 224 OR	Organic Chemistry Lab II	1
APM 106	Survey Of Calc & Appl II	4

Electives

Course	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		25
Open Electives		28

Directed Electives: UPPER DIVISION BIOLOGY-Environmental Biology

To ensure that ENB undergraduates obtain both strength and breadth of knowledge, **25 elective credit** hours in biology must be obtained through courses designed for juniors or seniors (i.e., courses numbered 300 or higher). Among them must be courses that satisfy requirements A-C (below).

1. **Field Experience Elective**
   At least 3 elective credits must come from an approved field biology course (in addition to the core field course, EFB 202). These credits may be obtained through an elective course

at Cranberry Lake Biological Station; an approved field course from another accredited institution; an approved internship (EFB 420) or independent research project (EFB498); or a field trip course (EFB 500). Some courses at CLBS meet both requirement A and a diversity requirement.

2. **Structure and Function**
   At least 3 credit hours must be in the subject area of organism-level physiology, anatomy, or development. The list of allowable courses below may vary slightly from year to year.
   - EFB 385 Comparative Vertebrate Anatomy (4 cr.) S
   - EFB 427 Plant Anatomy and Development (3 cr.) F
   - EFB 429 Plant Physiology (3 cr.) S
   - EFB 462 Animal Physiology: Environmental and Ecological (4 cr.) F
   - BIO 316 Anatomy & Physiology for Biology Majors (4 cr.) F,S (Not BIO 216)
   - BIO 355 General Physiology (3 cr.) F
   - BIO 447 Immunology (3 cr.) F
   - BIO 503 Developmental Biology (3 cr.) S
3. **Organismal Diversity**
   To encourage breadth in organism-level biology, students must complete at least one course from two of the four groups. (A course from each of the groups is strongly recommended).
   a. **Diversity of Microorganisms**
      - EFB 303 Introductory Environmental Microbiology (4 cr.) F
      - EFB 340 Forest and Shade Tree Pathology (3 cr.) S
      - EFB 342 Fungal Diversity and Ecology (3cr.) CLBS
      - EFB 350 Microbial Consortia (3 cr.) S
      - EFB 440 Mycology (3 cr.) F
   b. **Diversity of Plants**
      - EFB 326 Plant Evolution, Diversification and Conservation (3 cr.) S
      - EFB 327 Adirondack Flora (3 cr.) CLBS
      - EFB 336 Dendrology (3 cr.) F
      - EFB 435 Flowering Plants: Diversity, Evolution, and Systematics (3 cr.) F
      - EFB 446 Ecology of Mosses (3 cr.) S
      - EFB 496 Flora of Central NY (3 cr.) **Maymester**
      - EFB 496 Wetland Plants & Communities of Adirondacks (3 cr.) **CLBS**
   c. **Diversity of Invertebrate Animals**
      - EFB 351 Forest Entomology (3 cr.) F, odd years
      - EFB 352 Entomology (3 cr.) F, even years
      - EFB 355 Invertebrate Zoology (4 cr.) S
      - EFB 453 Parasitology (3 cr.) F
      - EFB 554 Aquatic Entomology (3 cr.) F
      - EFB 566 Systematic Entomology (3 cr.) S, even years
   d. **Diversity of Vertebrate Animals**
      - EFB 388 Ecology of Adirondack Fishes (3 cr.) CLBS
      - EFB 479 Field Ornithology (3 cr.) CLBS
      - EFB 482 Ornithology (4 cr.) S
      - EFB 483 Mammal Diversity (4 cr.) F
      - EFB 485 Herpetology (3 cr.) S
      - EFB 486 Ichthyology (3 cr.) F

Note that some courses at CLBS meet both requirement A and a diversity requirement.

Total Minimum Credits For Degree: 126

BACHELOR OF SCIENCE IN FOREST HEALTH

Forest Health is a multidisciplinary and collaborative field of study that involves the understanding, monitoring, and protection of the world's forest resources. Forests support biodiversity, provide immense ecosystem services including water purification and carbon sequestration, and provide essential raw materials. Forest health experts support healthy forests by managing threats caused by invasive species, poor management, climate change, fire, and other anthropogenic factors.

A foundation in forest health requires coursework in ecology, dendrology, forest management, silviculture, mycology, plant pathology, and entomology. This major was developed to address the demand for broadly trained graduates to work in wide range of professional capacities in government agencies, the private sector, and academia.

Required Courses

APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 132	Orientation Seminar:EFB	1
EFB 202	Ecol Monitor&Bio Assessmnt	3
EFB 210	Diversity of Life I	3
EFB 211	Diversity of Life II	3
EFB 245 OR	Forest Health Colloquium	1
EFB 344	Forest Health Seminar	1
EFB 303	Intro Envrn Microbiology	4
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1
EFB 311	Principles of Evolution	3

EFB 320	General Ecology	4
EFB 336	Dendrology I	3
EFB 340	Forest/Shade Tree Path	3
EFB 351 OR EFB 352	Forest Entomology Entomology	3 3
EFB 420 OR EFB 498	Prof Internship/Envrn Biology Independent Research/Envrn Bio	1 - 5 1 - 5
EFB 425	Forest Health Senior Synthesis	3
EFB 439	Forest Health Monitoring	3
EFB 494	Forest Health Capstone	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 210	Elements Of Organic Chem	4
FOR 344		
FOR 345	Introduction to Soils	3
FOR 110	Environmental Physics	3

NOTE: 3 credits of EFB 498 or EFB 420 are required.

Electives

Course	Codes*	Credits
General Education Course in one of the following categories: US History	G	3

& Civic Engagement, The Arts, World History and Global Awareness, World Languages		
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		15
Open Electives		19

Directed Electives

To ensure that Forest Health majors obtain both strength and breadth of knowledge, 15 elective credit hours must be selected from the following list, including at least one course from five of the seven categories.

1. **Forest Protection and Conservation Biology**
    - EFB 390 Wildlife Ecology & Management (4 cr.) F
    - EFB 413 Intro Conservation Biology (3 cr.) S
    - EFB 502 Ecology and Management of Invasive Species (3 cr.) F
2. **Forestry/Wood Products**
    - FOR 322 Natural Resources Measurements and Sampling (3 cr.) F
    - FOR 360 Principles of Management (3 cr.) F,S
    - FOR 465 Natural Resources and Policy (3 cr.) S
    - FOR 480 Urban Forestry (3 cr.)
    - RMS 376 Decay of Wood Products (3 cr.) S
3. **Technology**
    - BTC 401 Molecular Biology Techniques (3 cr.) F
    - BTC 425 Plant Biotechnology (3 cr.) S
    - BTC 426 Plant Tissue Culture Methods (3 cr.) F
    - ESF 300 Introduction to Geospatial Information Technologies (3 cr.) F,S
4. **Ecology and Environmental Science**
    - EST 370 Introduction to Personal Environmental Interpretation Methods (3 cr.) F
    - EFB 445 Plant Ecology and Global Change (3 cr.) S
    - EFB 505 Microbial Ecology (3 cr.) S
    - EFB 516 Ecosystems (3 cr.) S
    - EFB 518 Systems Ecology (3 cr.) F
    - FOR 338 Meteorology (3 cr.) F

5. **Biodiversity**
    - EFB 326 Plant Evolution, Diversification and Conservation (3 cr.) S
    - EFB 342 Fungal Ecology and Diversity (3 cr.) CLBS
    - EFB 351 Forest Entomology (3 cr.) F, even years
    - EFB 352 Entomology (3 cr.) F, odd years
    - EFB 355 Invertebrate Zoology (4 cr.) S
    - EFB 428 Mycorrhizal Ecology (3 cr) F even years
    - EFB 435 Flowering Plants: Diversity, Evolution, and Systematics (3 cr.) F
    - EFB 440 Mycology (A) (3 cr.) F
    - EFB 453 Parasitology (3 cr.) F
    - EFB 482 Ornithology (4 cr.) S
    - EFB 493 Mammal Diversity (4 cr.) F
    - EFB 485 Herptology (3 cr.) F
    - EFB 486 Ichthyology (3 cr.) S
    - EFB 566 Systematic Entomology (3 cr.) S, even years
6. **Mathematics and Physical Science**
    - APM 105 Survey of Calculus and Application I (4 cr.) F,S
    - APM 106 Calculus and its Applications II (A) (4 cr.) F,S
    - APM 510 Statistical Analysis (3 cr.) F
    - FOR 323 Forest Biometrics (3 cr.) S
    - PHY 102 General Physics II (A) (4 cr.) S
7. **Anatomy and Physiology**
    - EFB 325 Cell Biology (3 cr.) S
    - EFB 427 Plant Anatomy and Development (3 cr.) F
    - EFB 462 Animal Physiology: Environmental & Ecological (4 cr.) F
    - EFB 530 Plant Physiology (3 cr.) S
    - EFB 531 Plant Physiology Lab (2 cr.) S
    - EFB 570 Insect Physiology (3 cr.) S

Total Minimum Credits For Degree: 126

BACHELOR OF SCIENCE IN WILDLIFE SCIENCE

Wildlife science is the application of ecological knowledge in a manner that strikes a balance between the needs of wildlife populations and the needs of people. Coursework and faculty expertise span the animal kingdom and the planet, with a programmatic emphasis on North American species, policies, and practices. The focus is applied ecology, and students gain the skills, knowledge, and abilities required to meet contemporary and future challenges facing wildlife such as restoring habitat, securing populations of rare and vulnerable species, mitigating human-wildlife conflicts, controlling invasive species and disease, managing sustainable harvests, and ensuring species persistence under climate change. The curriculum prepares students for working in state or federal wildlife agencies, non-governmental conservation organizations, or consulting firms and also prepares students for continuing on to a graduate degree program, which may greatly expand employment opportunities and is often necessary for careertrack positions.

Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 132	Orientation Seminar:EFB	1
EFB 202	Ecol Monitor&Bio Assessmnt	3
EFB 210	Diversity of Life I	3
EFB 211	Diversity of Life II	3
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1
EFB 311	Principles of Evolution	3
EFB 320	General Ecology	4
EFB 390	Wildlife Ecology&Mgt	4

EFB 491	Applied Wildlife Science	3
EFB 493	Wildlife Habitats & Populatns	4
ESF 300	Intro/Geospatial Info Tech	3
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FOR 110 OR	Environmental Physics	3
FCH 210 OR	Elements Of Organic Chem	4
FOR 345	Introduction to Soils	3
FOR 465 OR	Natural Resources Policy	3
FOR 489	Natural Resources Law & Policy	3
EFB 482 OR	Ornithology	4
EFB 483	Mammal Diversity	4

Electives

Course	Codes*	Credits
General Education Course in two of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	6
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		18
Open Electives		22

Directed Electives

To ensure that Wildlife Science undergraduates obtain both strength and breadth of knowledge, and position themselves for professional certification by The Wildlife Society, 18 elective credits must be obtained in the following subject areas (A-D), through specific courses that are designed for juniors or seniors (i.e. courses numbered 300 or higher)

1. **Field experience (3 credits):**
   This requirement can be satisfied during any year, and is normally done via coursework at Cranberry Lake Biological Station. ESF field courses offered during semester break, field courses offered by other institutions or organizations (e.g, School for Field Studies), independent research projects, or job-related internships during the summer session.
2. **Vertebrate Structure and Function (3 credits):**
   Choose at least one course from the following:
   - EFB 385 Comparative Vertebrate Anatomy (4 cr.) S
   - EFB 462 Animal Physiology: Environmental and Ecological (4 cr.) F
   - EFB 480 Principles of Animal Behavior (4 cr.) F
3. **Botany and Plant Science (6 credits)**
   Choose at least two courses from the following:
   - EFB 326 Plant Evolution, Diversification and Conservation (3 cr.) S
   - EFB 336 Dendrology (3 cr.) F
   - EFB 337 Field Ethnobotany (3 cr) **CLBS**
   - EFB 340 Forest Shade and Tree Pathology (3 cr.) F
   - EFB 427 Plant Anatomy and Development (3 cr.) F
   - EFB 429 Plant Physiology (3 cr.) S
   - EFB 435 Flowering Plants: Diversity, Evolution and Systematics (3 cr.) F
   - EFB 440 Mycology (3 cr.) F
   - EFB 445 Plant Ecology and Global Change (3 cr.) S
   - EFB 446 Ecology of Mosses (3 cr.) S
   - EFB 496 Wetland Plants & Communities of Adirondacks (3 cr.) **CLBS**
   - EFB 496 Flora of Central NY (3 cr.) **Maymester**
4. **Wildlife Specialization (6 credits):** choose at least two courses from one or more categories as listed below:

1. a. Population and habitat management:
    EFB 370 Population Ecology and Management (3 cr.) S
    EFB 438 Ecology and Management of Waterfowl (3 cr.)
    EFB 449 Wetlands Conservation and Management (3 cr.) S, even years
    EFB 487 Fisheries Science and Management (3 cr.) F
    EFB 502 Ecology and Management of Invasive Species (3 cr.) S
    EFB 518 Systems Ecology: Ecological Modelling and Design
    FOR 232 Natural Resources Ecology (3 cr.) S
    FOR 442 Watershed Ecology and Management (3 cr.) F
    FOR 496 Forest Management and Wildlife (3 cr.) S

   b. Wildlife Health:
    EFB 360 Epidemiology (3 cr.) F
    EFB 400 Toxic Health Hazards (3 cr.) F
    EFB 453 Parasitology (3 cr.) F
    EFB 462 Animal Physiology: Environmental and Ecological (4 cr.) S

   c. Biodiversity
    EFB 352 Entomology (3 cr.) F
    EFB 355 Invertebrate Zoology (4 cr.) S
    EFB 413 Introduction to Conservation Biology (3 cr.) F
    EFB 486 Ichthyology (3 cr.) S
    EFB 485 Herpetology (3 cr.) F

   d. Human dimensions of conservation
    EFB 305 Indigenous Issues and the Environment (3 cr.) S
    EST 353 Behavior Change and the Environment (3 cr.) F
    EST 390 Social Processes and the Environment (3 cr.) S
    EST 366 Attitudes, Values and the Environment (3 cr.) S, even years
    EST 460 Land Use Law (3 cr.) S
    EST 312 Sociology of Natural Resources (3 cr.) S
    EST 493 Environmental Communication Workshop (3 cr.) S

Total Minimum Credits For Degree: 126

GRADUATE PROGRAMS IN THE DEPARTMENT OF ENVIRONMENTAL AND FOREST BIOLOGY

Environmental Biology department offers MS, MPS and PhD in Environmental and Forest Biology with areas of research designed to provide a strong background and focus to students pursuing different research topics. Faculty with nationally and internationally recognized expertise define the scope of subject matter within each study area, recommend acceptance of students, and guide them through a course of study appropriate to student goals and aspirations. Most students develop a degree of depth and specialization in at least one areas of graduate study (see below).

M.S.

The master of science degree in Environmental and Forest Biology entails a research-based thesis (6-12 credits of thesis research) in addition to 18-24 credits of graduate coursework (including special research topics and at least three seminars) for a total of at least 30 graduate credits. Students earning a M.S. degree find a much wider range of job options that have greater responsibilities and compensation compared to jobs that require only a B.S. degree. Many jobs at the M.S. level require an ability to perform research. Students interested in research positions in government, non-profit organizations, and academic and industry settings should pursue a M.S., rather than M.P.S. degree. Additionally, although not required by many graduate schools, a M.S. degree is often a key step toward earning a Ph.D. The M.S. student presents a thesis proposal to the major professor and committee who will guide completion of the research and writing of the thesis. A capstone seminar and defense of thesis are required.

M.P.S.

The master of professional studies degree in Environmental and Forest Biology requires graduate coursework credits graduate seminars and professional experience (internship). The M.P.S. degree is designed to accommodate a great breadth of student goals and needs, including students desiring additional education following some experience in their field, and science teachers seeking the master's degree for permanent certification. As in all degree programs in EFB, the student will be guided through the M.P.S. by a steering committee.

Ph.D.

The doctor of philosophy degree in Environmental and Forest Biology may be pursued directly from the bachelor’s level, or following a master's degree program. Doctoral study culminates in a dissertation (or its equivalent as refereed publications) based on original research. In many cases this work serves as a foundation for future studies and publications throughout the student's career. Research activity is often funded through extramural grants to the student’s major professor. Abundant opportunities exist to gain teaching experience during the doctoral program. A written and oral examination is required to proceed to doctoral candidacy, at least one year prior to the capstone seminar and defense of the dissertation. Of the 60 credits required, 30-48 are awarded for coursework (including special research topics and at least five seminars) and 12-30 credits for the dissertation.

Graduate Research Areas

Applied Aquatic & Fisheries Science

Study in this area provides advanced preparation in biological concepts of fisheries and aquatic sciences as they relate to ecology and resource management. M.P.S. students will undertake a professional experience in management or policy, or a synthesis course in aquatic ecology and management planning. M.S. and Ph.D. students will address important research questions with advanced methods in aquatic sciences. Research themes are diverse, examples include parasitology, zebrafish colony management, fish physiology, behavior, otolith microchemistry, population ecology and habitat relationships, restoration, hypoxia and environmental change, trophic dynamics and food webs, species conservation, species at risk, biodiversity, fisheries management, stream ecology, larval fishes, early life history, wetlands, invasive species ecology, limnology, marine ecology, contaminants, environmental change.

Chemical Ecology

Chemical ecologists study organismal interactions, both intra- and interspecific, mediated by chemical substances. These interactions occur among microbes, plants, and animals. Study of such interactions typically involves joint efforts of biologists and chemists in basic and applied research in the laboratory and field. The application of chemical ecology has contributed significantly to reduced pesticide use and improved yields in forestry and agriculture while protecting the environment from harmful contaminants.

The study of chemical ecology is offered through collaboration between the Department of Environmental Biology and the Department of Chemistry. Interested students should apply to the department of major interest. Faculty from both areas contribute to the development of a plan of study enabling each student to acquire advanced skills in either biology or chemistry and an ample understanding of the other field to grapple with problems requiring an understanding of both.

Conservation Biology

This area entails study and maintenance of biological diversity at the level of genes, populations, communities, ecosystems and biomes; intellectual underpinnings include evolutionary theory, systematic biology, population biology and ecosystem science. Conservation biology seeks ways to integrate biological principles with social, economic and political perspectives to achieve conservation goals.

Ecology and Evolution

This integrative study area allows students to investigate the relationships of organisms to their environment and those factors that affect their distribution and abundance. Both the practical and theoretical applications of ecology are emphasized through courses and research.

There are four major areas in ecology: organismal ecology, population-evolutionary ecology, community ecology and systems ecology. In consultation with the student's steering committee, courses are chosen from these areas, as well as other disciplines. Specific research may encompass any of the four major areas of ecology and entail the study of the distribution and abundance of organisms, community structure including trophic relationships, diversity, succession and ecosystem properties, such as patterns of energy transfer and biogeochemical cycling.

Entomology

Graduate study opportunities prepare students in the basic aspects of insect life and the role of insects in relation to humans and their environment.

The wide range of effects stemming from insect activity, from the beneficial to the deleterious, allows for a variety of research subjects in which insects play a major role. Thesis topics may concern insects that affect forests, shade trees and wood products, those relating to the health and well-being of humans, those playing key roles as parasites and predators of pest species, and those serving as food for many birds and vertebrate animals. Current research areas include population dynamics of forest defoliators, pheromone communications in beetles and moths, evolution of chemical communication, effects of forest practices on stream benthic insects, natural control of insects in forest systems and biochemistry of insect detoxification mechanisms.

Environmental Biotechnology

Environmental Biotechnology is defined as a branch of biotechnology that addresses environmental problems, such as the genetic rescue of a species, the removal of pollution, renewable energy generation or biomass production, all by using biological processes for the protection and restoration of the quality of the environment.

The tools of biotechnology are having ever increasing applications to conserving our natural environments. Examples include the restoration of species and ecosystems, phyto- and microbial-remediation of polluted soils and water, making cleaner, more efficient and recyclable products, and increasing our understanding of how the environment works at molecular and cellular levels. The study of environmental biotechnology provides opportunity in a broad range of specialties fundamental to the understanding of plants, animals, and microbes and their interaction with other organisms and environments.

Indigenous People & the Environment

Indigenous people are the stewards of fully 4% of the land area of the United States and represent some 700 distinct communities possessing detailed knowledge of the biota of their homelands. Native American land holdings in North America collectively contain more wildlands than all of the National Parks and Nature Conservancy areas in North America. Globally, Indigenous people inhabit areas with some of the highest remaining biodiversity on the planet and are actively being engaged as partners in biodiversity conservation. Issues of sustainable development, resource management and ecological restoration all include Native American stakeholders. Federal agencies are required to consult with tribes on a government-to-government basis on a host of scientific and natural resource policies. Thus, our ESF graduates have a high probability of encountering issues involving Indigenous cultures and TEK.

However, the majority of scientific professionals and educators have little understanding of the value of TEK or its cultural context. Exposure to TEK has a legitimate role in the education of the next generation of biologists, environmental scientists, and natural resource managers. TEK has value not only for the wealth of biological information it contains, but for the cultural framework of respect, reciprocity and responsibility in which it is embedded (Kimmerer 1998, Pierotti and Wildcat 2000). The Center for Native People and the Environment has developed a series of integrated educational offerings that will enrich our curriculum with coursework and allied programs that increase student's awareness of TEK and Native American perspectives on the environment.

Microbiology

Graduate study opportunities exploring the role and diversity of microbes in clinical, industrial, and environmental realms.

Our understanding of microbes' central role in host health & physiology, biogeochemical processes, and global change continues to expand. ESF's Microbiology program provides a basic education in the core disciplines of microbiology, but relies heavily on student-driven cutting-edge research. Depending on the major professor, training will include basic microbiological, molecular, and computational techniques to answer current questions in microbiology. Current research areas include, but are not limited to, pathogenic microbiology, microbial ecology, virology, bacteriology, microbial diversity and physiology, host-microbe interactions, and vector-borne diseases. Graduate degrees in microbiology better prepare students for a wide range of clinical, industrial, or environmental microbiology occupations.

Molecular Biology and Ecology

Graduate students in this integrative program develop and apply molecular biological methods to address questions in Ecology.

Students in this graduate area conduct interdisciplinary research using molecular tools to address important ecological and evolutionary questions. Students work with their faculty advisor to develop research projects, often combining both laboratory and field work. Areas of research at ESF cut across several disciplines, and include phylogenetics, biogeography, phylogeography, population genetics, genomics, conservation genetics, animal and plant diseases, immunology, and biodiversity. Coursework requirements developed with the major professor and steering committee, and are tailored to individual student project and career goals.

Mycology and Forest Pathology

The study of Mycology and Forest Pathology provides opportunity in a broad range of specialties fundamental to the understanding of fungi and their interaction with other organisms, and for specializations in forest pathology.

Graduate students in this program are provided with advanced preparation in the biology of fungi and in the concepts and practicalities of forest pathology. Current research interests include; taxonomy and systematics of fungi; mycorrhizal ecology; biology of parasites and symbionts; growth, developmental biology, and ultrastructure of fungi; disease resistance in trees; genetic engineering; plant-pathogen interactions; fungal phylogenetics; molecular ecology; biodiversity and conservation of fungi.

Students in this graduate area use a range of tools to address important questions pertaining to the above. Students work with their faculty advisor to develop research projects, often combining both laboratory and field work. Coursework requirements are developed with the major professor and steering committee and are tailored to individual student project and career goals.

Plant Science

Plants, as the base for ecological food chains, serve as the structural and functional foundation of natural and managed systems. The study of plant science and biotechnology provides opportunity in a broad range of specialties fundamental to the understanding of plants and their interaction with other organisms and for specializing in plant biotechnology.

Emphasis is on forests and related plant systems. Current research interests include dynamics of plant communities as affected by humans and the environment; mechanisms of plant succession; epidemiology of forest and urban tree diseases; taxonomy, physiology, growth and ultrastructure of fungi; heritability of wood properties and disease resistance of trees; biochemistry and physiology of plant stress response; photosynthesis; mycorrhizae; plant reproductive biology; genetic engineering; transformation; molecular evolution; phylogenetics; taxonomy; plant-pathogen interactions, tissue culture and study of ancient DNA.

Wildlife Ecology and Management Ecology

Study in this area provides students with advanced preparation in biological concepts of wildlife populations as they relate to resource management. M.P.S. students will undertake a professional experience in wildlife management or policy, or a synthesis course in wildlife management planning. M.S. and Ph.D. students will address important research questions in wildlife science, typically aimed at supporting resource management agencies in their decision making.

The work of a wildlife biologist is diverse and often includes monitoring the status of wildlife populations, restoration of declining or extirpated species or populations, managing sustainable harvests of game species, identifying and managing threats to wildlife and their habitat, mitigation of human-wildlife conflict, and communicating wildlife issues and regulations with the public. Graduate education is rapidly becoming a universal prerequisite to employment as a professional wildlife biologist. A major strength of our program is the diversity of our research partners, including the U.S. Fish and Wildlife Service, National Park Service, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Geological Survey, the New York State Department of Environmental Conservation, and many other state agencies. Graduate students working on agency-funded projects typically network with representatives from these agencies, which often opens up career opportunities. Certification by The Wildlife Society is supported by our faculty, and also enhances career opportunities because many state and federal agencies, and consulting firms give hiring preference to those who are certified. Graduates with an advanced degree in Wildlife Ecology and Management from ESF are employed worldwide, with nearly 100 percent placement shortly after graduation.

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.) **G** = General Education Course (GenEd), **E** = Engineering, **ES** = Engineering Sciences, **M** = Mathematic, **NS** = Natural Sciences, **PE** = Professional Education, **S** = Summer-only*

DEPARTMENT OF ENVIRONMENTAL RESOURCES ENGINEERING

Stephen Shaw, Chair
402 Baker Laboratory
315-470-6633
315-470-6958 (fax)

Our departmental mission is to engage in teaching, research, and service to advance environmental resources engineering practices and meet the needs of the world. Faculty strengths are in ecological engineering, geospatial engineering, water resources engineering, and the broader field of environmental resources engineering. Teaching includes innovative class, lab, and field exercises in foundational and advanced engineering topics, where our flexible curriculum allows students to focus on traditional or novel engineering practices. Students receive a well-balanced education, including courses that consider the social, economic, and environmental impacts of engineering practice, fundamental engineering and environmental engineering courses, and specialized courses that capture the breadth of their field of study.

The ERE department is internationally recognized for coupling research and service, and many ERE courses address community needs. The ERE department provides unparalleled mentoring to train students in engineering science and design so they can join our alumni as leaders in professional practice and research.

BACHELOR OF SCIENCE IN ENVIRONMENTAL RESOURCES ENGINEERING

Environmental Resources Engineering degree program prepares graduates to operate with professional competence in environmental resources engineering. A broad base of study in engineering fundamentals enables graduates to enter professional practices that focus on the use and protection of soil, water, air, and other renewable and non-renewable resources. The program aims to educate professionals who will ensure sustainable development through environmentally responsible engineering solutions. **This program is accredited as an environmental engineering program by the Engineering Accreditation Commission of ABET, http://www.abet.org.**

Lower Division Required Courses

APM 205	Calculus I:Science & Engr	4
APM 206	Calculus II:Science & Engr	4
APM 307	Multivariable Calculus	4
APM 485	Diff Equat/Engr&Scientist	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
ERE 132	Intro/Envrnmntl Resrces Engr	1
ERE 133	Intro to Engineering Design	3
ERE 275	Ecological Engineering	3
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
GNE 271	Statics	3
GNE 273	Mechanics of Materials	3

PHY 211	General Physics I	3
PHY 212	General Physics II	3
PHY 221	General Physics I Laboratory	1
PHY 222	General Physics II Laboratory	1

"C-" is a requirement for students to pass each calculus course and move into the next course. This requirement is necessary to ensure engineering students have the quantitative skills to succeed in the ERE program. The admissions office uses C as a threshold for the calculus courses when students want to transfer into the ERE program.

Lower Division Electives

Course	**Codes***	**Credits**
General Education Course in two of the following categories: US History & Civic Engagement, The Arts, Social Science, World History and Global Awareness, World Languages	G	6
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Earth Science Elective: FOR 345, FCH 399, FOR 338, EAR105, EAR 111, or EAR 117	G	3
Biology Elective: EFB 103, EFB 303, EFB 307, EFB 320, EFB 360, EFB 400, EFB 424, EST 220, FOR 232, FOR 332, FOR 334, or FOR 442	G	3

Upper Division Required Courses

APM 395	Probability & Stats/Engr	3
CEE 337	Intro to Geotechnical Engrng	3
ERE 335	Numerical & Computing Methods	3
ERE 339	Fluid Mechanics	4
ERE 340	Engr Hydrology&Hydraulics	4

ERE 365	Principles of Remote Sensing	4
ERE 371	Surveying For Engineers	3
ERE 430	Engr Decision Analysis	3
ERE 440	Water and Wastewater Treatment	3
ERE 468	Solid & Hazardous Waste Engr	3
ERE 480	Fate & Trnsprt of Contaminants	3
ERE 488	Engineering Project Management	1
ERE 489	Env Res Engr Plan&Design	3

Upper Division Electives

Course	Codes*	Credits
Engineering Fundamentals Elective These courses are intended to introduce or reinforce basic concepts and theory within the engineering sciences. They are intended as intermediate level classes that build on lower division electives. Pre-approved SUNY ESF Engineering Fundamentals Elective courses are: • PSE 361 Engineering Thermodynamics • PSE 370 Principles of Mass and Energy Balances • CME 404 Applied Structures • Any approved Engineering Elective Pre-approved Syracuse University courses that satisfy the engineering fundamentals elective include: • ELE 231 Electrical Engineering Fundamentals • MAE 251 Thermodynamics		3

• ECS 222 Dynamics		
Engineering Elective These courses focus on theory and application of scientific principles and quantitative skills to monitor, assess, or design in the environmental resources engineering profession. Pre-approved SUNY ESF Engineering Elective courses are: • ERE 311 Ecological Engineering in the Tropics • ERE 412 River Form and Process • ERE 445 Hydrologic Modeling • ERE 465 Environmental Systems Engineering • GNE 461 Air Pollution Engineering • ERE 496 and ERE 596 Special Topics courses must be approved by the Department prior to registration Pre-approved Syracuse University courses that may be used to satisfy engineering electives include: • CEE 331 Analysis of Structures and Materials • CEE 332 Design of Concrete Structures • CEE 338 Foundation Engineering • CEE 443 Transportation Engineering • CEE 473 Transport Processes in Environmental Engineering • Special Topics courses offered through Syracuse University's L.C. Smith College of Engineering must be pre-approved by	E	9

the Department prior to registration 500-599 Graduate courses designed expressly for areas of specialization in post-baccalaureate programs. Qualified undergraduate students may enroll with permission of the instructor. 600-699 Graduate courses are designed expressly for advanced levels of specialization. Undergraduate students with a cumulative grade point average of 3.000 or better may enroll in these courses with an approved petition. • ERE 621 Spatial Analysis • ERE 622 Digital Image Analysis (requires permission of instructor) • ERE 674 Methods in Ecological Treatment • ERE 693 GIS-Based Modeling (requires permission of instructor)		
Technical Elective These courses focus on techniques, theory, and skills to advance competence in professional practice. Any CEE class, any APM class 200 level and above; any BPE class 300 level and above; any BTC class; any CME class with the exception of CME 202; any EFB class with the exception of EFB 120, 200, 217, 220, and 312; any EHS class; any ERE class; ESF 300 any FCH class 200 level and above; any FOR class 320 and above with exception of 475 to 478; any GNE class; or any SRE class. Any Special Topics course (496 or 596) must be		6

approved by the Department prior to registration.		

Total Minimum Credits For Degree: 128

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.) **G** = General Education Course (GenEd), **E** = Engineering, **ES** = Engineering Sciences, **M** = Mathematic, **NS** = Natural Sciences, **PE** = Professional Education, **S** = Summer-only*

GRADUATE PROGRAM IN ENVIRONMENTAL RESOURCES ENGINEERING

ERE participates in graduate education leading to the master of engineering, the master of professional studies, master of science, and doctor of philosophy degrees in environmental resources engineering. Graduate studies and research are primarily concerned with environmental and resource-related problems. ERE graduate students apply science and engineering to the conservation, restoration, holistic development, and improved utilization of the natural environment and its related resources.

Applicants to all programs of study are required to have a bachelor's degree in science or engineering and are expected to have completed at least one 3-credit course in physics, one 3-credit course in statistics, and two 3-credit courses in calculus. Students admitted without necessary background are required to take additional prerequisite courses required by the department.

Degrees

The Master of Engineering (M.E.) degree requires the successful completion of a minimum of 33 credits at the graduate level, of which 27 are in coursework. A 6 credit capstone design experience completes the M.E. degree requirements.

The Master of Professional Studies (M.P.S.) degree requires the successful completion of a minimum of 30 credits at the graduate level, of which at least 24 must be in coursework. A 3-6 credit comprehensive project or practicum completes the M.P.S. degree requirements.

The Master of Science (M.S.) degree requires the successful completion of a minimum of 30 credits at the graduate level, of which 18-24 are for coursework and 6-12 credits are for the thesis.

The Doctor of Philosophy (Ph.D.) degree requires the successful completion of a minimum of 60 credits at the graduate level, of which 30-48 are for coursework and 12-30 credits are for the dissertation.

All graduate degrees in ERE require completion of at least 15 credit hours of graduate coursework in engineering and applied science courses. A seminar is also required. Program mastery courses may be satisfied by prior study. Plans of study are individualized by academic advisors so that students acquire needed depth and breadth in their training and courses and reach their professional goals.

Graduate Options

There are five graduate options for the M.P.S., M.S., and Ph.D. degrees:

Ecological Engineering (M.P.S., M.S., Ph.D.)

Ecological Engineering is the design of ecosystems for the mutual benefit of humans and the environment. Ideal design considers humans to be part of nature rather than apart from nature.

At ESF we believe that ecological engineering education and research should meet local to global needs. We teach and research sustainable solutions and approach ecological engineering broadly, working in many areas of the world and in most major areas of ecological engineering.

Program Requirements

Program prerequisite or co-requisite courses beyond the departmental requirement include at least one semester of study in thermodynamics, fluid mechanics, or statics; probability and statistics; ecology; and hydrology.

Program mastery courses include at least one course (3+ credit hours) in each of these areas of competence: 1) Ecosystem Restoration; 2) Pollutant Treatment; 3) Modeling; and 4) Ecosystem Sciences.

Environmental Management (M.P.S.)

Environmental Management combines environmental engineering science with environmental policy, social sciences, and management tools to provide breadth and perspective for the student aspiring to managerial responsibility.

Student coursework is designed to enhance technical and problem-solving skills to meet contemporary needs of environmental managers.

Program Requirements

Program prerequisite or co-requisite courses beyond the departmental requirement include at least one semester of study in at least three of the following fields: chemistry; computer science; environmental science; economics; and geographic measurements.

Program mastery courses include at least one course (3+ credit hours) in each of these areas of competence: 1) Project Management; 2) Environmental Policy; 3) Environmental Resources Engineering.

Environmental Resources Engineering (M.P.S., M.S., Ph.D.)

Environmental Resources Engineering takes an interdisciplinary approach to solve environmental resource-related problems in urban and natural settings.

Emphasis is placed on applying science and engineering principles to the analysis and design of engineered systems, processes and products that improve the conservation, restoration, development, and utilization of the built and natural environments. Students use modern engineering tools and techniques such as micrometeorology, remote sensing, hydrodynamic and atmospheric modeling, and systems analysis.

Program Requirements

Program prerequisite or co-requisite courses beyond the departmental requirements include at least one semester of study in thermodynamics, fluid mechanics, or statics; hydrology, chemistry, or biology; and computing methods.

Program mastery courses are arranged to meet the objectives of the individual student program. A student’s program of study in this option may combine competence areas in the other ERE options, or introduce new competence areas.

Geospatial Information Science and Engineering (M.P.S., M.S., Ph.D.)

Geospatial Information Science and Engineering is designed for specialized study in spatial information acquisition, analysis, modeling and applications.

This includes theoretical and applied projects in sensing systems and the location, measurement, analysis and description of ground features and earth resources. It also includes use of geographic information systems (GIS) to incorporate spatial data into a wide range of environmental and engineering problems.

Program Requirements

Program prerequisite or co-requisite courses beyond the departmental requirement include at least one year of physics and one engineering science course in surveying, numerical methods, or computer science.

Program mastery courses include at least one course (3+ credit hours) in each of these areas of competence: 1) remote sensing; 2) geographic information systems; 3) spatial analysis and programming; 4) statistics.

Students in the MPS program will take additional coursework in at least one of these areas, MS students will take additional coursework in at least two areas, and Ph.D. students will take additional coursework in at least three of these areas.

In addition to competence areas listed above, there is flexibility for students interested in supplementary areas. For example, students in the past have expanded their knowledge in geography, ecology, forestry, systems analysis, electrical/computer engineering and mathematics. Courses from these competence areas are identified in consultation with the Major Professor and Steering Committee.

Water Resources Engineering (M.P.S., M.S., Ph.D.)

Water Resources Engineering addresses the analysis, prediction and design of water resource systems.

Emphasis is placed on applying engineering techniques to reduce impacts on human and natural systems. Students pursue solutions to water resources problems, in recognition of environmental, economic, legal, social and managerial constraints. The department has computing facilities, field sites, and a fluids laboratory with a tilting sediment recirculating flume and river geomorphology table to support research activities. The program takes advantage of departmental expertise in GIS and remote sensing to address problems at a variety of scales. Analytic techniques typically blend a combination of statistics, numerical analyses, and computer science.

Program Requirements

Program prerequisite or co-requisite courses beyond the departmental requirement include at least one semester of study in fluid mechanics, computing methods, and engineering hydrology.

Program mastery courses include at least one course (3+ credit hours) in each of these areas of competence: 1) physical hydrology; 2) computational modeling; and 3) water quality.

DIVISION OF ENVIRONMENTAL SCIENCE

Russell D. Briggs, Division Director
358 Illick Hall
315-470-6989

Environmental science at ESF is an interdisciplinary degree program that takes full advantage of its location within an environmentally focused college. The program offers students a tremendous variety of courses and faculty members to choose from, excellent facilities for research and field study, and a level of faculty expertise that is rarely found at other colleges.

The faculty members who deliver the program perform teaching, research and public service activities to promote environmental practices that will improve the lives of people within New York state and around the world.

The program's objectives are to prepare students who:

- Will engage in environmental work while employed by government agencies and industry or in private consulting jobs that specialize in public works and the inventory, management, design, use, restoration, and protection of natural and cultural resources,
- Are prepared to enter advanced academic studies involved with any of the many aspects of environmental science, and
- Will continue to develop the knowledge and skills needed to adapt to changing technological, environmental, and business conditions to the benefit of society, employer and self.

BACHELOR OF SCIENCE IN ENVIRONMENTAL SCIENCE

The curriculum in the bachelor's degree program provides a strong foundation in the sciences and introduces students to the interdisciplinary breadth of environmental science through a selection of core courses dealing with the geographical, physical, social and living environments.

- **Senior Staff Assistant/Curriculum Coordinator**: Ann Moore

Students have the flexibility to satisfy their core requirements by completing courses in biology, chemistry, ecology, geography, engineering, forestry, environmental studies and other areas of study. College-wide general education requirements provide additional opportunities for students to complete courses in the arts, humanities and social sciences to develop a broader context for personal and professional growth.

Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 106	Survey Of Calc & Appl II	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 320	General Ecology	4
ENS 132	Orientation Seminar:EnvSci	1
ESF 300	Intro/Geospatial Info Tech	3
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
EWP 407	Writing/Env & Sci Professionls	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3

FCH 153	General Chemistry II Lab	1
FOR 207	Introduction To Economics	3
PHY 211	General Physics I	3
PHY 212	General Physics II	3
PHY 221	General Physics I Laboratory	1
PHY 222	General Physics II Laboratory	1

Lower Division Electives

Course	Codes*	Credits
Free electives		12
General Education Course in two of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	6
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Environmental Science Core

Students must complete one course from each of the following environmental science core areas.

NOTE: Courses used to complete the advanced chemistry, biology, or mathematics requirements, environmental science core requirements, or option requirements may NOT be used to satisfy more than one of these requirements.

The Physical Environment

EAR 305	Earth Science of Energy	3
EAR 403	Geomorphology	3
ERE 380	Energy Systems Engineering	3
EST 231	Environmental Geology	3
FCH 210	Elements Of Organic Chem	4
FCH 221	Organic Chemistry 1	3

AND FCH 222	Organic Chemistry Lab 1	1
FCH 360	Physical Chemistry I	3
FOR 338	Meteorology	3
FOR 340	Watershed Hydrology	3
FOR 345	Introduction to Soils	3
GNE 172	Statics and Dynamics	4
The Living Environment EFB 303	Intro Envrn Microbiology	4
EFB 326	Plant Evol,Diversificatn&Cons	3
EFB 327	Adirondack Flora	3
EFB 336	Dendrology I	3
EFB 342	Fungal Diversity & Ecology	3
EFB 345		
EFB 351	Forest Entomology	3
EFB 355	Invertebrate Zoology	4
EFB 351	Forest Entomology	3
EFB 355	Invertebrate Zoology	4
EFB 384	Field Herpetology	3
EFB 388	Ecology/Adirondack Fishes	3
EFB 440	Mycology	3
EFB 462	Animal Physiol:Envrn&Ecol	4
EFB 483	Mammal Diversity	4
EFB 485	Herpetology	3
EFB 486	Ichthyology	3
The Social Environment EST 220	Urban Ecology	3

EFB 337	Field Ethnobotany	3
EST 361	History/Am Envrn Movement	3
EST 390	Social Processes & Envrn	3
EST 450	Sustainable Enterprise	3
EWP 390	Literature of Nature	3
FOR 465	Natural Resources Policy	3
FOR 487	Environmental Law and Policy	3
FOR 489	Natural Resources Law & Policy	3

Advanced Courses in Chemistry, Biology or Mathematics

An advanced course is one that has at least one prerequisite or is numbered 300 or above. Note: Courses used to complete the advanced courses in chemistry, biology or mathematics requirement may NOT be used to complete the environmental science core or option requirements.

Required Courses

Course	Codes*	Credits
Advanced Courses in science or mathematics		6

Option Area

Students must complete at least 15 credits in ONE of the following option areas of study. Courses used to complete the advanced chemistry, biology, or mathematics requirements; environmental science core requirements; or upper division electives may not be used to satisfy the option area requirements.

Environmental Information and Mapping (16 credits required)

ERE 365	Principles of Remote Sensing	4
ERE 371	Surveying For Engineers	3
FOR 458	Advanced Topics in GIS	3
GEO 381	Cartographic Design	3
LSA 300 OR	Digital Methods & Graphics I	3

EFB 518	Systms Ecology: Eco Mdlng&Dsgn	3

Water Science (15 credits required)

FOR 340	Watershed Hydrology	3
FOR 345	Introduction to Soils	3
FOR 442	Watershed Ecology & Management	3

Choose TWO courses from the list below:

Watershed Science

EFB 423	Marine Ecology	4
EFB 424	Limnology:Study Inland Waters	3
EFB 486	Ichthyology	3
EFB 487	Fisheries Science & Mgt	3
EFB 542	Freshwater Wetland Ecosys	3
ERE 412	River Form and Process	3
ERE 508	Water-An Incredible Journey	3
FOR 338	Meteorology	3
GEO 316	River Environments	3
CEE 657	Biogeochemistry	3

NOTE: CIE 657, Ecological Biogeochemistry, is an upper-division Syracuse University course. Access by petition only; confer with your academic advisor.

Health and the Environment (17 credits required)

Required Courses

EHS 250	Foundations/Envrn Health	2
EFB 400	Toxic Health Hazards	3
EFB 360	Epidemiology	3

Elective courses

EFB 303	Intro Envrn Microbiology	4
EFB 307	Principles Of Genetics	3
EFB 308	Prin Of Genetics Lab	1

EFB 325	Cell Biology	3
EFB 385	Comparative Vert Anatomy	4
EFB 453	Parasitology	3
EFB 462	Animal Physiol:Envrn&Ecol	4
EHS 320	Disease Prevention	3
EHS 350	Environmental Health Managemnt	3
EHS 440	Occupational Health and Safety	3
EHS 480	Hazardous Waste Management	3
ENS 470	Environmental Risk Assessment	3
FST 102	Contemporary Food Issues	3

Earth and Atmospheric Systems Science & Analysis

(16 credits required)

Required Courses		
FCH 399	Intro/Atmospheric Sciences	3
EFB 424	Limnology:Study Inland Waters	3
FOR 345	Introduction to Soils	3

Choose TWO courses from the list below:

Elective course		
APM 307	Multivariable Calculus	4
APM 485	Diff Equat/Engr&Scientist	3
APM 585	Part Diff Equat/Engrs&Scientst	3
CIE 457	Biogeochemistry	3
ERE 365	Principles of Remote Sensing	4
FCH 380	Analytical Chemistry I	2
FCH 381	Analytical Chemistry II	3
FCH 510	Environmental Chemistry I	3

FCH 511	Atmospheric Chemistry	3
FCH 515	Meth/Envrn Chem Analysis	3
MCR 480	Fundamentals of Microscopy	3

NOTE: Upon consultation with option area coordinator, students may select courses beyond those listed above that align with professional goals.

Renewable Energy

(15 credits required)

Required Courses		
SRE 441 OR CME 305	Biomass Energy Sustainable Energy Sys/Bldgs	3 3
SRE 325	Energy Systems	3
SRE 337	Energy Resource Assessment	3
SRE 479	Life Cycle Assessment	3

and a minimum of 3 credits from the following:

Elective Course		
CME 305	Sustainable Energy Sys/Bldgs	3
ERE 380	Energy Systems Engineering	3
EST 427	Environmental &Energy Auditing	3
FCH 360	Physical Chemistry I	3
ECH 202	Prin Mass/Energy Balance	3
ECH 212	Engr Thermodynamics	3
SRE 422	Energy Markets and Regulation	3
SRE 416	Sustainable Energy Policy	3
SRE 454	Sustainble Energy Fin&Analysis	3
PHY 305		

Upper Division Electives

Course	Codes*	Credits

Electives		15

Students completing the environmental science program must complete 15 credits of upper division electives to satisfy the graduation requirements. Course taken to satisfy the advanced math/science or option areas cannot also be used to satisfy the upper division elective requirement.

Under the guidance of their academic advisor, students may design their own block of electives. Course selection should support the student's capstone research, career or advanced academic study goals. Alternatively, this requirement can also be satisfied by choosing an official college minor. A list of minors is available:

Undergraduate Minors

Senior Synthesis

Capstone Courses		
ENS 498	Resrch Prob/Envrn Science	1
ENS 498 OR ENS 420	Resrch Prob/Envrn Science Internship in Env Science	3 3
	Project-Oriented Coursework*	3
ENS 494	Capstone Seminar	1
ENS 498 OR ENS 420	Resrch Prob/Envrn Science Internship in Env Science	1 - 5 1 - 5

NOTE: ENS 498 and ENS 420 are taken for 3 credits

*Students may select from a list of project-oriented coursework to fulfill their senior synthesis requirement. Upon consultation with their advisor, students may also select courses beyond those listed ona case-by-case basis. Acceptable courses include:

- ENS 496 Renewable Energy Capstone Seminar
- ENS 596 International Interdisciplinary Urban Ecosystem Design
- EFB 525 Limnology Practicum (student will need to enroll in an additional credit hour)
- ESF 496 Special Topics classes (must confer with advisor)
- Other

Total Minimum Credits For Degree: 126

BACHELOR OF SCIENCE IN ENVIRONMENTAL HEALTH

Environmental health focuses on the study of how people interact with their environment—the air and water around us, the plants and animals we encounter, and the workplaces and homes where we spend much of our lives. The field is broad, encompassing the direct effects of the environment on human health, and the factors that adversely affect the ecological balances essential to human health and environmental quality.

Core Courses

APM 105	Survey Of Calc & Appl I	4
APM 106	Survey Of Calc & Appl II	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 303	Intro Envrn Microbiology	4
EFB 360	Epidemiology	3
EFB 400	Toxic Health Hazards	3
EHS 250	Foundations/Envrn Health	2
EHS 320	Disease Prevention	3
EHS 350	Environmental Health Managemnt	3
EHS 360	Environmental Sampling Methods	3
EHS 420	Prof Internship/Env Health	1 - 5
EHS 440	Occupational Health and Safety	3
EHS 480	Hazardous Waste Management	3
ENS 132	Orientation Seminar:EnvSci	1
ENS 470	Environmental Risk Assessment	3

ENS 494	Capstone Seminar	1
ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FCH 221	Organic Chemistry 1	3
FCH 222	Organic Chemistry Lab 1	1
FCH 223	Organic Chemistry II	3
FCH 224	Organic Chemistry Lab II	1
FCH 399	Intro/Atmospheric Sciences	3
NSD 114	Food Safety/Quality Assur	2
PHY 101	Major Concepts of Physics I	4
PHY 102	Major Concepts of Physics II	4

NOTE: PHY 101 and PHY 102 both include a lab.

General Education Electives

Course	Codes*	Credits
General Education Course in two of the following categories: US History & Civic Engagement, The Arts, Social Sciences, World History and Global Awareness, World Languages	G	6
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Focus Area Electives

21 credits required for breadth and depth of knowledge.

Breadth: 3 credits from each of 3 focus areas (total of nine credits)

Depth: 12 credits from a fourth focus area.

NOTE: Some Focus Area Elective courses may have prerequisites, effectively exceeding the 126 minimum credit requirement for the B.S.

NOTE: Only three credits total from the 21 can be from a 200-level course or lower without prior approval of the curriculum coordinator.

A. Built Environment

Courses		
EST 132	Orientation Seminar:EST	1
EST 220	Urban Ecology	3
EST 231	Environmental Geology	3
LSA 311	Natural Proc-Design&Plan	3
LSA 326	Land Arch Dsgn Studio I	5
LSA 451	Comprehensive Land Plan	3
LSA 470	Thematic Land Dsgn Studio	6

B. Geospatial Technology

Courses		
ERE 365	Principles of Remote Sensing	4
ERE 371	Surveying For Engineers	3
ERE 553	Intro to Spatial Information	1
ERE 566	Intro/Global Positioning Sys	1
ESF 300	Intro/Geospatial Info Tech	3

C. Soils

Courses		
ERE 511	Ecological Engr in the Tropics	3
FOR 332	Forest Ecology	4

FOR 345	Introduction to Soils	3
FOR 535	Advanced Forest Soils	3
FOR 635	For Soils/Their Analyses	3

D. Water and Wastewater

Students interested in this focus area are encouraged to take APM205 and APM206 in place of APM105 and APM106, as the higher level calculus is required for many of the courses; also students interested in this focus area are encouraged to take PHY211/221 and PHY212/222 in place of PHY101 and PHY102, as the higher level physics is required for many of the courses.

Courses		
CEE 442	Treatment Proc. in Env. Eng.	4
EAR 401	Hydrogeology	3
EAR 420	Contaminant Hydrogeology	3
EFB 496	Topics/Envrn&Forest Bio	1 - 3
EFB 505	Microbial Ecology	2
ERE 275	Ecological Engineering	3
ERE 339	Fluid Mechanics	4
ERE 340	Engr Hydrology&Hydraulics	4
ERE 440	Water and Wastewater Treatment	3
ERE 480	Fate & Trnsprt of Contaminants	3
FCH 360	Physical Chemistry I	3
FCH 510	Environmental Chemistry I	3
FOR 487	Environmental Law and Policy	3

E. Solid/Hazardous Materials and Waste Management

Courses		
CEE 341	Intro. to Environmental Engrng	3
EFB 496	Topics/Envrn&Forest Bio	1 - 3
ERE 275	Ecological Engineering	3
ERE 340	Engr Hydrology&Hydraulics	4

ERE 405	Sustainable Engineering	3
ERE 465	Environmental Systems Engrng	3
ERE 468	Solid & Hazardous Waste Engr	3
ERE 480	Fate & Trnsprt of Contaminants	3
FOR 487	Environmental Law and Policy	3

F. Hydrogeology

Courses		
EAR 401	Hydrogeology	3
EAR 420	Contaminant Hydrogeology	3
ERE 480	Fate & Trnsprt of Contaminants	3
ENS 496	Hydrology	3
	Human Health	
ERE 508	Water-An Incredible Journey	3
FOR 340	Watershed Hydrology	3
FOR 345	Introduction to Soils	3
FOR 442	Watershed Ecology & Management	3

G. Food Protection

Courses		
FST 102	Contemporary Food Issues	3
FST 307	Feeding the World: Global Agr	3
FST 402	Urban Food Systems	3
FST 421	Morality of a Meal: Food Ethic	3
NSD 114	Food Safety/Quality Assur	3
NSD 115	Food Science I	3
NSD 225	Nutrition in Health	3
NSD 427	Public Health Nutrition	3

NSD 455	Community Nutrition	3
NSD 481	Medical Nutr Therapy I	3
NSD 555	Food, Culture and Environ.	3

H. Public Health

Courses

PHP 221	Community Health Promotion	3
PHP 309	Health Disparities	3
FST 403	Right to Food and Nutrition	3
PHP 302	Influencing Healthy Behavior	3
PHP 305	Community Mental Health	3
PHP 313	Issues Challenges Healthcare	3
PHP 306	Understanding Health Systems	3
PHP 318	Dynamics of Addiction	3
PHP 414	Ethics & Law Hlthcare Adm	3
PHP 415	Public Health Ethics	3
PHP 437	LGBTQ Health	3
	Well Being	
PHP 438	Native American Health Promotion	3
PHP 462	Culture&Reprod Health&Med	3
PHP 463	Global Health	3

I. Pre Medical Track

Students taking this track as their depth area must also select courses from 4 other focus areas, rather than three other focus areas for their breadth. This focus area does not count as one of the three breadth areas, but courses can count as Open Electives.

Courses

BTC 498	Resrch Prob/Biotechnology	1 - 9
EFB 307	Principles Of Genetics	3

EFB 308	Prin Of Genetics Lab	1
EFB 325	Cell Biology	3
EFB 385	Comparative Vert Anatomy	4
FCH 530	Biochemistry I	3
FCH 532	Biochemistry II	3

Open Electives

Six (6) Credit hours. Students can take more than the 4 hours of open electives, but need to be aware that those extra credits will not substitute for required courses. Students are encouraged but not required to use some of their open electives to do research projects either on or off campus within the EHS framework. Below are listed some courses that might be of interest to EHS students.

EST 203 Introduction to Sociology
EST 220 Urban Ecology
EST 245 Foundations of Environmental Communication
EST 321 Government and the Environment
EST 361 History of the American Environmental Movement
EST 390 Social Processes and the Environment
EST 395 Public Communication of Science and Technology
EST 426 Community Planning and Sustainability

EFB 217 Peoples, Plagues, and Pests
EFB 352 Entomology
EFB 453 Parasitology

LSA 190 Clashing Perspectives in the Built Environment

FOR 202 Introduction to Sociology
FOR 204 Natural Resources in American History
FOR 489 Natural Resources Law and Policy

Total Minimum Credits For Degree: 126

NOTE: For students considering a career in Environmental Risk Assessment or Environmental Remediation, it is strongly recommended that they that take:

ENV 165 Hazardous Waste Operations and Emergency Response (2 Credits) at Onondaga Community College over Winter Break. This course culminates with the awarding of the 40 hour HAZWOPER Certification, which is required by OSHA and many potential internship sponsors or employers.

GRADUATE PROGRAM IN ENVIRONMENTAL SCIENCE (GPES)

Russell Briggs, Graduate Program Coordinator
202 Baker Lab
315-470-6989

The Graduate Program in Environmental Science (GPES) supports interdisciplinary environmental research and teaching at SUNY ESF and offers unique graduate programs that serve the needs of our students. GPES is comprised of faculty from each of the seven departments at SUNY ESF who understand the importance of interdisciplinary collaborations to manage and solve critical environmental problems.

Requirements

The academic requirements of the graduate program in environmental science are designed to provide graduates with a sound preparation to meet the rapidly evolving challenges of the field as leading scholars and professionals. Programmatic requirements constitute a framework which includes a comprehensive core foundation emphasizing theory, issues and methods; extended knowledge within an area of study; and a synthesis experience.

In addition, students should have an academic background and/or work experience related to the selected area of study. Wherever possible, deficiencies should be made up prior to matriculation.

Master of Science (M.S.)

The Master's Degree is designed as a two-year experience. The minimum total credits for the degree is 30. Lists of courses that meet requirements identified in this section have been approved by each area of study.

These lists are not exclusive; courses not on these lists may be taken with the approval of the Major Professor and Steering Committee, as indicated on the Form 3B.

Required credit hours are identified in three categories:

1. **Core**: The broad interdepartmental focus of GPES is reflected in the core requirements - A minimum of 9 credit hours distributed in 3 areas: social science, natural or physical science, and methods/tools.
2. **Area of Study**: A minimum of 15 credit hours (excluding 898 and 899 courses) in AOS courses are required.
3. **Thesis**: A minimum of 6 credit hours of research resulting in a document that clearly demonstrates graduate level accomplishments of the student, followed by a defense examination. Students must have an approved Thesis Proposal.

Concurrent Degree

Concurrent degree students may “double count” 8 credit hours toward their M.S. degree.

Environmental Science Seminar

There is no seminar requirement for the Master of Science.

Advanced Standing

A maximum of 6 graduate credit hours with a grade of B or above that have not been applied to another degree may be transferred via petition. The petition must include an attached syllabus and a justification of how the courses are to be included on the student's Plan Sheet.

Petitions regarding Core requirements may be submitted following matriculation. Petitions regarding Area of Study requirements are to be submitted following the formalization of the student's steering committee (submission of Form 2A establishes the steering committee).

Master of Professional Studies (M.P.S.)

The Master of Professional Studies (MPS) degree is a 30 credit hour experience aimed at professional applications of environmental knowledge.

Core Requirements

Required course work: A total of 9 credit hours that includes one 3-hour social science course, one 3-hour natural or physical science course, and one 3-hour methods or tools course emphasizing applications of technical knowledge.

Area of Study Requirements

A minimum of 12-15 credit hours of course works in the chosen area of study, as determined by the major professor and study area faculty. Students in the Water and Wetland Resources program are required to take either (i) a minimum of 18** credit hours of area of study coursework and 3 hours of synthesis OR (ii) 15 credit hours of coursework in the area of study combined with 6 hours of synthesis. Students select a study area at the time of application for admission into the program.

A minimum of 12 credit hours of coursework is required in the chosen area of study, as determined by the major professor and study area faculty. Students select a study area at the time of application for admission to the program.

Synthesis Requirements

Students select either an Internship (minimum of 3 credit hours) or prepare a synthesis paper (3 credit hours). Some internships may extend to 6 credit hours, reducing electives to 0. All students must present a capstone seminar in their final semester and submit a written Capstone report documenting their research or internship experience. The length, depth, and format of the report is at the discretion of the student's supervisory committee. See Appendix B for internship guidance.

Advanced Standing

1. Course transfers. A maximum of six graduate credit hours with a grade of B or above that have not been applied to another degree may be transferred via Petition. The Petition must

include an attached syllabus, and a justification of how the courses are to be included on the student's Plan Sheet. Petitions for course transfers are submitted following matriculation.
2. Credit for prior experience. Applicants with a minimum of three (3) years of post-baccalaureate full-time professional experience directly related to the intended area of study may apply for 6 credit hours of advanced standing in the program. Partial credit for experience cannot be awarded. When awarded for prior work experience, the 6 credit hours are applied toward the Synthesis requirement.
3. All College Forms

Concurrent Degree

Concurrent degree students may "double-count" 8 credit hours toward their MPS degree.

Environmental Science Seminar

All students are required to take two (2) semesters of ENS 797 Environmental Science Seminar OR, in consultation with the Major Professor, appropriate seminars in other ESF departments or Syracuse University (the latter for credit only). ENS 797 is normally completed as an Audit, but at times may be taken for credit if offered.

Doctor of Philosophy (Ph.D.)

The Ph.D. program provides a unique opportunity to develop integrative research within a strong college community of environmental analysts and to draw upon the expertise of scholars at Syracuse University. Entering students are required to complete the equivalent of the GPES master's core either from prior graduate study or coursework taken within the first year of residency.

The Ph.D. in Environmental and Natural Resources Policy (ENRP) has separate and distinct requirements (discussed below). Also, applicants are expected to have completed a master's research thesis.

Graduate Areas of Study

Biophysical and Ecological Economics (M.S., M.P.S., Ph.D.)

Students in the Biophysical and Ecological Economics (BEE) study area develop an understanding of environmental problems and solutions through analyses of the relations between the human economy of goods and services and the biophysical economy of networks of energy and material resource flows.

Drawing on insights from social and physical sciences, BEE helps students to develop critical thinking, intellectual approaches, measurement tools and modeling skills for analyzing increasingly important topics in environment and natural resource science and policy. Specific course work in biophysical and ecological economics is supplemented by course work in ecology, resource management, environmental economics, policy analysis and others.

Coupled Natural and Human Systems (M.S., M.P.S., Ph.D.)

The Coupled Natural and Human Systems (CNHS) area of study fosters interdisciplinary research and scholarship that explicitly integrates the social and biophysical dimensions of environmental issues using a systems approach.

Our research addresses the challenges of sustaining natural and social capital during the Anthropocene—the current era in which humans shape all major Earth system processes. Drawing on diverse backgrounds, CNHS students and faculty recognize humans as integral components of ecosystems and seek to understand their interactions and dynamics of change at multiple scales. Faculty mentors form collaborative and cross-disciplinary teams to advise CNHS students based on their wide range of expertise and experiences. An emphasis is placed on research and graduate training experience with applications to emerging sustainability issues in real-world settings.

Ecosystem Restoration (M.S., M.P.S., Ph.D.)

The ecosystem restoration study area focuses on the technical, biogeochemical, ecological and cultural aspects of rehabilitating and restoring degraded ecosystems, habitats and landscapes.

The program is designed for graduate students who wish to take an interdisciplinary approach to ecosystem restoration, have access to multidisciplinary expertise, and develop advanced knowledge of ecological engineering, conservation biology, restoration ecology, forest and habitat restoration, landscape ecology and eco-cultural restoration to address complex environmental problems. Current research includes urban ecology and renewal, aquatic restoration, invasive species, agroforestry, brownfields, traditional ecological knowledge and the spatial monitoring, modeling and analysis of integrated ecological processes. Field sites and study areas are located throughout the world and involve a wide variety of ecosystems, cultures and landscapes. Specific course work in ecosystem restoration is supplemented by courses offerings in science, engineering, mathematics, natural resources, and environmental and social policy.

Environmental Communication and Participatory Processes (Ph.D. only)

This Ph.D. study area addresses the communicative dynamics of behaviors, attitudes, values, perceptions, and ideologies. It includes decision making, public policy, public participation, campaign development, organizational effectiveness, conflict prevention and resolution, and risk communication which all hinge on the ability of participants to communicate and use information effectively, strategically, and ethically.

GPES students within this option will be prepared to enter diverse arenas of academia, industry, non-government organizations, and government structures well equipped to facilitate and/or participate in interactions among individual citizens, non-government organizations, publics, agencies, bureaucracies, scientists, and others. They will have the skills and knowledge that will allow them to choose appropriate process structures and strategies to reach objectives.

Environmental and Community Land Planning (M.S., M.P.S., Ph.D.)

The program is designed for students with social science, natural science, engineering, or design backgrounds who are interested in an interdisciplinary and integrative program. Some students have majors in interdisciplinary programs in urban studies or environmental studies. Students develop an understanding and knowledge of development processes, natural systems and governmental planning and regulation. They develop a capacity to analyze environmental and community land planning problems and to form imaginative solutions. Skills obtained include preparation of land and environmental databases, plans, policies and implementation programs.

Environmental Monitoring and Modeling (M.S., M.P.S., Ph.D.)

This study area focuses on multidisciplinary approaches to measuring and modeling environmental systems and processes.

Students address pressing environmental problems in an integrative manner by taking advantage of a broad range of faculty expertise, a variety of course offerings related to the environment and access to advanced field equipment, study sites and computational hardware. Current research in this area includes sustainable development, air quality, water resources, biogeography, terrestrial and aquatic ecosystems, climate and anthropogenic change, forest biometrics and energy systems. Specific course work in environmental monitoring and modeling is supplemented by courses offerings in the fields of science, engineering, mathematics, natural resources and environmental and social policy.

Environmental and Natural Resources Policy (Ph.D. only)

The Environmental and Natural Resources Policy (ENRP) doctoral program is an interdisciplinary Ph.D. program in that it combines social science (especially policy) with biophysical science.

The problems we study are grounded in the biophysical world, most specifically with the human impact on biophysical systems and vice versa. Investigating these problems requires scientific understanding of the interconnections between ecosystems and social systems; the skills developed in the ENRP program help our graduates to creatively and appropriately design managerial and policy solutions, as well as conduct research studies.

Human Dimensions of the Environment (M.S., M.P.S., Ph.D.)

Human Dimensions of the Environment deals with people's relationships and interactions with the biophysical world. This area incorporates knowledge from both the social and biophysical sciences to examine system interactions.

Research in this area works toward (1) understanding human perceptions, behaviors, attitudes and values with respect to natural resources and the environment; and (2) applying empirical findings to the development of social and biophysical science theory as it relates to human interactions with natural and constructed environments.

Water and Wetland Resource Studies (M.S., M.P.S., Ph.D.)

The water and wetland resources area of study focuses on technical, social, and institutional aspects of water resources management, water quality issue mitigation, and water system restoration.

Individual students may emphasize biophysical or social science subject areas but all study in both areas. The biophysical science aspects include the physical, chemical and biological interactions occurring in water systems. The social science aspects are concerned with planning, regulation, law and institutions, and management of water and wetland resources.

Recommended coursework includes:

- physical sciences: civil engineering, geology, geomorphology, hydrology, meteorology, environmental engineering, soils, water chemistry, hydrogeology, hydrogeochemistry and geographic information systems;
- biological sciences: ecology, entomology, fisheries biology, forestry, microbiology, water quality and limnology;
- social sciences: administration, economics, government, history, law, ethics, philosophy and policy.

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.)* ***G*** =

*General Education Course (GenEd), **E** = Engineering, **ES** = Engineering Sciences, **M** = Mathematic, **NS** = Natural Sciences, **PE** = Professional Education, **S** = Summer-only*

DEPARTMENT OF ENVIRONMENTAL STUDIES

Theresa Selfa, Chair
106 Marshall Hall
315-470-6636
315-470-6915 (fax)

The Environmental Studies program emphasizes interdisciplinary social science, humanities and natural science approaches to environmental understanding and stewardship.

ES programs maintain a strong academic orientation, facilitating student and faculty engagement with fundamental environmental challenges and dynamics such as multiple and conflicting levels of environmental governance, participatory democracy, sustainable development, uses and limits of scientific prediction, discourses of environment, cultural expressions of nature, risk, and ecological sustainability.

BACHELOR OF SCIENCE IN ENVIRONMENTAL EDUCATION AND INTERPRETATION

Environmental Education teaches people of all ages about the natural environment, so that they can make informed decisions on how to care for it.

Interpretation is a communications process that reveals meanings and relationships about natural, cultural, historical, and recreational resources. Interpretation and environmental education work hand-in-hand to help make connections between the world of science and the public. Through the art of interpretation, students will learn how to help people make connections with the natural world and science through educational programs and materials.

Required Courses

APM 104	College Algebra & PreCalculus	3
OR		
APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3
EFB 104	General Biology II Laboratory	1
EFB 120	The Global Envirnmnt & Society	3
EFB 210	Diversity of Life I	3
EFB 211	Diversity of Life II	3
EFB 320	General Ecology	4
EST 132	Orientation Seminar:EST	1
EST 133	Intro to Environmental Studies	3
EST 361	History/Am Envrn Movement	3
EST 370	Intro/Pers Env Interp Methods	3
EST 407	Assessment for Env Programs	3
EST 415	Environmental Justice	3

EST 444	Creative Responses to the Env	3
EST 471	Non-Personal Envrn Interp Meth	3
EST 494	Sr. Seminar in Envrn Studies	1
EST 499	Envrn Studies Internship	3
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FOR 372	Fund/Outdoor Recreation	3

Electives

Course	Codes*	Credits
General Education Course in one of the following categories:The Arts, Western Civilization, Other World Civilizations, Foreign Language	G	3
Directed Electives		30
Open Electives		24

Directed Electives: Environmental Education & Interpretation

1. **Conservation Biology and Resource Management**
   At least 6 credits hours must be in the subject area of advanced conservation biology and Management. Allowable courses are listed below. The list may vary slightly from year to year.
   - EFB 370 Population Ecology and Management
   - EFB 390 Wildlife Ecology & Management (4 cr.) F
   - EFB 413 Introduction to Conservation Biology (4 cr.) S
   - EFB 423 Marine Biology (4 cr.) S even years
   - EFB 487 Fisheries Science and Management (3 cr.) F
   - EST 220 Urban Ecology (3 cr.) F
   - FOR 332 Forest Ecology (4 cr.) F
   - FOR 404 Ecotourism Abroad (3 cr.) S
   - FOR 475 Recreation Behavior and Management (3 cr.) F
   - FOR 476 Ecotourism and Nature Tourism (3 cr.) F

2. **Advanced Communication**
   At least 6 credit hours must be in the subject area of advanced communication. Allowable courses are listed below. The list may vary slightly from year to year.
   - EST 395 Public Communication of Science and Technology (3 cr.) S
   - EST 493 Environmental Communication Workshop (3 cr.) S
   - EWP 390 Literature of Nature (3 cr.) F, S
   - EWP 394 The Art of Storytelling (3 cr.) F
   - EWP 407 Writing for Environmental and Science Professionals (3 cr.) F, S
   - EWP 420 Public Presentation Skills (3 cr.) F, S
   - EWP 450 Digital Storytelling (3 cr.) F, S
   - EWP 494 Creative Non-fiction in the Sciences (3 cr.) S
   - LSA 300 Digital Methods and Graphics I (3 cr.) F
3. **Advanced Environmental Education and Interpretation**
   At least 3 credit hours must be in the subject area of advanced interpretation. Allowable courses are listed below. The list may vary slightly from year to year.
   - EST 333 Inquiry-Based Science Education (3 cr.) S
   - EST 472 Natural History Museums and Modern Science (3 cr.) Maymester
   - EST 474 Advanced Interpretation and Environmental Education (3 cr.) S

4. **Organismal Diversity**
   To encourage breadth in organism-level biology, students must complete 12 credit hours in any combination from this list.
   - **Environmental Biology**
     - EFB 202 Ecological Monitoring & Bio Assess (3 cr.) CLBS Summer
   - **Earth Sciences**
     - EST 231 Environmental Geology (3 cr.) S
     - FOR 338 Meteorology (3 cr.) S
     - FOR 340 Watershed Hydrology (3 cr.) S
     - FOR 345 Introduction to Soils (3 cr.) F
     - FOR 442 Watershed Ecology and Management (3 cr.) F
     - Diversity of Microorganisms
     - EFB 303 Introductory Environmental Microbiology (4 cr.) F
     - EFB 340 Forest and Shade Tree Pathology (3 cr.) S
     - EFB 342 Fungal Diversity and Ecology (3 cr.) CLBS
     - EFB 428 Mycorrhizal Ecology (3cr.) F, even years
     - EFB 440 Mycology (3 cr.) F
   - **Diversity of Plants**
     - EFB 326 Plant Evolution, Diversification and Conservation (3 cr.) S
     - EFB 327 Adirondack Flora (3 cr.) CLBS
     - EFB 336 Dendrology (3 cr.) F
     - EFB 337 Field Ethnobotany (3 cr.) CLBS
     - EFB 435 Flowering Plants: Diversity, Evolution, and Systematics (3 cr.) F
     - EFB 446 Ecology of Mosses (3 cr.) S
     - EFB 496 Flora of Central NY (3 cr.) Maymester
     - EFB 496 Wetland Plants & Communities of Adirondacks (3 cr.) CLBS
   - **Diversity of Invertebrate Animals**
     - EFB 351 Principles of Forest Entomology (3 cr.) S
     - EFB 352 Elements of Entomology (3 cr.) F
     - EFB 355 Invertebrate Zoology (4 cr.) S
     - EFB 453 Parasitology (3 cr.) F
     - EFB 554 Aquatic Entomology (3 cr.) F
   - **Diversity of Vertebrate Animals**
     - EFB 388 Ecology of Adirondack Fishes (3 cr.) CLBS
     - EFB 482 Ornithology (4 cr.) S
     - EFB 483 Mammal Diversity (4 cr.) F
     - EFB 484 Winter Mammalian Ecology (3 cr.) S
     - EFB 485 Herpetology (3 cr.) S
     - EFB 486 Ichthyology (3 cr.) S
5. **Diversity, Equity, Inclusion and Social Justice**
   At least 3 credit hours are required in this subject area related to the inclusion of diverse perspectives in Environmental Education and Interpretation.

   - Refer to general education list for DEISJ approved courses

Total Minimum Credits For Degree: 123

BACHELOR OF SCIENCE IN ENVIRONMENTAL STUDIES

Students may enter the Bachelor of Science program as first-year students or as transfer students. Students who are preparing to transfer to ESF as juniors must have earned at least 60 credits of college coursework, in courses comparable to the lower-division course requirements as noted below.

In the first two years of the program, students develop a foundation in the social sciences, humanities, and natural sciences as they relate to environmental affairs. During that time, students also fulfill SUNY general education requirements and take some open elective courses.

Option Areas

In the final two years of the program, students must select one of three specializations called Option Areas.

Environment, Communication and Society

This option focuses on how communication and social systems influence environmental affairs and shape our perceptions of the non-human world. It addresses the subjects of rhetoric and discourse; news media; public participation; advocacy campaigns; collaboration; conflict resolution; risk communication; social processes; and representations of nature in literature and popular culture.

Environmental Policy, Planning and Law

This option is concerned with how environmental policies, plans, and laws from the local to the global are created, implemented and contested. It emphasizes legislative, regulatory, and collaborative approaches to addressing environmental issues.

Natural Systems Applications

This option is designed for students interested in the interface between biology and socio-economic issues. It provides an emphasis on natural systems and their interactions with societal issues ranging from education to habitat management.

Lower Division Environmental Studies Core Courses		
APM 103	Applied Algebra & Trigonometry	3
OR		
APM 104	College Algebra & PreCalculus	3
OR		
APM 105	Survey Of Calc & Appl I	4
EFB 100	Survey of Biology	4
OR		
EFB 101	Gen Bio I:Organismal Bio&Ecol	3

AND EFB 102	General Biology I Laboratory	1
EFB 103 AND	Gen Bio II:Cell Bio & Genetics	3
EFB 104 OR	General Biology II Laboratory	1
EST 231	Environmental Geology	3
EFB 120	The Global Envirnmnt & Society	3
ESF 200	Information Literacy	1
EST 132	Orientation Seminar:EST	1
EST 133	Intro to Environmental Studies	3
EST 221	Intro/American Government	3
EST 245	Foundations/Envrn Communicatn	3
EST 255	Research Methods/Envrn Studies	3
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
EWP 290	Research Writing & Humanities	3
FCH 110 AND	Survey of Chemical Principles	3
FCH 111 OR	Survey/Chemical Principles Lab	1
FCH 150 AND	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FOR 207	Introduction To Economics	3

Lower Division Electives

Course	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3

General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Directed Electives		27
Open Electives		18

Upper Division Environmental Studies Core Courses

APM 391	Intro/Probability&Stats	3
EFB 320 OR	General Ecology	4
FOR 232 OR	Natural Resources Ecology	3
EST 220 OR	Urban Ecology	3
FOR 442 OR	Watershed Ecology & Management	3
LSA 321	Ecol Appl/Plng & Design	3
EST 321	Government & Environment	3
EST 361	History/Am Envrn Movement	3
EST 494	Sr. Seminar in Envrn Studies	1
EWP 407	Writing/Env & Sci Professionls	3
	Senior Synthesis	

Upper Division Electives

Course	Codes*	Credits
Upper Division Computing OR Natural Science Course		

Environment, Communication and Society Option

EST 390	Social Processes & Envrn	3
EST 395	Public Communcatn/Science&Tech	3
EST 493	Envrn Comm Workshop	3
	Choose two of the following five courses: EWP 495, EWP 420, ESF 300, EFB 417, EFB 312	6

	Option Courses (Including 3 credits in Methods)	15

Environmental Policy, Planning and Law Option

EST 550	Envrn Impact Analysis	3
	Method Courses	6
	Law Option Courses	3
	Planning Option Courses	3
	Environmental Policy/Planning/Law Option Courses	15

Natural Systems Applications Option

Course	Codes*	Credits
Field Methods GIS (Required)		3
Field Methods Scientific Breadth		3
Natural Applications Suboptions Natural Systems		3
Natural Applications Suboptions Environmental Quality		3
Social Science Policy or law courses		9
Social Science Communication courses		6
Social Science Critical Issues in the Environment		3

Total Minimum Credits For Degree: 122-125 (total credits must include a minimum of 51 credit hours at the 300 level or above)

GRADUATE PROGRAMS

The Department of Environmental Studies offers degree and certificate programs in environmental studies, science, and policy, as well as interdepartmental master's and Ph.D. options.

Programs integrate and balance the social sciences, humanities, and natural sciences in creative, interdisciplinary contexts.

Advanced Standing

1. **Course transfers**. A maximum of six graduate credit hours with a grade of "B" or better that have not been applied to another degree may be transferred via Petition. The Petition must include an attached syllabus, and a justification of how the courses are to be included on the student's Plan Sheet. Petitions for course transfers are submitted following matriculation.
2. **Credit for prior experience** (M.P.S. degree only). Applicants with a minimum of three (3) years of post-baccalaureate, full-time professional experience directly related to the intended area of study may apply for 6 credit hours of advanced standing in the M.P.S. program. Partial credit for experience cannot be awarded. When awarded for prior work experience, the 6 credit hours are applied toward the Synthesis requirement.

Master of Science (M.S.)

M.S. Program Requirements

The Environmental Studies M.S. degree program is a 30-credit-hour experience focused on advanced academic scholarship and research related to environmental affairs and sustainability. This degree requires the completion of a Master's thesis. Details on thesis proposals and expectations are available in the M.S. in Environmental Studies student handbook. All students must present a Capstone Seminar during their final semester. If necessary, the distribution of required credits may be adjusted to take into account a student's prior academic work and background. It is recommended that students entering this program have some academic background in Environmental Policy or Communication, and Environmental Science or Ecology.

Core Courses (9 credits)

EST 600	Foundations/Envrnmntl Studies	3

All students also take at least two of the following:

Elective Courses

EST 608	Env Adv Camp & Conflict Res	3
EST 612	Environmntl Policy &Governance	3
EST 613	Urbanization & the Environment	3
EST 615	Environmental Justice	3
EST 640	Envrn Thought and Ethics	3

EST 645	Mass Media&Envrn Affairs	3
EST 650	Envrn Perception&Human Behavr	3
EST 708	Environment and Society	3
EST 770	Regen Approaches Sust Futures	3

Research Methods (6 credits)

All students take:

Core Courses		
EST 603	Research Methods and Design	3

And one additional research methods course, typically from the following list and typically to support their thesis research:

Elective Courses		
APM 510	Statistical Analysis	3
APM 625	Sampling Methods	3
APM 630	Regression Analysis	3
EST 604	Survey Research Methods	3
EST 605	Qualitative Methods	3
EST 617	Measuring Envrnmntl Inequality	3
EST 702	Env&Nat Res Prog Eval	3
EST 705	Environmental Policy Analysis	3
LSA 640	Research Methods	3

NOTE: Other research methods courses may be identified in collaboration with the student's advisor.

Generalized / Thematic Area (9 credits)

All students take three courses--typically in a thematic area--in consultation with their major professor. The thematic area should be used to substantively prepare the student for thesis work. EST 898 and EST 899 may not be included as thematic area courses.

Thesis Research (6 credits)

All students with an approved thesis proposal take at least six credits of:
EST 899. Master's Thesis Research

Master of Professional Studies (M.P.S.) in Environmental Studies

The M.P.S. in Environmental Studies degree program is a 30-33 credit-hour experience focused on advanced academic scholarship and its application to environmental affairs and sustainability. This degree requires the completion of a synthesis experience, often involving an individual or group-based professional internship. All students must present a Capstone Seminar during their final semester. See your advisor or the Department Office for information on procedures and deadlines for setting up the Capstone Seminar. The distribution of required credits may be adjusted to take into account a student's prior academic work and background. All courses are 3 credit hours unless noted otherwise. It is recommended that students entering this program have some academic background in Environmental Policy or Communication, and Environmental Science or Ecology.

M.P.S. Program Requirements

Core (12 credits)

Four courses cover the disciplinary and methodological scope of the field and demonstrate its applicability to problem analysis and the quest for sustainability. For full-time students, these courses are usually taken in the first year of the program; Part-time students may take these courses over multiple years. These courses provide a basis of common knowledge among students in the MPS program.

Required Courses

EST 600	Foundations/Envrnmntl Studies	3

AND three of the following:

These are the recommended courses to help develop the fundamental knowledge and skill set for Environmental Studies:

Required Courses

EST 606	Envrn Risk Perceptn/Comm&Pol	3
EST 608	Env Adv Camp & Conflict Res	3
EST 612	Environmntl Policy &Governance	3
EST 613	Urbanization & the Environment	3
EST 615	Environmental Justice	3
EST 616	Global Persp on Env Justice	3
EST 624	Nature,Recreation and Society	3
EST 635	Pub Part&Decision Making	3
EST 640	Envrn Thought and Ethics	3

EST 645	Mass Media&Envrn Affairs	3
EST 650	Envrn Perception&Human Behavr	3
EST 652	Managing Sustainability	3
EST 708	Environment and Society	3
EST 770	Regen Approaches Sust Futures	3

Alternate courses may be identified in collaboration with the student's advisor.

Natural Sciences (3 credits)

At least one natural science course is required in order to enhance the student's existing knowledge. Typically this would be one of the following courses, though alternatives may be considered in consultation with the student's advisor.

Required - 1 course chosen from:

Required Courses

EFB 518	Systms Ecology: Eco Mdlng&Dsgn	3
EFB 523	Tropical Ecology	3
EFB 600	Toxic Health Hazards	4
EFB 611	Topics in Envrnmntl Toxicology	3
EFB 623	Marine Ecology	5
EFB 650	Landscape Ecology	3
FOR 538	Meteorology	3
FOR 642	Watershed Ecology & Management	3
FOR 680	Urban Forestry	3
SRE 525	Energy Systems	3
SRE 535	Renewable Energy	3

Research / Technical Methods (3 credits)

At least one research or technical methods course is required to provide skills necessary to apply environmental knowledge and pursue the synthesis experience for the MPS. Typically this would be one of the following, but an alternative course may be selected in consultation with the student's advisor.

Required - 1 course chosen from:

Elective Courses

APM 510	Statistical Analysis	3
APM 625	Sampling Methods	3
APM 630	Regression Analysis	3
ENS 519	Spatial Ecology	3
ERE 551	GIS for Engineers	3
EST 550	Envrn Impact Analysis	3
EST 570	Intro/Pers Env Interp Methods	3
EST 603	Research Methods and Design	3
EST 604	Survey Research Methods	3
EST 617	Measuring Envrnmntl Inequality	3
EST 627	Environmental &Energy Auditing	3
EST 671	Non-Personal Envrn Interp Meth	3
EST 702	Env&Nat Res Prog Eval	3
EST 705	Environmental Policy Analysis	3
FOR 557	Fundamentals of GIS	3
FOR 659	Advanced GIS	3
LSA 500	Digital Methods & Graphics I	3
LSA 501	Landscape Representation II	3
LSA 552	Graphic Communication	3
LSA 640	Research Methods	3
LSA 650	Behavr Factor/Comm Desgn	3
SRE 679	Life Cycle Assessment	3

Generalized / Thematic Area (9 credits)

Three additional courses are selected in consultation with the student's Steering Committee. The Generalized or Thematic Area courses are used to prepare the student for capstone synthesis work and post-graduation work opportunities by enhancing a solid knowledge of some aspect of Environmental Studies. Course selection is determined through the Graduate Program of Study;

students will be encouraged to include courses in their plans of study that enhance their career goals. EST 898 and EST 899 may not be included as Generalized or Thematic Area courses.

Synthesis (3-6 credits)

In order to synthesize and apply their knowledge of Environmental Studies, all students take 3-6 credit hours of one of the following:

- EST 798 Problems in Environmental Studies (3-6 cr, Synthesis Paper)
- EST 898 Professional Experience (6 cr, Internship)

OR successfully complete a group research project or internship via enrollment in a graduate-level course with such a focus (3-4 cr), such as EST 690, International Environmental Policy Consultancy.

Master of Professional Studies (M.P.S.) in Environmental Leadership, Justice, and Communication

M.P.S. Program Requirements

EST 555	Public Relations Mgt/Env Profs	3
EST 606	Envrn Risk Perceptn/Comm&Pol	3
EST 608	Env Adv Camp & Conflict Res	3
EST 612	Environmntl Policy &Governance	3
EST 615	Environmental Justice	3
EST 616	Global Persp on Env Justice	3
EST 617	Measuring Envrnmntl Inequality	3
EST 635	Pub Part&Decision Making	3
EST 640	Envrn Thought and Ethics	3
EST 798	Problems/Envrn Studies	1 - 3
OR		
EST 898	Professional Experience	1 - 12

Certificate of Graduate Study in Environmental Decision Making

The Certificate of Graduate Study in Environmental Decision Making is designed is designed for graduate students at ESF and those enrolled in law, management, public administration, or information studies programs at Syracuse University. It provides an exposure to specialized environmental study that is relevant to students with related professional interests. The focus of this certificate is on environmental decision making, the processes by which stakeholders seek solutions to environmental problems.

Student Eligibility

Graduate students currently matriculated and in good academic standing in their graduate degree programs at SUNY ESF and Syracuse University are eligible to apply for entrance to the certificate program.

Administrative Procedures

Application and admissions procedures, compliance with college requirements for successful graduate study and the awarding of certificates are all administered by ESF's Dean of Instruction and Graduate Studies, 227 Bray Hall. If enrollment limitations are established, acceptances will be made on a rolling basis, according to the date of receipt of applications.

Certificate Program Requirements

Core Courses

EST 635	Pub Part&Decision Making	3

Choose 9 credits from the following two lists*, at least one course from each:

Environmental Policy and Law

EST 609	Collaborative Governance Proc	3
EST 612	Environmntl Policy &Governance	3
EST 615	Environmental Justice	3
EST 660	Land Use Law	3
EST 702	Env&Nat Res Prog Eval	3
EST 705	Environmental Policy Analysis	3
EST 770	Regen Approaches Sust Futures	3
EST 796	Adv Topics/Envrn Studies	1 - 3
FOR 687	Environmental Law & Policy	3
FOR 689	Natural Resources Law & Policy	3
LAW 716		
LAW 865		
PAI 775	Engy, Envrmnt, Rsrces Policy	0 - 8
PAI 777	Econ of Environmental Policy	0 - 8
SRE 622	Energy Markets and Regulation	3

Human and Environment Interactions

EST 606	Envrn Risk Perceptn/Comm&Pol	3

EST 608	Env Adv Camp & Conflict Res	3
EST 613	Urbanization & the Environment	3
EST 624	Nature,Recreation and Society	3
EST 640	Envrn Thought and Ethics	3
EST 645	Mass Media&Envrn Affairs	3
EST 650	Envrn Perception&Human Behavr	3
EST 750		
EST 708	Environment and Society	3
LSA 650	Behavr Factor/Comm Desgn	3
PAI 730	Problems in Public Admin.	0 - 8

*Alternate courses may be substituted in these two areas, by petition.

Certificate of Advanced Study in Environmental Leadership

The graduate certificate of advanced study in Environmental Leadership equips decision-makers, managers, facilitators, advocates, and community leaders with the skills and understanding to address complex environmental challenges. Participants in the program will develop their capacities to find common ground among diverse points of view, to advance decision making that considers both scientific knowledge and deeply held values, and to facilitate cooperation across social, organizational, and administrative boundaries.

All students take

EST 640	Envrn Thought and Ethics	3
EST 612	Environmntl Policy &Governance	3
EST 635	Pub Part&Decision Making	3

Certificate of Advanced Study in Science & Environmental Communication and Public Relations Management

The certificate of advanced study in Science and Environmental Communication and Public Relations Management prepares current and future environmental professionals, decision-makers, and engaged citizens to communicate effectively, as well as to analyze and assess factors influencing public perceptions of environment, science, and risk. Effective communication and dialogue in environmental decision-making is emphasized, as participants learn to develop, engage, and evaluate audience-centered communication strategies that respond to points of convergence and conflict.

All students take

EST 555	Public Relations Mgt/Env Profs	3
EST 606	Envrn Risk Perceptn/Comm&Pol	3
EST 608	Env Adv Camp & Conflict Res	3

Certificate of Advanced Study in Environmental Justice and Inequality

The Certificate of Advanced Study in Environmental Justice and Inequality is designed to equip people interested in social and justice issues, including environmental professionals, community leaders, and advocates, with the analytical skills to deeply engage existing research and evidence on the unique environmental vulnerabilities faced by marginalized communities. This engagement uses a theory and case-based grounding in the structural and systemic factors that generate and perpetuate these inequities. The program's interdisciplinary approach includes tools and methods drawn from geography, sociology, environmental and public health, policy and law, sustainability science, and critical race theory. It builds upon these frameworks to develop new strategies for equitable and liberatory practice.

All students take

EST 615	Environmental Justice	3
EST 616	Global Persp on Env Justice	3
EST 617	Measuring Envrnmntl Inequality	3

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.) **G** = General Education Course (GenEd), **E** = Engineering, **ES** = Engineering Sciences, **M** = Mathematic, **NS** = Natural Sciences, **PE** = Professional Education, **S** = Summer-only*

DEPARTMENT OF LANDSCAPE ARCHITECTURE

M.Margaret Bryant, Chair
101 Marshall Hall
315-470-6544

Since 1911 the Landscape Architecture program at SUNY ESF has been educating practitioners and teachers, designers and planners, advocates and policy makers who have devoted careers to a viable, sustainable integration of natural and cultural communities.

The Department of Landscape Architecture offers three degree programs designed to educate students to contribute in varied ways to society and the wise use of land and landscape. Each provides a basis for students to establish career directions in the profession of landscape architecture and related fields. The bachelor and Master of Landscape Architecture, and master of science degrees are offered. Qualified undergraduate students may apply for the combined B.L.A./M.S. fast-track option.

Students in the department are required to have a laptop computer with appropriate software. Guidelines are available from the Department of Landscape Architecture. Many classes also have required field trips to project sites, or to study built works. Course fees attached to such classes cover transportation. Course fees also cover supplies for final plots for class assignments.

BACHELOR OF LANDSCAPE ARCHITECTURE

The B.L.A. program is designed for those students desiring to enter the profession of landscape architecture either directly after completing the degree or after completing graduate school. This is a professional degree with an emphasis on the skills and knowledge required to qualify as a landscape architect.

Accreditation

The degree is accredited by the Landscape Architectural Accreditation Board (LAAB).

The B.L.A. degree is granted at the end of five years of study and requires the successful completion of 141 credit hours. Students are accepted into the lower-division landscape architecture program as freshmen or as sophomore transfers and into the upper-division program as junior transfers.

Lower Division Required Courses

APM 103	Applied Algebra & Trigonometry	3
EFB 100	Survey of Biology	4
ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
EWP 290	Research Writing & Humanities	3
LSA 132	Orientation Seminar:LSA	1
LSA 182	Drawing Studio	3
LSA 206	Art,Culture&Landscape II	3
LSA 212	Place/Culture/Design	3
LSA 220	Intro/Landscape Architect	3
LSA 226	Foundation Design Studio I	4
LSA 227	Foundation Design Studio II	4
LSA 300	Digital Methods & Graphics I	3
LSA 301	Landscape Representation II	3

LSA 305	History/Landscape Arch I	3
LSA 311	Natural Proc-Design&Plan	3
LSA 333	Plant Materials	2

Electives

Course	Codes*	Credits
General Education Course: Social Sciences	G	3
General Education Course select one: World History and Global Awareness, World Languages, US History & Civic Engagement	G	3

Upper Division Required Courses

EWP 407	Writing/Env & Sci Professionls	3
LSA 312		
LSA 321	Ecol Appl/Plng & Design	3
LSA 326	Land Arch Dsgn Studio I	5
LSA 327	Land Arch Dsgn Studio II	5
LSA 342	Land Arch Construct Tech	4
LSA 343	Landscape Materials&Structures	3
LSA 422	Land Arch Dsgn Studio III	5
LSA 423	Land Arch Dsgn Studio IV	5
LSA 424	Prep:Off-Camp Des Studio	1
LSA 425	Orient:Off-Camp Dsgn Studio	3
LSA 433	Planting Design&Practice	3
LSA 451	Comprehensive Land Plan	3
LSA 455	Prof Prac/Lndscpe Arch	3

LSA 458	Off-Camp:Adv Visit,Wkly Rpts	4
LSA 459	Off-Camp:Dsgn Journal/Proj Ntb	4
LSA 460	Off-Camp:Thesis Project	7
LSA 461	Off-Camp Final Present Sem	1
LSA 470	Thematic Land Dsgn Studio	6
	Free Electives	15

Total Minimum Credits For Degree: 141*

*curriculum pending NYSED approval

B.L.A./M.S. FAST TRACK

This option is available to outstanding fourth-year bachelor of landscape architecture students and provides the opportunity to receive both the bachelor of landscape architecture and master of science degrees during a six-year period at the College. Students who apply must have a minimum 3.000 GPA and are accepted into the program during the fall semester of the fourth year of the bachelor of landscape architecture program. The transition between the bachelor of landscape architecture and master of science curriculum requirements begins in the fall of the fifth year. The B.L.A. degree is awarded on completion of all professional requirements and a minimum of 141 credit hours. The M.S. degree is awarded after the completion of 30 graduate credits and successful completion of a research thesis. Depending on the student's needs and research interests, there are two options available for pursuing an off-campus semester or a field research component. The first option (option A) allows students to pursue the off-campus semester with their undergraduate peers. The second option (option B) links the off-campus semester to graduate field research for their theses.

Fast-Track Option A – Summer start

Fourth Year, Summer option only

LSA 458	Off-Camp:Adv Visit,Wkly Rpts	4
LSA 459	Off-Camp:Dsgn Journal/Proj Ntb	4
LSA 460	Off-Camp:Thesis Project	7

Fifth Year (25-28 credits)

LSA 455	Prof Prac/Lndscpe Arch	3
LSA 461	Off-Camp Final Present Sem	1
LSA 470 OR	Thematic Land Dsgn Studio	6
LSA 670	Thematic Land Dsgn Studio	6
LSA 596	Spec Topics/Lndscpe Arch	1 - 3
LSA 640	Research Methods	3
LSA 697	Topics+Issues/Land Arch	Audit
LSA 799	Capstone/Thesis Prop Dev	3
	Directed Electives	6 - 9

B.L.A. program completed with a minimum of 141 credits earned

Sixth Year (12-24 credits)

LSA 899	Masters Thesis Research	1 - 12
	Directed Electives	6 - 12

Students may register for LSA 899 Master's Thesis Research as necessary for completion up to the time limit of the M.S. program. Minimum of 6 credits required.

B.L.A./M.S. fast-track program completed with a minimum of 171 credits hours of which a minimum of 30 credit hours must be graduate level courses.

Fast-Track Option B – Fall start

Fifth Year (24-27 credits)

LSA 455	Prof Prac/Lndscpe Arch	3
LSA 470 OR	Thematic Land Dsgn Studio	6
LSA 670	Thematic Land Dsgn Studio	6
LSA 596	Spec Topics/Lndscpe Arch	1 - 3
LSA 625	Orient/Experientl Studio	Audit
LSA 640	Research Methods	3
LSA 697	Topics+Issues/Land Arch	Audit
	Directed Electives	6 - 9

Fifth Year, Summer (6-12 credits)

LSA 760 OR	Off-Camp Experient Studio	12
LSA 798	Research Problem	1 - 12

6 credits of LSA 798 may be taken to fulfill this requirement. LSA 760 or LSA 798 must be linked to thesis.

B.L.A. program completed with a minimum of 141 credits

Sixth Year (18-24 credits)

LSA 899	Masters Thesis Research	1 - 12
	Graduate-level Directed Electives	6 - 12

Students may register for LSA 899 Master's Thesis Research as necessary for completion up to the time limit of the M.S. program. Minimum of 6 credits required.

B.L.A./M.S. fast-track program completed with a minimum of 171 credits, of which a minimum of 30 credits must be graduate level courses.

MASTER OF LANDSCAPE ARCHITECTURE (M.L.A.)

The degree is accredited by the Landscape Architectural Accreditation Board (LAAB).

A three-year program for applicants who have no design or planning background leads to the fully accredited professional degree of master of landscape architecture (M.L.A.). This program is for students who intend to complete coursework full time. Applicants with a related design or planning degree may enter the three-year program with advanced standing.

The M.L.A. program, for the student seeking a first professional degree in landscape architecture, is a more tightly structured curriculum because it leads to the prerequisite work experience that qualifies the graduate for the Landscape Architecture Registration Examination (L.A.R.E.).

M.L.A. Program Requirements

LSA 500	Digital Methods & Graphics I	3
LSA 501	Landscape Representation II	3
LSA 552	Graphic Communication	3
LSA 600	Design Studio I	4
LSA 601	Design Studio II	4
LSA 605	History of Landscape Arch	3
LSA 611	Natural Factors Analysis	3
LSA 615	Site Construction	3
LSA 620	Design Studio III	4
LSA 632	Plants and Landscapes	2
LSA 633	Planting Design&Practice	3
LSA 640	Research Methods	3
LSA 645	Construct Document Studio	3
LSA 650	Behavr Factor/Comm Desgn	3
LSA 651	Comprehensive Land Plan	3
LSA 655	Prof Prac/Lndscpe Arch	3
LSA 670	Thematic Land Dsgn Studio	6

LSA 697	Topics+Issues/Land Arch	1
LSA 700	Design Studio V	4
LSA 799	Capstone/Thesis Prop Dev	3
LSA 800	Capstone Studio	6

Final Integrative Experience

M.L.A. students must complete an integrative experience. Students must participate in the capstone studio and complete a 6-credit independent design project during the final semester of the program. M.L.A. students must disseminate the results of their integrative studies through capstone seminars.

The M.L.A. program requires 70 credit hours.

Master of Science (M.S.)

Because the M.S. program serves the advanced professional, course requirements do not address foundation professional courses in landscape architecture. However, the student, in consultation with the major professor and steering committee, has great flexibility in developing a program of study suited to career goals in the chosen area of study.

M.S. Program Requirements

LSA 640	Research Methods	3
LSA 697	Topics+Issues/Land Arch	1
LSA 799	Capstone/Thesis Prop Dev	3
LSA 899	Masters Thesis Research	1 - 12

Students may register for LSA 899 Master's Thesis Research as necessary for completion up to the time limit of the M.S. program. Minimum of 6 credits required.

Final Integrative Experience

M.S. students must complete an integrative experience and must complete a thesis (6 credits). The thesis may be research in which new, original knowledge is generated, it may be a study that focuses on the application of existing knowledge to a new situation, or it may combine both elements. Students must disseminate the results of their integrative studies through capstone seminars.

Areas of Study

The landscape architecture graduate degree programs provide a well-balanced curriculum in landscape architectural design and planning, coupled with opportunities to pursue individualized advanced study in a broad range of topics.

The diversity of faculty interests and expertise offer both M.L.A. and M.S. students opportunities for in-depth exploration in three areas of study: community design and planning, cultural landscape conservation, and landscape and urban ecology.

Community Design and Planning (M.L.A., M.S.)

The purpose of this area is to address design, planning and research with regard to human settlements including discrete traditional communities such as cities, towns, hamlets, and their hinterlands; regional and rural communities connected to agriculture, watersheds and forests; and specialized communities such as institutional and corporate campuses, co-housing and new towns.

Cultural Landscape Studies and Conservation (M.L.A., M.S.)

This area addresses a range of issues germane to the developmental and interpretive history of the cultural landscape. At its most fundamental level, the study area prepares students to address preservation planning and management for a range of cultural landscape types including historic sites and settlements, designed landscapes and vernacular landscapes.

There is also a growing set of interdisciplinary methods relevant to cultural landscape studies such as critical history, landscape representation, media, visual perception and reception of landscapes, interpretation, narrative and participatory design. Graduate students may explore and/or integrate these methods with design and preservation practices.

Landscape and Urban Ecology (M.L.A., M.S.)

The purpose of this area of study is to address a range of theoretical and practical applications in landscape and urban ecosystems as they relate to the practice of landscape architecture and community design.

In this contemporary interdisciplinary approach, students will learn about the structure, heterogeneity and ecological processes of a broad range of natural, modified and urban landscapes. People are recognized as an integral part of the landscape and are included as a major focus of research and practice.

Doctoral Level Studies

Doctoral level studies in landscape architecture may be tailored in connection with the interdisciplinary Ph.D. program in the Graduate Program in Environmental Science (GPES). Please see The Division of Environmental Science section of this catalog.

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.) G = General Education Course (GenEd), E = Engineering, ES = Engineering Sciences, M = Mathematic, NS = Natural Sciences, PE = Professional Education*

ESF OPEN ACADEMY

Dr. Darshini Roopnarine, Director
315-470-6810

The ESF Open Academy is an academic unit that encompasses the College's outreach programs including online education, summer semester, professional and public education, and visiting student support.

To these ends, ESF faculty, staff and students, along with our partners, pursue a diverse range of programs and projects—all with an aim to enhance leadership, education, and practice in the science, design, engineering and management of natural resources and the environment. Programs include on-campus, off-campus, and online credit and non-credit opportunities for professionals, middle and high school students, ESF students, and lifelong learners.

BACHELOR OF SCIENCE IN SUSTAINABILITY MANAGEMENT

The Bachelor of Science in Sustainability Management (SM) is a fully online Bachelor of Science completion program (in effect, the third and fourth program years) that integrates discipline- and career-focused knowledge, skills, and perspectives based on the three pillars of sustainability: economics, society, and the environment. Emphasis is placed upon understanding how key environmental dimensions of sustainability are interdependent with socially and economically viable policies and practices. This program builds upon a broad and flexible foundation at the lower division with specialized sustainability college coursework at the upper division. Students synthesize knowledge and skills and strengthen workforce-readiness through a capstone project. The program's upper division sustainability coursework prepares graduates for a wide and expanding range of career positions in the public, private and non-profit sectors.

Lower Division Required Courses

Lower Division Courses are expected to be completed prior to matriculation in the Sustainability Management degree program.

Course	Codes*	Credits
Physical/Natural Science Elective		3
Introduction to Sustainability		3
Ecology		3 - 4
College Algebra or Higher		3
Probability & Statistics		3
Economics		3
English with a focus on Writing 1		3
English with a focus on Literature		3
Public Speaking		3
DEISJ General Education Course		3
Sociology		3
Free Electives		21

Total Lower Division Credits Required: 60 – 61

Lower Division Courses are expected to be completed prior to matriculation in the Sustainability Management degree program.

Elective		
GENEDU	General Education Elective	3
GENEDU	General Education Elective	3
Upper Division Required Courses		
SUS 300	Sus Systems: Eco, Econ, & Soc	3
SUS 310	Human & Soc Dim Sustainability	3
SUS 320	Eco. Dim. Of Sustainability	3
SUS 330	Intro Sustain. Data Analysis	3
SUS 340	Principles Sustainable Dvlpmnt	3
SUS 350	Intro. Spatial Analysis & GIS	3
SUS 360	Climate Change&Sustainability	3
SUS 400	Analysis Sustainable Systems	3
SUS 410	Sustainable Urbanism	3
SUS 420	Sust Enrgy: Tech,Systms&Policy	3
SUS 430	Managerial Ecnmcs for Sustblty	3
SUS 440	Env Justice:Pol, Law & Society	3
SUS 450	Civic Engagement&Particip Plng	3
SUS 480	Sustainability Mngmnt Capstone	3

Upper Division Elective

Course	Codes*	Credits
Upper Division Elective Courses		18

Total Upper Division Credits Required: 60

Total Minimum Credits For Degree: 120

DEPARTMENT OF SUSTAINABLE RESOURCES MANAGEMENT

Chris Nowak, Chair
319 Bray Hall
315-470-6575
315-470-6535 (fax)
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Our mission in SRM is to advance our understanding of current environmental issues through cutting edge research, education, and outreach, with a special focus on sustainably managing renewable, natural and constructed resources, including energy, forests, recreation, soils, water, and building materials, to provide short- and long-term benefits with and for people. With a group of internationally known faculty, we address these issues both locally and nationally, across a range of scales through both applied and fundamental research, technology transfer and teaching.

The department offers programs leading to bachelor's, master's and doctoral degrees at the main college campus in Syracuse, N.Y., and three programs leading to the associate in applied science (A.A.S.) degree at The Ranger School in Wanakena, N.Y. See the Ranger School for information about the associate of applied science degrees in forest technology, land surveying technology, and environmental and natural resources conservation.

Undergraduate Programs

Sustainable Resources Management programs prepare students for work with public and private sector organizations and consultancies, and for further professional or scientific study at the graduate level.

Summer Program

The Summer Program is required for all B.S. degree candidates in FES, FRM and NRM. The program is a four-week session that begins at the end of May and lasts through late June. It is taught at ESF's Wanakena Campus in the Adirondacks. The program consists of one course: FOR 304 Adirondack Field Studies. Students must complete the summer program before the junior year. Students who completed an A.A.S. degree from the ESF Ranger School meet this requirement through transfer credits.

BACHELOR OF SCIENCE IN CONSTRUCTION MANAGEMENT

Construction Management prepares students to work in an integrated team with a diverse group of owners, architects, engineers, construction craftspersons, and material suppliers. The manager helps to ensure that the owner's goals for cost, schedule, quality, and sustainability are met. Students may enter the Bachelor of Science program as first-year students or as transfer students. Our graduates have excellent placement rates and starting salaries.

The Bachelor of Science degree in Construction Management at ESF is distinguished by a strong emphasis on project-based learning, a unique focus on sustainability, a hands-on laboratory environment, and a strong relationship with Syracuse University.

- Students are engaged each semester in classes, clubs, and competitions that allow them to take on responsibility and deliver projects for the campus and community. Whether building bridges or tiny homes, planning net zero projects for displaced residents or autistic children, CM students are building our future. To read how the CM students won a national prize for their work, and then helped the project be built.
- ESF is a leader in sustainability, and the Construction Management program is no different. Our CM students take multiple courses on sustainability, and a majority take and pass the LEED Green Associate exam. CM students help to organize and run the NYS Green Building Conference, where they meet and engage with professionals on the cutting edge of the industry.
- The green building materials lab, the wood machining lab, and the material testing lab give students the hands-on experience to understand the materials and processes used for construction.
- ESF construction managers work alongside Syracuse University architects and engineers on integrated team projects and competitions. ESF Construction Management students taking classes at Syracuse University find themselves working with students from Real Estate, Management, Architecture, and Civil Engineering majors.

The educational program, leading to the professional Bachelor of Science degree in Construction Management, is accredited by the American Council for Construction Education.

Lower Division Required Courses

APM 104	College Algebra & PreCalculus	3
APM 105	Survey Of Calc & Appl I	4
CME 132	Orientation Seminar:SCME	1
CME 215	Sustainable Construction	3
CME 226	Statics&Mechanics of Materials	4
CME 106	Engr Materials/Sustainble Cons	3
CME 332	Mech/Elect Equipment	3

CME 142	Light Construction	3
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
EWP 290	Research Writing & Humanities	3
FCH 110	Survey of Chemical Principles	3
FCH 111	Survey/Chemical Principles Lab	1
FOR 205	Principles of Accounting	3
FOR 207	Introduction To Economics	3
FOR 360	Principles of Mgmt/Envrn Prof	3
PHY 211	General Physics I	0 - 8
PHY 221	General Physics I Laboratory	0 - 8

General Education Courses

Course	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

APM 391	Intro/Probability&Stats	3
CME 255	Plan Interpn&Quantity Takeoff	3
CME 303	Construction Mngmnt Internship	1 - 4
CME 305	Sustainable Energy Sys/Bldgs	3
CME 327	Site Investigatns & Solutions	3

CME 331	Construction Safety	3
CME 335	Cost Engineering	3
CME 343	Construction Estimating	3
CME 404	Applied Structures	3
CME 405	Bldg Info Modelng/Cons Mgt	3
CME 453	Construct Plan/Scheduling	3
CME 454	Capstone in Construction Mngmt	3
CME 455	Construct Contracts/Specs	3
CME 497	Senior Ethics Seminar	1
ERE 371	Surveying For Engineers	3
FOR 485	Business and Managerial Law	3
RMS 387	Renewable Mat/Sustainable Cons	3
RMS 422	Composite Mat/Sustainable Cons	3

Free Electives

Course	Codes*	Credits
Electives		18

Total Minimum Credits For Degree: 124

BACHELOR OF SCIENCE IN FOREST ECOSYSTEM SCIENCE

The Forest Ecosystem Science degree is based on a vision that combines professional competency in forest management skills with an enhanced understanding of ecological sciences. Students interested in this program typically are drawn to natural settings and environments, enjoy nature, and want to understand how forested ecosystems work. ESF provides a wide variety of opportunities to meet student needs utilizing 25,000 acres of forest lands as teaching laboratories. Internships with natural resource-based organizations in the business, public and nonprofit sectors provide additional hands-on experiences. Experiential field learning is combined with learning concepts and skills in the classroom and laboratory on ESF's Syracuse campus.

The undergraduate curriculum in forest ecosystem science consists of two broad categories of courses. The first category, general education, provides students with knowledge and skills that are useful and important for all educated persons regardless of their profession as well as preparation for advanced courses leading to a specific profession. The second category, professional courses, provides students with direct preparation for a career. The first two years of college usually focus on general education and the second two on the professional studies.

The FES program allows students to obtain the professional skills that employers look for in new employees and a deeper understanding of the scientific basis of those skills. These skills are developed through a combination of core courses focusing on biology, ecology, ecosystems, and management. The forest ecosystem science degree offers a wide variety of employment opportunities. Graduates work throughout the United States in public agencies, private industry, and for nonprofit organizations. They also are well prepared to enter graduate programs in management of forest and natural resources, ecological research, or other areas of applied forest biology.

Forest ecosystem science offers a wide variety of employment opportunities. Graduates work throughout the United States in public agencies, private industry, and for nonprofit organizations. They also are well prepared to enter graduate programs in management of natural resources, ecological research, or other areas of applied forest biology.

The educational program, leading to the professional Bachelor of Science degree in Forest Ecosystem Science, is accredited by the Society of American Foresters (SAF) under Forestry.

Lower Division Required Courses

APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 101	Gen Bio I:Organismal Bio&Ecol	3
EFB 102	General Biology I Laboratory	1
EFB 103	Gen Bio II:Cell Bio & Genetics	3

EFB 104	General Biology II Laboratory	1
ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
EWP 290	Research Writing & Humanities	3
FCH 150	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FCH 152	General Chemistry II	3
FCH 153	General Chemistry II Lab	1
FOR 132	Orientation Seminar: SRM	1
FOR 207	Introduction To Economics	3
FOR 232	Natural Resources Ecology	3
FOR 332	Forest Ecology	4
FOR 360	Principles of Mgmt/Envrn Prof	3
PHY 101	Major Concepts of Physics I	0 - 8

Upper Division Required Courses

EFB 336	Dendrology I	3
ESF 300	Intro/Geospatial Info Tech	3
FOR 304	Adirondack Field Studies	4
FOR 313	Tree Structure and Function	3
FOR 322	Nat Res Measuremnts & Sampling	3
FOR 323	Forest Biometrics	3
FOR 334	Silviculture	4
FOR 345	Introduction to Soils	3
FOR 465	Natural Resources Policy	3
FOR 492	Capstone Rsrch in Frst Eco Sci	3

FOR 493	Capstone Synth in ForEco Stwrd	3

Elective Courses

Course	Codes*	Credits
Directed Electives: Biophysical Science	PE	12
Directed Electives: Management and Human Dimensions	PE	9
Free Electives		14
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Students should consult with their advisors and read the Sustainable Resources Management Handbook for lists of courses that can be elected to meet degree requirements.

Total Minimum Credits For Degree: 124

BACHELOR OF SCIENCE IN FOREST RESOURCES MANAGEMENT

Professional forestry education has been featured at ESF since the College's founding in 1911. Today's Forest Resources Management program is the top (#1) Forestry Program in the United States according to Study.com. The program is based on a clear vision that combines professional competency with a strong foundation in the biophysical sciences, humanities, and social sciences to meet society's needs for forest managers.

Many ESF students enjoy trees and forests and want to work in forested settings. They appreciate nature, and want to master the knowledge and skills needed to conserve and manage forests and the environment. With 25,000 acres of college forestlands as teaching and research laboratories, ESF provides many opportunities to meet student needs for experiential learning. The Forest Technology program at ESF's Wanakena campus prepares students for careers in field forestry and is one option towards the Forest Resources Management program that emphasizes field skills. Internships with forest-based organizations in the private, public and nonprofit sectors amplify these hands-on experiences. Practical experience is combined with learning concepts and problem solving and critical thinking skills in the classroom and laboratory on ESF's Syracuse campus.

Forest resources management is an integration of forest ecology and biology, forest measurements, forest policy and administration, and courses to predict and evaluate the effects of manipulation.

Timber, water, soils, recreation, wildlife, and a broad array of environmental values and services, such as biodiversity and healthy forest systems, are important results of effective management. This major prepares students to be well-rounded generalists who can practice forestry and succeed as professionals in a variety of allied natural resources management fields.

Forest resources management offers a wide variety of employment opportunities. Our graduates are working throughout the United States as professional foresters and natural resource managers in private industry, public agencies, and for nonprofit organizations. Their duties can range from timber management to recreation planning to environmental education, to name a few.

The educational program, leading to the professional Bachelor of Science degree in Forest Resources Management, is accredited by the Society of American Foresters (SAF) under Forestry.

Lower Division Required Courses

APM 103 OR	Applied Algebra & Trigonometry	3
APM 104	College Algebra & PreCalculus	3
APM 391	Intro/Probability&Stats	3
EFB 100	Survey of Biology	4
EFB 336	Dendrology I	3

ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
EWP 290	Research Writing & Humanities	3
FCH 110 AND	Survey of Chemical Principles	3
FCH 111 OR	Survey/Chemical Principles Lab	1
FCH 150 AND	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FOR 132	Orientation Seminar: SRM	1
FOR 207	Introduction To Economics	3
FOR 232	Natural Resources Ecology	3
FOR 313	Tree Structure and Function	3
FOR 332	Forest Ecology	4
Upper Division Required Courses ESF 300	Intro/Geospatial Info Tech	3
FOR 304	Adirondack Field Studies	4
FOR 322	Nat Res Measuremnts & Sampling	3
FOR 323	Forest Biometrics	3
FOR 333	Natural Resrc Managerial Econ	3
FOR 334	Silviculture	4
FOR 345	Introduction to Soils	3
FOR 360	Principles of Mgmt/Envrn Prof	3
FOR 370	Forest Mgmt Dec Mkng&Plng	3
FOR 373	Sustainable Harvesting Pract	3
FOR 402	Prof Forestry Mentoring Prog	1
FOR 421	Prctical Ethics for Rsrce Mgrs	3

FOR 433	Advanced Silviculture	3
FOR 465	Natural Resources Policy	3
FOR 490	Integrated Resources Mgt	3

Elective Courses

Course	Codes*	Credits
Technical Electives Technical electives must include at least one course in each of the subject areas: human dimensions; water resources; forest health; wildlife management; business finances; and wood products. Students should consult with their advisor and the Sustainable Resources Management Handbook for recommended courses	PE	18
Free Electives		15
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Total Minimum Credits For Degree: 125

BACHELOR OF SCIENCE IN NATURAL RESOURCES MANAGEMENT

The Natural Resources Management (NRM) program is structured to introduce students to a wide range of renewable natural resources (soils, water, vegetation, wildlife, recreation), while maintaining substantial flexibility for student-centered learning in understanding and managing natural systems. It is based on a vision that combines professional competency in management skills with a strong foundation in the social and biophysical sciences.

The program develops professional skills that employers tell us are the most important traits they look for in new employees. These traits are developed through a broad base of classes in the natural sciences, social sciences and humanities, communication, and quantitative and qualitative problem-solving skills. The majority of work scheduled during the first two years (lower division) is in these areas. This major prepares students to be well-rounded natural resources managers.

The educational program, leading to the professional degree in Natural Resources Management, is accredited by the Society of American Foresters (SAF) under Natural Resources and Ecosystem Management.

Lower Division Required Courses

APM 103 OR	Applied Algebra & Trigonometry	3
APM 104	College Algebra & PreCalculus	3
APM 391	Intro/Probability&Stats	3
EFB 100	Survey of Biology	4
ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
EWP 290	Research Writing & Humanities	3
FCH 110 AND	Survey of Chemical Principles	3
FCH 111 OR	Survey/Chemical Principles Lab	1
FCH 150 AND	General Chemistry I	3
FCH 151	General Chemistry I Lab	1
FOR 132	Orientation Seminar: SRM	1
FOR 110	Environmental Physics	3

FOR 207	Introduction To Economics	3
FOR 232	Natural Resources Ecology	3
FOR 360	Principles of Mgmt/Envrn Prof	3
FOR 372	Fund/Outdoor Recreation	3
LSA 233	Plants in the Landscape	3

Lower Division Elective Courses

Course	Codes*	Credits
General Education Course in one of the following categories: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3
Sociology or Psychology Course One course from EST 203, SOC 101 or PSY 205.		3

Upper Division Required Courses

ESF 300	Intro/Geospatial Info Tech	3
FOR 205	Principles of Accounting	3
FOR 304	Adirondack Field Studies	4
FOR 322	Nat Res Measuremnts & Sampling	3
FOR 333	Natural Resrc Managerial Econ	3
FOR 345	Introduction to Soils	3
FOR 465	Natural Resources Policy	3
FOR 475	Recreation Behavior &Managemnt	3

FOR 485	Business and Managerial Law	3
FOR 490	Integrated Resources Mgt	3

Upper Division Required Courses

Course	Codes*	Credits
Free Electives		21
Vegetation Management		3
Technical Writing Directed Elective		3
Water Resources Directed Elective		3
Wildlife or Fisheries Course One course from EFB 390, EFB 413, or EFB 487		3 - 4
Specialized NRM Course: Two upper division courses with a Natural Resources focus, see FNRM Student Handbook		6

Total Minimum Credits For Degree: 122

BACHELOR OF SCIENCE IN SUSTAINABLE ENERGY MANAGEMENT

The Sustainable Energy Management (SEM) degree program introduces students to a wide range of energy markets and resources (e.g., fossil fuels, electricity, renewable and sustainable energy resources), while maintaining substantial flexibility for student-centered learning in understanding and managing energy systems. It combines professional competency in management skills with a strong foundation in the social and biophysical sciences.

The study of energy use and the development of sustainable sources of energy has become a critical national and global issue. Energy issues include concerns about the quality and quantity of the different potential resources, energy security, and the potential impacts on the environment and human health. It is essential that energy professionals understand the production and conversion of different forms of energy, their current and potential future supplies, the markets and policy mechanisms that regulate their supply, and their associated impacts on the environment.

The SEM program exposes students to views from a variety of disciplines as they investigate issues related to current and future energy supply and use. Students explore sustainable uses of energy and resources and develop the professional knowledge and skills needed to conserve and manage energy resources.

The SEM program develops the professional skills that private industry, public agency, and nonprofit organization employers look for in employees. These traits are acquired through foundational courses in the natural sciences, social sciences and humanities, communication, and quantitative and qualitative problem-solving, and critical thinking skills. The program requires a base of coursework in math and science, and additional work in applied economics, statistics, and applied energy courses. It has a strong focus on developing management skills needed to work in the energy field so that alumni are well-rounded managers in the energy field. The program also provides the skills and knowledge needed to be successful in future graduate degree work.

ESF provides a variety of opportunities to meet students' needs through on-campus sustainable energy demonstration projects and research. Classroom- and laboratory-learned concepts and skills are expanded upon through experiential ESF-based and off-campus field learning. For example, the Central NY region has significant and diverse (e.g., solar and wind installations, hydropower, and biomass-based facilities) that the program uses for experiential learning opportunities.

SEM students integrate the skills and knowledge accumulated from professional and supporting coursework in their senior year capstone experience. Capstone projects analyze the technical, financial, and environmental aspects of a real-world energy related issue and develop recommendations based on those analyses. The results are presented orally and in a written report to demonstrate their abilities as future energy resource managers.

Importantly, the SEM major was designed with enough flexibility so that students can focus on specific interests and, if desired, supplement their employment credentials with one or more ESF minors (e.g., Sustainable Construction, Economics, Management). Many students also study aboard, and nearly all SEM students have paid internships between their junior and senior years.

Lower Division Required Courses

APM 103	Applied Algebra & Trigonometry	3
OR		
APM 104	College Algebra & PreCalculus	3
OR		
APM 105	Survey Of Calc & Appl I	4
APM 391	Intro/Probability&Stats	3
EFB 100	Survey of Biology	4
ESF 200	Information Literacy	1
EWP 190	Writing And The Envrnment	3
EWP 220	Public Presentation Skills	3
EWP 290	Research Writing & Humanities	3
FCH 110	Survey of Chemical Principles	3
AND		
FCH 111	Survey/Chemical Principles Lab	1
OR		
FCH 150	General Chemistry I	3
AND		
FCH 151	General Chemistry I Lab	1
FOR 132	Orientation Seminar: SRM	1
FOR 110	Environmental Physics	3
FOR 207	Introduction To Economics	3
FOR 360	Principles of Mgmt/Envrn Prof	3
SRE 150	Intro to Sust Energy Managemnt	1

Lower Division Elective Courses

Course	Codes*	Credits
General Education Courses - Select one from the following four subject areas: US History & Civic Engagement, The Arts, World History and Global Awareness, World Languages	G	3
General Education Course in Diversity, Equity, Inclusion and Social Justice	G	3

Upper Division Required Courses

CME 305	Sustainable Energy Sys/Bldgs	3
ESF 300	Intro/Geospatial Info Tech	3
EWP 407	Writing/Env & Sci Professionls	3
FOR 205	Principles of Accounting	3
FOR 333	Natural Resrc Managerial Econ	3
FOR 485	Business and Managerial Law	3
SRE 325	Energy Systems	3
SRE 337	Energy Resource Assessment	3
SRE 416	Sustainable Energy Policy	3
SRE 422	Energy Markets and Regulation	3
SRE 441	Biomass Energy	3
SRE 450	Sustainbl Energy Capstone Plng	1
SRE 454	Sustainble Energy Fin&Analysis	3
SRE 479	Life Cycle Assessment	3
SRE 491	Sustainable Energy Mgt Capstne	3

Upper Division Elective Courses

Course	Codes*	Credits
Students should consult with their advisor and the Sustainable Resources Management Handbook for recommended courses		15
Free Electives		21

Total Minimum Credits For Degree: 120

GRADUATE PROGRAMS SUSTAINABLE RESOURCES MANAGEMENT

The SRM graduate program prepares students for careers in resource administration, management, scientific research, professional education, and a variety of other specialized positions related to the sustainable management of natural and built systems and resources.

M.F. M.P.S, M.S. & Ph.D. in Forest Resources Management

Master of Forestry (M.F.)

The Master of Forestry (MF) graduate degree program enables students to integrate knowledge and expertise drawn from both the natural and social sciences, and to apply their knowledge to solve practical forest management problems.

The primary focus of the program is to provide an opportunity for graduates coming from diverse academic backgrounds with non-forestry baccalaureates to gain a professional education in forestry. As such, the program is designed to be the first professional degree in forestry attained by a student. Graduates will successfully function as professional foresters on multi-disciplinary forest management teams and respond to the challenges related to the sustainable management of local, regional, and global forest resources.

The degree requires 37 graduate credits of coursework, of which at least 24 must be taken in residence at ESF. The degree accredited as a professional forestry program by the Society of American Foresters under Forestry.

The program is open to both students with some prior background in forestry and natural resources, and for those without such background. More than four (4) semesters may be required for students from non-science backgrounds who need additional basic undergraduate coursework as part of their degree program. The MF program is designed for May admission to accommodate the 4-week summer field course at the Ranger School in Wanakena, NY that is taught in June. All MF students must begin the program with this important foundational field course.

Undergraduate Required Core Courses

FOR 304	Adirondack Field Studies	4
ESF 300	Intro/Geospatial Info Tech	3
EFB 336	Dendrology I	3

Graduate Required Core Courses

FOR 522	Forest Mensuration	3
FOR 524	Forest Biometrics	3
FOR 532	Forest Ecology	4

FOR 533	Natural Resrc Managerial Econ	3
FOR 545	Introduction to Soils	3
FOR 570	Forest Mgmt Dec Mkng&Plng	3
FOR 573	Sustainable Harvesting Pract	3
FOR 689	Natural Resources Law & Policy	3
FOR 690	Integrated Resources Mgmt	3
FOR 898	Prof Exp/Intern	1 - 6
FOREST RESOURCES MANAGEMENT DIRECTED ELECTIVE		3

Master of Professional Studies (M.P.S.)

The Master of Professional Studies (M.P.S.) graduate degree program enables students to integrate knowledge and expertise drawn from both the natural and social sciences, and to apply their knowledge to solve practical forest and natural resources management problems. The primary focus of the program is to provide an opportunity for graduates coming from related academic backgrounds with baccalaureates to gain a professional education in forestry. As such, the program is designed to be the first professional degree in forest and natural resources management. Graduates will successfully function as professional managers on multi-disciplinary forest and natural resources management teams and respond to the challenges related to the sustainable management of local, regional and global resources.

The M.P.S. degree is a coursework-based degree that enables students to increase, refine, and integrate their natural science and social science knowledge and expertise in forest and natural resources management.

The degree requires at least 30 graduate credits of coursework. At least 24 of the course credits must be taken in residence at ESF. Within these credits, students must complete a core of required courses and other requirements.

The program is open to both students with some prior background in forestry and natural resources and for those without such background. Students with a degree in a related discipline (e.g., ecology, biology, wildlife, chemistry, etc.) can complete the M.P.S. degree in twelve (12) to eighteen (18) months. Students without a general science background will require eighteen (18) to twenty-four (24) months to complete the program. The curriculum is designed for fall admission, but spring semester admission is possible. More than four (4) semesters may be required for students from non-science backgrounds who need additional basic undergraduate coursework as part of their program of study.

Required Courses

GRADUATE LEVEL STATISTICS	3

FOR 560	Principles of Mgmt/Envrn Prof	3
FOR 692	Capstone/Resources Management	3
15 CREDIT IN AREA OF STUDY		15
QUANTITATIVE METHODS		3

Master of Science (M.S.)

The Master of Science (M.S.) graduate degree program enables students to integrate knowledge and expertise drawn from both the natural and social sciences, and to research issues and apply their knowledge to solve practical problems in forest and natural resources management situations. The primary focus of the program is to provide an opportunity for graduates coming from related academic backgrounds with baccalaureate degrees to gain a science-based education in forest and natural resources management. Graduates will successfully function as researchers and managers on multi-disciplinary forest management teams and respond to the challenges related to the sustainable management of local, regional and global resources.

The program is open to both students with some prior background in forestry and natural resources and for those without such background. Students with a degree in a related discipline (e.g., ecology, biology, wildlife, chemistry, etc.) can complete the M.S. degree in twenty-four (24) to thirty (30) months. Students without a general science background will require more than thirty (30) months to complete the program. More than four (4) semesters of coursework may be required for students from non-science backgrounds who need additional basic undergraduate coursework as part of their program of study.

The degree requires at least 30 graduate credits, of which 24 are for coursework and six for the thesis. One-half of the 24 hours of coursework must be at the 600-level or above. At least 18 of the coursework credits must be taken in residence at ESF. All students must take two topical seminars.

Doctor of Philosophy (Ph.D.)

The Doctor of Philosophy (Ph.D.) graduate degree program enables students to extend knowledge and expertise from their natural and social science background in their baccalaureate and master's degrees. It is normally built upon a M.S. degree, but in some instances it can be undertaken after a non-research based graduate degree (such as a J.D., M.B.A, M.P.A, or M.P.S. degree).

The primary focus of the program is to provide an opportunity for graduates coming from diverse academic backgrounds to gain a science-based education in forest and natural resources management.

The degree provides students with an opportunity for in-depth study and to conduct a comprehensive scientifically based research program using advanced research tools. Ph.D. dissertations are expected to lead to a number of peer-reviewed articles in influential journals.

The degree is appropriate for students interested in advanced positions as forest and natural resources educators, researchers, managers, consultants and analysts on the local, regional and global levels.

The program is open to both students with some prior background in forestry and natural resources and for those without such background. Students with degrees in a related discipline (e.g., ecology, biology, wildlife, chemistry, etc.) can complete the Ph.D. degree in three (3) to five (5) years. Students with a general science background, but little or no forest or natural resources experience, may require more than five (5) years to complete the program.

The degree requires at least 60 graduate credit hours, of which 48 are for coursework and 12 for the dissertation. One-half of the 48 hours of coursework must be at the 600-level or above. At least 24 coursework credits must be taken in residence at ESF. All students must take two topical seminars.

Areas of Study

Forest Management and Operations (M.F.)

The Forest Management and Operations area of study focuses on the the management of forest ecosystems. Students learn how management decisions affect the sustainability of forests and provides the training necessary to be a professional forester. It is an applied area of study designed to meet professional accreditation standards.

Ecology and Ecosystems (M.P.S., M.S., Ph.D.)

The Ecology and Ecosystems area of study focuses on the structure, function, dynamics, and resilience of terrestrial ecosystems, at a range of scales, from tree genetics and plant physiology to landscape ecology, modeling and remote sensing.

Because functioning and resilient ecosystems are central to human well-being, research opportunities in this area of study address a diversity of topics that help us better understand and enhance the sustainability of terrestrial ecosystems in a rapidly changing world.

Economics, Governance and Human Dimensions (M.P.S., M.S., Ph.D.)

The Economics, Governance and Human Dimensions area of study emphasizes the human dimensions of resource systems involved in the processes of decision-making and action related to how coupled human-natural systems may be managed for sustainable outcomes.

This area of study also incorporates rigorous research into human behavior in recreational and natural settings, a topic that draws from multiple disciplinary perspectives in the social sciences.

Forest Management & Silvicuture

The Forest Management and Silviculture area of study focuses on sustainable management of forest ecosystems.

Because functioning and resilient forest ecosystems are essential to human well-being, research opportunities in this area of study address practices and decisions, economic and recreational considerations, landowner objectives and/or policies, ecological underpinnings, and applied science related to the sustainable management of forests.

Monitoring, Analysis and Modeling (M.P.S., M.S., Ph.D.)

The Monitoring, Analysis and Modeling area of study focuses on the application of statistical and operations research methods and techniques used to sample, describe and predict how individual trees, forest stands and terrestrial ecosystems change over both temporal and spatial scales.

Because trees and forests respond in varying ways to an array of human and natural disturbances, research opportunities in this area of study address a diversity of topics that help us to better understand and evaluate the dynamics of terrestrial ecosystems in a rapidly changing world.

M.P.S., M.S., & Ph.D. in Natural Resources Management (CIP code: 3.0199)

The Natural Resources Management program focuses on both the underlying theory and on-the-ground application of practices to achieve sustainable outcomes in natural resource systems.

Because management practices and decisions arise from the combination of ecological knowledge, economic considerations and landowner/manager objectives and/or policies, research opportunities in management are interdisciplinary by nature.

M.P.S, M.S. & Ph.D. in Sustainable Construction Management (CIP code: 14.3301)

Areas of Study

Construction Management (M.S., M.P.S.)

This option is for students who plan to specialize in construction management. Studies depend upon the student's previous education, professional objectives and interests.

Recent graduates have matriculated upon completion of undergraduate degrees in architecture, mechanical engineering, construction management and civil engineering.

M.S. in Construction Management

Applicants for the Construction Management area of study leading to an M.S. degree are required to have a bachelor’s degree in one of the following: science, construction management, business, management, architecture or engineering.

Topics for M.S. research may include the following areas in the management of construction projects: Construction project management, Estimating, cost engineering, building codes and zoning, Production management, Computer graphics and computer applications in construction.

For the M.S. degree in Construction Management the following courses are required (or equivalent with committee approval):

Required Courses

CME 543	Construction Estimating	3
CME 653	Construct Plan/Scheduling	3

CME 654	Construction Project Mgt	3

M.P.S. in Construction Management

The M.P.S. degree is a non-thesis degree open to students with a demonstrated interest in the profession of construction management. A bachelor's degree in one of the following is strongly recommended: science, construction management, business, management, architecture, engineering, or related field of study.

Coursework

- Required: 12 cr hrs
- Directed Electives: 6-12 cr hrs
- Open Electives: 3-9 cr hrs
- Practicum/Synthesis Project: 3-6 cr hrs
- Total credit hours: 30 cr hrs

Required Courses (12 credits)

CME 543	Construction Estimating	3
CME 653	Construct Plan/Scheduling	3
CME 654	Construction Project Mgt	3
CME 658	Construct Contracts/Specs	3

Directed Elective Courses (6 - 12 credits)

CME 525	Const Methods&Equipment	3
CME 531	Construction Safety	3
CME 535	Cost Engineering	3
CME 658	Construct Contracts/Specs	3

Open Elective Courses (3 - 9 credits)

FOR 665	Natural Resources Policy	3
FOR 670	Resource & Envrn Economics	3
FOR 680	Urban Forestry	3
FOR 687	Environmental Law & Policy	3
FOR 770	Ecological Economics & Policy	3
EST 550	Envrn Impact Analysis	3
EST 603	Research Methods and Design	3
EST 604	Survey Research Methods	3

EST 605	Qualitative Methods	3
EST 626		
EST 627	Environmental &Energy Auditing	3
EST 635	Pub Part&Decision Making	3
EST 640	Envrn Thought and Ethics	3
EST 660	Land Use Law	3

Professional Experience/Synthesis Project (3-6 credits)

CME 898	Prof Experience/Synthesis	1 - 6

Sustainable Construction (M.S., M.P.S.)

This option is for students interested in sustainable construction practices including topics such as energy use in buildings, material use in sustainable construction, life cycle analysis, environmental rating systems and environmental performance measures.

Students with a strong background in science are given greater consideration.

M.S. in Sustainable Construction

Applicants for the Sustainable Construction area of study leading to an M.S. degree are required to have a bachelor's degree in one of the following: science, construction management, architecture or engineering. It is preferred that students have a science background and to have completed courses in physics, chemistry and calculus.

Topics for the M.S. or Ph.D. research may include the following: Energy systems in buildings, Sustainable materials, Environmental performance measures, Building codes, Renewable materials, Deconstruction and reuse, Life cycle analysis, building performance.

For the M.S. degree in Sustainable Construction, students must complete coursework in construction project management if this was not part of their undergraduate degree.

M.P.S. in Sustainable Construction

The M.P.S. degree is open to students with a demonstrated interest in sustainable construction such as properties of construction materials, energy systems in buildings, rating systems and building performance. A bachelor'cs degree in one of the following is strongly recommended: science, construction management, architecture, engineering, or related degree. It is preferred that students have a science background and to have completed courses in physics, chemistry and calculus.

Coursework

- Required: 12 cr hrs
- Directed Electives: 6-12 cr hrs
- Open Electives: 3-9 cr hrs
- Practicum/Synthesis Project: 3-6 cr hrs

- Total credit hours: 30 cr hrs

Core courses (12 credits)

CEE 678	Rehab of Civil Infrastructure	0 - 8
CME 504	Envrn Perform Measures/Bldgs	3
CME 505	Sustainable Energy Sys/Bldgs	3
CME 532	Mech/Elect Equipment	3
CME 565	Sustainable Innovatns/Res Cons	3
CME 605	Bldg Info Modelng/Cons Mgt	3

Construction management courses (6-12 credits)

CME 543	Construction Estimating	3
CME 653	Construct Plan/Scheduling	3
CME 654	Construction Project Mgt	3

Application electives (3-9 credits)

EST 550	Envrn Impact Analysis	3
EST 603	Research Methods and Design	3
EST 604	Survey Research Methods	3
EST 605	Qualitative Methods	3
EST 626		
EST 627	Environmental &Energy Auditing	3
EST 635	Pub Part&Decision Making	3
EST 640	Envrn Thought and Ethics	3
EST 660	Land Use Law	3
FOR 665	Natural Resources Policy	3
FOR 670	Resource & Envrn Economics	3
FOR 680	Urban Forestry	3
FOR 687	Environmental Law & Policy	3
FOR 689	Natural Resources Law & Policy	3

FOR 770	Ecological Economics & Policy	3

Professional Experience/Synthesis (3-6 credits):

CME 898	Prof Experience/Synthesis	1 - 6

M.P.S., M.S., & Ph.D. in Sustainable Energy

The Sustainable Energy (SE) graduate program enables students to focus on energy resource management and policy research with a strong foundation in the social and biophysical sciences.

The study of responsible energy resources use and the development of sustainable sources of energy have become critical national and global issues. Energy concerns include the quality and quantity of energy resources, energy security, and the impacts of energy generation, transmission and use on the environment and human health. The SE program prepares graduates to lead in addressing these concerns through the development of professional competency in transdisciplinary research and analytical skills. SE graduates advance into careers in academia, sustainable energy administration and management, scientific research, consulting, environmental advocacy, and a variety of other specialized positions related to sustainable energy resources.

SE students take courses in energy systems and pathways, resource management, environmental engineering, law and policy, and statistical analysis, among others. Rather than follow a specific track, the curriculum path for each student will follow a mentor-based approach tailored to individual professional and research interests. Students work with their major professor and steering committee to develop their coursework curriculum, which includes opportunities for both classroom-based and lab- and field-based instruction.

- M.P.S. students are required to complete 30 credit hours of graduate coursework.
- M.S. students are required to take 30 graduate credit hours, including 24 hours of coursework credit and six thesis research credits; 12 coursework credit hours must be at the 600-level or above.
- Ph.D. students are required to take 60 graduate credit hours, including 48 hours of coursework credit and 12 hours of thesis research credit.

Certificate in Climate Sustainability Leadership

The Advanced Certificate in Climate & Sustainability Leadership is a science-based leadership and management-oriented certificate for emerging professionals who work on greenhouse gas emissions reduction, climate adaptation, and sustainability projects.

This program is a 10-credit advanced certificate that provides content training in climate change science, current climate protection, policies, analytic tools and critical thinking, project management, problem solving, workplace effectiveness, communication, and fundraising.

Students in this advanced certificate program will also participate in the Strategic Energy Innovations' (SEI) Climate Corps Fellowship program. Climate Corps fellows gain real-world expertise in the climate change field, while working with private, public and nonprofit partners in the community to address real world climate and sustainability projects and cultivate the next generation of environmental leaders. The SEI Climate Corp Fellowship program develops

relationships with partners to identify placements for fellows and raises funds from partners that provides fellows with stipend and tuition support for the academic program they participate in at SUNY ESF.

Required Courses

SRE 650	Climate&Sust Science&Practce I	3
SRE 660	Climate&Sust Science&Prctce II	3
SRE 898	Prof Experience/Internship	1 - 12

CERTIFICATE IN CLIMATE & SUSTAINABILITY LEADERSHIP

The Advanced Certificate in Climate & Sustainability Leadership is a science based leadership and management-oriented certificate for emerging professionals who work on greenhouse gas emissions reduction, climate adaptation, and sustainability projects.

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Required Courses

SRE 650	Climate&Sust Science&Practce I	3
SRE 660	Climate&Sust Science&Prctce II	3
SRE 898	Prof Experience/Internship	1 - 12

THE RANGER SCHOOL

Mariann Johnston, Director
Wanakena Campus
315-848-2566
315-848-3249 (fax)

The SUNY ESF Ranger School in Wanakena, N.Y., offers students a unique educational experience in a spectacular natural setting.

The Ranger School confers the associate in applied science degree (A.A.S.) in three areas of study: forest technology, land surveying technology, and environmental and natural resources conservation. The Ranger School's one-plus-one plan allows students to complete their first year at the college of their choice, then spend their second year at The Ranger School. While many move directly into outdoor careers in the areas of conservation, forestry and surveying, some use their A.A.S. as a hands-on, experience-based step toward a bachelor of science degree, earned at ESF's main campus in Syracuse, N.Y.

Academic Programs

Associate of Applied Science (A.A.S.) Degree

The Ranger School offers Associate of Applied Science (A.A.S.) degrees in three areas. The A.A.S. is typically earned with two years of study.

There are several advantages of combining a Ranger School associate's degree with a four-year B.S. degree at the ESF Syracuse Campus. Ranger School graduates who go on to pursue the bachelor's degree have a solid field education and are well positioned to benefit from the deeper ecological and social understanding provided by the professional curriculum.

Students wishing to transfer from the Ranger School to the B.S. programs at the Syracuse campus will be admitted as juniors. Students entering programs in the Sustainable Resources Management Department will be given credit for the summer session in field forestry. Students entering Environmental Biology programs may petition for credit in Ecological Monitoring and Biological Diversity assessment. They will still have to complete some physical sciences, social sciences and humanities requirements while in residence at Syracuse, depending on prior preparation.

NOTE: Students contemplating subsequent transfer should concentrate their freshman year electives in the social sciences and humanities.

NOTE: It is recommended that students complete the first semester in chemistry, one semester in physics and a course in calculus prior to transferring.
It is possible to be admitted without these courses, but subsequent progress in the program becomes more difficult.

ENVIRONMENTAL AND NATURAL RESOURCES CONSERVATION (A.A.S.)

The environmental and natural resources conservation program provides students with the scientific theory and applied skills necessary for a technical career in the environmental and natural resources sector. This program will provide students with a solid grounding in applied ecological and sociopolitical concepts, accompanied by technical training in plant and tree identification, land surveying, natural resources measurements, geospatial applications, soil and water monitoring, wildlife techniques and forest recreation.

Students interested in a baccalaureate degree may wish to investigate programs in the Environmental Biology, Environmental Studies or the Sustainable Resources Management departments. Transfer is possible upon completion of the A.A.S. degree at Wanakena. Students should consult with an advisor in the Undergraduate Admissions office as soon as possible.

The freshman year environmental and natural resources conservation curriculum consists of general studies courses which may be taken at any accredited four-year, community, or technical college.

First Year Required Courses

Course	Codes*	Credits
General Biology with lab	G	4
Science Course with lab (Biology, Chemistry, or Physics)		4
English with a Focus on Writing (Two 3-credit courses)	G	6
Trigonometry or pre-calculus (1 course)	G	3
Diversity, Equity, Inclusion & Social Justice	G	3
Total Maximum Transfer Credits		20

Second Year Required Courses

FTC 200	Dendrology	3
FTC 202	Intro To Surveying	3

FTC 204	Intro/Nat Res Measurements	4
FTC 206	Forest Ecology	4
FTC 207	Communications and Safety	3
FTC 208	Remote Sensing and GIS	3
FTC 210	Wildlife Techniques 1	1
FTC 211	Silviculture	3
FTC 212	Adirondack Cultural Ecology	1
FTC 219	Intro to Forest Recreation	1
FTC 221	Natural Resources Management	3
FTC 234	Wildlife Conservation	3
FTC 236	Env Interp Principles&Technque	3
FTC 237	Intro/Water & Soil Resources	4
FTC 238	Forest Insects and Disease	3
FTC 239	GIS Practicum	1
FTC 240	Wildlife Techniques 2	1

Total Minimum Credits for Degree: 64

FOREST TECHNOLOGY (A.A.S.)

A degree in Forest Technology provides students with knowledge of the field practice of forest management, the ability to work and communicate effectively with professional and paraprofessional personnel, and an understanding of the physical, biological and quantitative aspects that form the basis of forestry. The educational program in forest technology, leading to the associate of applied science degree in forest technology, is accredited by the Society of American Foresters (SAF).

Students wishing to pursue a baccalaureate degree may wish to investigate programs in the Sustainable Resources Management Department, in particular the Forest Resource Management and Natural Resource Management degree options provide viable transfer pathways for Ranger School students. Students should consult with an advisor in the Undergraduate Admissions office as soon as possible.

The first year forest technology curriculum consists of general studies courses which may be taken at any accredited four-year, community, or technical college.

First Year Required Courses

Course	Codes*	Credits
General Biology with lab	G	4
Science Course with lab (Biology, Chemistry, or Physics)		4
English with a Focus on Writing (Two 3-credit courses)	G	6
Trigonometry or pre-calculus (1 course)	G	3
Diversity, Equity, Inclusion & Social Justice	G	3
Total Maximum Transfer Credits		20

Second Year Required Courses

FTC 200	Dendrology	3
FTC 202	Intro To Surveying	3
FTC 204	Intro/Nat Res Measurements	4

FTC 206	Forest Ecology	4
FTC 207	Communications and Safety	3
FTC 208	Remote Sensing and GIS	3
FTC 209	Timber Harvesting	2
FTC 211	Silviculture	3
FTC 213	For Inventory Practicum	2
FTC 214	Leadership & Orgnztnl Perfrmnc	2
FTC 217	Wildland Firefighting & Ecol	2
FTC 219	Intro to Forest Recreation	1
FTC 221	Natural Resources Management	3
FTC 225	Timber Transportn&Utilization	2
FTC 234	Wildlife Conservation	3
FTC 238	Forest Insects and Disease	3
FTC 239	GIS Practicum	1

Total Minimum Credits For Degree: 64

LAND SURVEYING TECHNOLOGY (A.A.S.)

Land surveying technology students obtain a sound technical background in fundamental land surveying principles, techniques and skills. They become well-rounded technical specialists capable of teamwork, communication and problem solving, and they develop life-long learning skills and abilities.

The program provides students with a combination of surveying and land resource knowledge and related skills which are not available elsewhere. Students will be thoroughly exposed to the field of land surveying through a carefully planned combination of classroom lectures, demonstrations and hands-on experience. The educational program in land surveying technology, leading to the associate of applied science degree in land surveying technology, is accredited by the ETAC Accreditation Commission of ABET, https://www.abet.org/.

Students wishing to pursue a baccalaureate degree may wish to investigate programs in the Sustainable Resources Management Department such as Construction Management. The Ranger School does have an articulation agreement with SUNY Alfred State for students wishing to pursue a baccalaureate in the land surveying field.

The first year land surveying technology curriculum consists of general studies courses which may be taken at any accredited four-year, community, or technical college.

First Year Required Courses

Course	Codes*	Credits
General Biology with lab	G	4
Physics	G	4
English with a Focus on Writing (Two 3-credit courses)	G	6
Trigonometry or pre-calculus (1 course)	G	3
Diversity, Equity, Inclusion & Social Justice	G	3
Total Maximum Transfer Credits		20

Second Year Required Courses

FTC 200	Dendrology	3
FTC 202	Intro To Surveying	3

FTC 204	Intro/Nat Res Measurements	4
FTC 205	Comp-Aided Draftng&Dsgn I	2
FTC 206	Forest Ecology	4
FTC 207	Communications and Safety	3
FTC 208	Remote Sensing and GIS	3
FTC 214	Leadership & Orgnztnl Perfrmnc	2
FTC 225	Timber Transportn&Utilization	2
FTC 239	GIS Practicum	1
FTC 251	Adv Survey Measure&Comp	4
FTC 253	Survey Law	3
FTC 255	Boundary Surveying	3
FTC 256	Subdivision Surveys	2
FTC 257	Construction&Topo Surveys	3
FTC 259	Cmptr-Aided Draftng & Dsgn II	2

Total Minimum Credits For Degree: 64

** **Special Course Codes** (Code indicates course meets certain program or accreditation requirements. Ignore if there is no relevance to this program of study.) **G** = General Education Course (GenEd), **E** = Engineering, **ES** = Engineering Sciences, **M** = Mathematic, **NS** = Natural Sciences, **PE** = Professional Education, **S** = Summer-only*

A-Z COURSE LIST

APM - APPLIED MATHEMATICS

APM 101 Fundamentals/College Algebra (3)

Three hours of lecture/discussion per week. Algebraic operations on polynomials and rational functions as expressions, in equations, or inequalities. Graphing of linear and polynomial equations. An emphasis is placed on algebraic operations of expressions with rational exponents. Fall.

APM 103 Applied Algebra & Trigonometry (3)

Three hours of lecture per week. This course is designed to enable non-science students to solve practical problems in their specific areas of study. Topics include algebraic, exponential, logarithmic, and trigonometric functions used in measurement and modeling. Applications include percents, scaling, slopes, and contour mapping. Spring, Fall. Prerequisite(s): Math Placement or Consent of Instructor.

APM 104 College Algebra & PreCalculus (3)

Three hours of lecture/discussion per week. Course meets the SUNY general education requirement for mathematics. Elements of analytic geometry. Emphasis on the concepts of polynomial and rational functions, exponential and logarithmic functions, trigonometry and trigonometric functions and their application to design and life and management sciences. Fall and Spring. Prerequisite: Three years of high school mathematics.

APM 105 Survey Of Calc & Appl I (4)

Four hours of lecture per week. Introduction to calculus for students in the life and management sciences. Elements of analytic geometry, functions and their graphs, with an emphasis on the concepts of limits, and differentiation techniques for algebraic, exponential and logarithmic functions and their application to economics, and the life and management sciences. Some multivariable calculus including constrained optimization. Fall and Spring. Prerequisite: Precalculus or 3 1/2 years of high school mathematics. Note: Credit will not be granted for APM 105 after successful completion of MAT 284, MAT 285, or MAT 295 at SU. "

APM 106 Survey Of Calc & Appl II (4)

Four hours of lecture per week. A continuation of calculus for students in the life and management sciences. Elements of analytic geometry. An introduction to integration and applications of the definite integral. Differentiation and integration of trigonometric functions. Applications of first order differential equations and partial derivatives. Spring. Prerequisite: APM 105 or permission of the instructor. Note: Credit will not be granted for APM 106 after successful completion of MAT 286 or MAT 296 at SU.

APM 115 Essential Calculus (4)

A one semester course in differential and integral calculus. An emphasis on the concepts of limits, differentiation and integration techniques for algebraic, exponential, logarithmic functions, and trigonometric functions. This course is not intended for students that plan on taking additional Calculus courses. Offered in fall and spring. Credits will not be granted for APM 115 after successful completion of any Calculus course such as APM105, MAT 284, or beyond. Prerequisites: APM 103 or APM 104, or equivalent.

APM 205 Calculus I:Science & Engr (4)

Four hours of lecture/discussion per week. Analytic geometry, limits, derivatives of functions and equations, optimization, rates, graphs, differentials, mean-value theorem, and applications of the derivative. Fall. Prerequisite: APM 104 or permission of instructor.

APM 206 Calculus II:Science & Engr (4)

Four hours of lecture/discussion per week. This course is a one semester continuation of differential calculus. Integral calculus is used to describe growth and size. Topics include: techniques of integration and their application, convergence of sequences and series, separable and first-order differential equations, and polar coordinates. Spring. Prerequisite(s): Successful completion of a differential calculus course such as APM205 or MAT295.

APM 307 Multivariable Calculus (4)

4 hours of lecture/discussion per week. Topics include vectors three dimensions, analytic geometry of three dimensions, parametric curves, partial derivatives, the gradient, optimization in several variables, multiple integration with change of variables across different coordinate systems, line integrals, and Green's Theorem. Fall and Spring. Prerequisites: Completion of Differential and Integral Calculus with at least a C-; APM206 / MAT296, or the equivalent Note: Credit cannot be given for both APM307 and MAT397.

APM 391 Intro/Probability&Stats (3)

Three hours of lecture per week. Introduction to concepts and methods of statistics as applied to problems in environmental science and forestry. Topics include inference (confidence intervals and hypothesis testing), sampling distributions, descriptive statistics, exploratory data analysis, comparison of population means and proportions, categorical data analysis, regression and correlation, and nonparametric methods. Fall or Spring.

APM 395 Probability & Stats/Engr (3)

Three hours of lecture per week. This course provides a rigorous introduction to calculus-based probability and statistical theory, with applications primarily drawn from engineering and the environmental sciences. Topics include: descriptive statistics and data presentation, probability, the theory and use of discrete and continuous probability distributions, confidence intervals, classical and distributional hypothesis testing, and regression analyses. Spring. Prerequisite(s): One year of Calculus. Note: Credit will not be granted for both APM 395 and APM 595.

APM 485 Diff Equat/Engr&Scientist (3)

Three hours of lecture per week. First and second order ordinary differential equations, matrix algebra, eigen values and eigen vectors, linear systems of ordinary differential equations, numerical solution techniques and an introduction to partial differential equations. Spring. Prerequisite: MAT 295, MAT 296, MAT 397.

APM 510 Statistical Analysis (3)

Three hours of lecture per week. Applications of descriptive and inferential statistics to natural resource problems. Basic concepts and techniques of estimation, confidence intervals, and hypothesis testing applied to one- and two-sample settings, paired designs, simple linear regression and correlation, contingency tables, and goodness of fit tests. Statistical software used to enhance data analysis skills. Fall. Prerequisite(s): Graduate standing.

APM 585 Part Diff Equat/Engrs&Scientst (3)

Three hours of lecture per week. Analytical solutions of parabolic, hyperbolic and elliptic partial differential equations which appear in science and engineering. Numerical and approximate methods of solution. Spring.

APM 595 Probability & Stats/Engr (3)

Three hours of lecture per week. This course provides a rigorous introduction to calculus-based probability and statistical theory, with applications primarily drawn from engineering and the environmental sciences. Topics include: descriptive statistics and data presentation, probability, the theory and use of discrete and continuous probability distributions, confidence intervals, classical and distributional hypothesis testing, and regression analyses. Spring. Prerequisite(s): One year of Calculus. Note: Credit will not be granted for both APM 395 and APM 595.

APM 620 Experimental Design & ANOVA (3)

Three hours of lecture per week. Designing and analyzing experiments and observational studies; completely randomized, split plot, randomized complete block, and nested experiment designs; single-factor, factorial, and repeated measures treatment designs; expected mean squares and variance components; fixed, random, and mixed effects models; multiple comparison and contrast analyses; analysis of covariance; statistical computing. Spring. Prerequisites: Graduate status and an introductory course in statistics covering material through the one-way analysis of variance.

APM 625 Sampling Methods (3)

Three hours of lecture per week. Application of probability sampling methods to environmental science and forestry. Simple random, stratified, cluster, systematic, two-phase, line-intercept, point, variable radius plot, adaptive cluster, and other variable probability sampling designs; model-assisted ratio and regression estimators; inclusion probabilities; properties of estimators for design-based inference; Horvitz-Thompson estimation as a unifying theory. Fall.

APM 630 Regression Analysis (3)

Three hours of lecture per week. Topics include review of basic statistical concepts and matrix algebra, classical simple and multiple linear regression models, indicator or dummy variables in regression, residual analysis, transformation and logistic regression, weighted least squares, influence diagnostics, multicollinearity, nonlinear regression models, linear mixed models, statistical computing using SAS and interpretation of results. Fall. Prerequisite: APM 391 or equivalent.

APM 635 Multivariate Stat Method (3)

Three hours of lecture per week. Topics include review of basic statistical concepts and matrix algebra, multivariate normal distribution, Hotelling's T 2, multivariate analysis of variances, principal component analysis, factor analysis, discrimination and classification, cluster analysis, and canonical correlation analysis, statistical computing using SAS and interpretation of results. Spring. Prerequisites: APM 391 or equivalent.

APM 645 Nonparamet Stats&Cat Data Anal (3)

Three hours of lecture per week. Topics include: review of basic statistics, sign and ranked sign tests, median and Wilcoxon tests, binomial tests, x 2-test and contingency tables (with correspondence analysis), goodness-of-fit, nonparametric correlation and association analysis, nonparametric and robust regression, generalized linear models (Logistic and Poisson regression), and re-sampling methods (bootstrapping and cross-validation), statistical computing using SAS and interpretation of results. Fall. Prerequisite: APM 391 or equivalent.

APM 671 Map Accuracy Assessment (1)

One hour of lecture per week.Statistical concepts and methods for quantifying the accuracy of maps. Sampling design and analysis for assessing accuracy of categorical attributes (e.g. land cover) is emphasized, with some discussion of continuous variables. Spring, even numbered years.

APM 696 Spec Topics/Quant Methods (1-3)

Experimental and developmental courses in areas of quantitative methods not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration. Fall or Spring.

APM 730 Adv Regression Modeling Methds (3)

Three hours of lecture per week. Topics include: review of basic regression modeling techniques, theory of generalized linear models and techniques (e.g. Logistic, Poisson and Beta regression), quantile regression, linear and nonlinear mixed models, variogram and kriging, spatial regression models (e.g., spatial lag and spatial error models), local spatial statistics and models (geographically weighted regression), statistical computing using SAS, and interpretation of results. Spring. Prerequisite: APM 630 or equivalent

BPE - BIOPROCESS ENGINEERING

BPE 296 Special Topics in Engineering (1-3)

Provides experimental, interdisciplinary, or special coursework at the freshman and sophomore levels within the field of environmental resources engineering. Subject matter and course format vary from semester to semester and section to section. Fall and Spring.

BPE 300 Intro/Industrial Bioprocessing (3)

Three hours of lecture and discussions. Industrial examples of biotechnology and bioprocessing will be reviewed. Topics include applications of biotechnology and bioprocessing to the food, water and wastewater treatment, industrial biotechnology, biopharmaceutical, biochemical and biofuel industries. Through case studies of process flow sheets for different products students will develop an understanding of unit operations typically utilized in bioprocessing manufacturing operations. Fall. Prerequisite(s): EFB 103 and EFB 104; co-requisite(s): FCH 221 and FCH 222.

BPE 304 Prof Experience/Synthesis (1)

Twelve weeks full time employment approved by the department with an industrial or research partner acquired through on-campus interviews or other means. The student and the supervisor set goals and expectations for the internship. The students and supervisors also provide feedback on the performance of the student. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Summer.

BPE 305 Professional Co-op (1)

A semester of full-time employment approved by the department with an industrial or research partner acquired through on-campus interviews or other means. The student and the supervisor set goals and expectations for the co-op. The students and supervisors also provide feedback on the performance of the student. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall or Spring.

BPE 306 Professional Synthesis (1)

Students will develop a synthesis of their work experience from either BPE 304 or BPE 305 and present their results both orally and in a written report. Fall or Spring.

BPE 310 Colloid and Interface Science (3)

Three hours of lecture per week. This course will cover the basic principles of colloidal and interfacial science as applied to bioprocesses. It will provide a foundation and theoretical understanding that will be applied in bioseparations, transport phenomena, biochemical/ bioprocess engineering and other advanced courses in the bioprocess engineering curriculum. Fall. Prerequisites: PSE 370, PSE 361, FCH 150, FCH 152. Note: Credit will not be granted for both BPE 310 and PSE 467.

BPE 321 Biomolecular Kinetics (3)

Three hours of lecture per week. Reaction basics, biological basics, cell chemistry, metabolites, cell feed formulation, equilibrium. Elementary reactions, collision theory, transitional state, free radicals, pseudo-steady state hypothesis and equilibrium steps, hydrolysis and polymerization reactions. Enzymatic reactions, Protein-ligand interactions, enzymes with multiple interacting domains. Cell metabolism. Cell growth kinetics. Kinetic data analysis. Spring Prerequisite: EFB 103 Credit will not be granted for both BPE 321 and BPE 521.

BPE 420 Bioseparations (3)

Three hours of lecture per week. Lectures, discussions in Bioseparation Engineering. Topics covered include: particulates of biological origins, flocculation, separation techniques of interest in processing materials of biological origin: sedimentation, flotation, filtration, centrifugation, membrane processes – ultra, Nano and RO processes, dialysis, adsorption, chromatography, solvent extraction, crystallization. Fall. Prerequisite: ECH312 Engineering Thermodynamics, ECH322 Transport Processes

BPE 421 Bioprocess EngineerofReactions (3)

Three hours of lecture per week. Green chemistry, biotechnology, regulatory constraints, social and environmental responsibilities. Reactor mass and energy balances, bioprocess systems optimization. Ideal batch reactors, plug flow reactors (PFR), continuous stirred tank reactors (CSTR). Isothermal and non-isothermal operations, reactor sizing. Continuous culture and wastewater treatment processes. Fed-batch operations. Feed stability, thermostability, steady state, sustainability, catalyst instability, genetic instability, mixed cultures. Reactor selection, operational modes, areation, agitation, scale-up and down, instrumentation and control, sterilization of process fluids, equipment and aseptic operations. Reactive hazards, reactor runaway and biosafety. Fall. Prerequisite: BPE 321 Credit will not be granted for both BPE 421 and BPE 621.

BPE 422 Chem Reaction Eng&Prcss Safety (3)

Three hours of lecture per week. Main topics of coverage include conversion and reactor sizing, isothermal and non-isothermal reactor peration/design for flow and batch systems, multiple reactions, introduction to heterogeneous reactor design, sustainability and stability, reactor runaway, reactive hazard and process safety. Fall. Prerequisite: BPE 322.

BPE 438 Intro to Biorefinery Processes (3)

Three hours of lecture and discussions per week. Topics covered include chemical and physical properties of biomass feedstocks; sustainable biomass production/utilization, chemical and biological processes of converting plant biomass to chemicals, liquid fuels, and materials. Focus on green chemistry and/or environmentally benign processes, with some discussions on political and social aspects of sustainability and renewability. Fall. Prerequisite(s): FCH 150 & 151 and PSE 370 or consent of Instructor. Note: Credit will not be granted for both BPE 438 and PSE 438 nor BPE 638 nor PSE 638.

BPE 440 Bioproc Kinetics&Sys Engr Lab (3)

One hour of lecture and six hours of laboratory per week. Measurement and analysis of bioprocess systems, including steady-state and dynamic modeling of systems. Investigation of various bioprocesses including fermentation, enzymatic reactions, and reactive processes involving lignocellulosic materials. Spring. Prerequisite: BPE 420 and BPE 421.

BPE 450 Chemical&BPE Product Design (3)

Three hours of lecture per week. Quality by design of chemical and biochemical products range from specialty chemicals like protein/tissue, biologics to devices that perform chemical and/or bio- transformations. This course integrates the steps of product design from brainstorming and concept selection through design and manufacturing. Students will be taught and practice using the basic tools and principles of chemical / biochemical product design, including inventive problem solving (or TRIZ), house of quality, robust design, design for manufacturability, Failure Modes and Effects Analysis (FMEA) and Six Sigma. Other topics include multi-generational product planning, sustainability and life cycle analysis, basic economic evaluations, risk management, an introduction to entrepreneurship and new business development, as well as intellectual property and freedom-to-operate assessments. Case studies drawn from industry will also be illustrated. Fall. Pre-requisites: APM 395 and BPE 312.

BPE 481 Bioprocess Eng Design (3)

2.5 hours of lecture and 1.5 hours of studio per week. Design project and procedure; open-ended design options; mass/energy balances; unit operations; safety considerations; and economic analysis. Process simulation and computer-aided design for process synthesis and plant layout. Formulation and solution of original design problem(s) under realistic (e.g., socioeconomic, process, environmental, safety) constraints. Spring. Prerequisites: PSE 480, BPE 420, BPE 421, BPE 435, or equivalents. Note: Credit will not be granted for both BPE 481 and BPE 681.

BPE 496 Special Topics (1-3)

Lectures, readings, problems and discussions. Topics in environmental or resource engineering as announced. Fall and/or Spring.

BPE 498 Resrch Prob/Bioprocess Eng (1-4)

Independent study. The student is assigned a research problem in bioprocess engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research techniques rather than on discovery of results of commercial importance. The information obtained in the literature survey, along with the data developed as a result of the investigation, is to be presented as a technical report. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, and Summer.

BPE 503 Bioprocesss Plant Design (3)

Three hours of lecture per week. Topics covered include integration of process and support systems and equipment; concepts of facility design integrating Good Manufacturing Practice (GMP), equipment and systems cleanability, people flow, product protection, capital investment, and operating costs. This course will focus towards facility design in the bioprocess industry. Spring. Prerequisite(s): BPE 620, BPE 621.

BPE 510 Intro to Polymer Coatings (3)

Fundamental science of polymerization and film formation for a wide class of organic coatings, including acrylics, latexes, polyesters, amino resins, epoxies, alkyds, and silicon derivatives as well as the integration of appropriate binders and additives affecting coating quality. Reaction chemistries and their distinguishing characteristics for several cross-linking agents. Reaction kinetics are considered with emphasis on the influence of conditions during synthesis. Various organic coatings are compared based on desired mechanical and optical properties along with specific applications. The nature of defects and the resulting effect on product lifetime of coatings are examined. Online Academic Year and/or Summer Session. Prerequisite(s): B.S. from an accredited institution with at least one semester of organic chemistry or permission of instructor.

BPE 511 Radiatn Curing Equip,Inst&Sfty (3)

Technologies used for commercial radiation curing for energy-efficient and environmentally-responsible curing of resins, inks, coatings and adhesives pertinent to industry chemists, engineers, technicians, and managers. Ultra violet light (UV), electron beam (EB), radio frequency (RF) and Infrared (IR) generating systems, along with ancillary equipment used to quantify energy deposition. Basic equipment functions, interaction of radiation sources with specific substrates and chemistries, benefits and drawbacks of each technology, and safety and handling considerations. Emphasis is placed on effectively selecting and justifying equipment appropriate for specific applications. Online Academic Year and/or Summer Session. Prerequisite(s): B.S. from an accredited institution with at least one semester of organic chemistry or permission of instructor.

BPE 521 Biomolecular Kinetics (3)

Three hours of lecture per week. Reaction basics, biological basics, cell chemistry, cell metabolites, cell feed media formulation, chemical equilibrium. Elementary reactions, collision theory, transitional state, free radicals, pseudo-steady state hypothesis and fast equilibrium steps, ligand-induced protein refolding, multiple domain interactions, complex enzymatic catalysis, hydrolysis and polymerization reactions. Cell metabolism, metabolic pathway, biotic-abiotic interactions. Cell growth kinetics. Kinetic data analysis. Spring. Prerequisite: EFB 103 Credit will not be granted for both BPE 321 and BPE 521.

BPE 522 Chem Reaction Engnrng Kinetics (3)

Three hours of lecture/discussion per week. Fundamental concepts in chemical reactions, basic reaction rate theory, steady-state approximation, transition-state theory, reaction mechanisms of chemical reactions, analysis of kinetic data. Evaluation of literature regarding kinetic measurements. Spring. Pre-requisites: APM 485 and BPE 362

BPE 535 Transport Phenomena (3)

Three hours of lecture per week. Principles of heat and mass transfer as applied to the bioprocess industries. Topics include conduction, convective heat and mass transfer, diffusion of both steady-state and transient situations, analogies for heat and mass transfer, boundary layers, porous media transport, heat and mass transfer analysis. Discussion of specific bioprocess examples. Spring. Note: Credit will not be granted for both BPE 335 and BPE 535.

BPE 536 Radiation Curing/Polymer Tech (3)

Broad treatment of development and use of radiation curing of polymer technologies as they apply to industry-related roles such as chemists, engineers, technicians, and managers. Properties and development of free-radical and cationic systems initiated by various radiation sources. Chemical and physical underpinnings of common radiation curable materials and mechanisms. Analysis techniques that monitor the cure reaction and the properties of cured material. Emphasis on the considerations and challenges in common applications of radiation curable polymer systems and associated costs, regulatory, and safety considerations. Online Academic Year and/or Summer Session. Prerequisite(s): B.S. from an accredited institution with at least one semester of organic chemistry or permission of instructor.

BPE 596 Special Topics (1-3)

Lectures, conferences, discussions and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper-division undergraduate. Fall and/or Spring.

BPE 620 Bioseparations (3)

Three hours of lecture per week. Cell disruption, solid liquid separations, centrifugation, chromatographic techniques (gel filtration, affinity, ion exchange), and membrane processes. Extraction. Crystallization and drying. Aseptic filtration. Fall. Prerequisite: BPE 501. Note: Credit will not be granted for both BPE 620 and BPE 420.

BPE 621 Bioreaction Engineering (3)

Three hours of lecture per week. Green chemistry, biotechnology, regulatory constraints, social and environmental responsibilities. Reactor design equations, bioprocess systems optimization. Ideal batch reactors, plug flow reactors (PFR), continuous stirred tank reactors (CSTR). Isothermal and non-isothermal operations, reactor sizing. Continuous culture and wastewater treatment processes. Fed-batch operations. Feed stability, thermostability, steady state, sustainability, catalyst instability, genetic instability, mixed cultures. Reactor selection, operational modes, areation, agitation, scale-up and down, instrumentation and control, sterilization of process fluids, equipment and aseptic operations. Reactive hazards, reactor runaway and biosafety. Nonideal reactors. Fall. Prerequisites: BPE 321 or ECH 341 Credit will not be granted for both BPE 421 and BPE 621.

BPE 623 Chem/Lignocellulosic Biomass (3)

Three hours of lecture and discussion per week; advanced science course with discussion and literature research through the topics in chemistry of lignocellulosic biomass, including wood, grasses, and agriculture residues; major (cellulose, hemicelluloses, lignin) and minor constituents (extractives) -biosynthesis, structure, properties, physico-chemical association, use in biorefineries. Spring Prerequisite: Organic Chemistry I Lecture and Lab plus either Organic Chemistry II Lecture and Lab or PSE223 Lecture and Lab or equivalent or by instructor's permission

BPE 635 Unit Process Operations (3)

Two hours of lecture and three hours of laboratory and/or recitation, discussions. Topics include packed towers, tray columns, fluidized bed, fluid mechanic limitations, pressure drop, mass transfer coefficient, mass transfer limits, thermodynamic limits, equilibrium stage calculations, packed tower and tray column design and performance analysis. Fall.

BPE 638 Intro to Biorefinery Processes (3)

Three hours of lecture and discussions per week. Topics covered include chemical and physical properties of biomass feedstocks; sustainable biomass production/utilization, chemical and biological processes of converting plant biomass to chemicals, liquid fuels, and materials. Focus on green chemistry and/or environmentally benign processes, with some discussions on political and social aspects of sustainability and renewability. Fall. Note: Credit will not be granted for BPE 638 and BPE 438 nor PSE 438 nor PSE 638.

BPE 640 Bioproc Kinetcs&Exp Data Analy (3)

One hour of lecture and six hours of laboratory per week. Planning and execution of laboratory exercises. Measurement and analysis of adsorption, chemical and biological transformations, including batch and/or continuous systems. Adsorption and chemical transformation or catalytic reactions may include solid catalyst(s), acid catalyst(s), base catalysts(s) or other agents. Biological transformation may include enzyme, bacteria, fungi or yeast. Bioprocess kinetics and mass transfer effects. Coaching fellow students on experimental procedures and safety requirements. Parametric analysis. Report writing and seminar presentation. Spring. Prerequisite(s): Consent of instructor Note: Credit will not be granted for both BPE 440 and BPE 640.

BPE 650 Adv Catalysis& Surface Reactns (3)

Three hours of lecture per week. Intended for graduate students in Bioprocess Engineering and Chemical Engineering. Topics covered in this course may include gas and/or liquid interactions with solid surfaces, adsorption, catalysis on solid surfaces, and kinetics in systems involving solid particles and/or macromolecules. Discussions will be on an advanced level especially for kinetics and reactor analysis. Spring. Pre-requisites: BPE 421, or permission of instructor

BPE 658 Advanced Biocatalysis (3)

Three hours of lecture per week. This course is intended for graduate students in Bioprocess Engineering. Topics covered in this course may include enzyme, microbial and/or mammalian cell catalyzed molecular transformations. Biotransformations occur, at the fundamental level, due to the particular enzymes. Interactions between enzyme and ligand / substrate hold the key on how the reaction is regulated. On the cell level, enzymes work in tandem to convert one or more key substrate into one or more desired product. The mechanism and progress in the understanding of molecular transformations in microbial and mammalian systems are selectively covered. Discussions will be on an advanced level especially for kinetics and reactor analysis. Fall. Prerequisite: BPE 421 Bioprocess Kinetics and System Engineering, or permission of instructor.

BPE 681 Bioprocess Plant Design (3)

Three hours of lecture per week. Topics covered include integration of process and support systems and equipment; concepts of facility design integrating Good Manufacturing Practice (GMP), equipment and systems cleanability, people flow, product protection, capital investment, and operating costs. This course will focus towards facility design in the biopharmaceutical industry. Spring. Prerequisites: BPE 620, BPE 621 or equivalents.

BPE 796 Advanced Topics (1-3)

Lectures, conferences, discussions and laboratory. Advanced topics in forest engineering, paper science and engineering, and wood products engineering. Fall and/or Spring. Prerequisite: Permission of instructor.

BPE 797 Seminar (1-3)

Discussion of assigned topics in the fields related to Bioprocess Engineering. Spring and Fall.

BPE 798 Resrch/Bioprocess Engineering (1-12)

Independent research topics in Bioprocess Engineering. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. Credit hours to be arranged.

BPE 898 Prof Experience/Synthesis (1-6)

A supervised, documented professional work experience in the Master of Professional Studies degree program. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, or Summer. Pre- or co-requisite(s): Approval of proposed study plan by advisor, faculty, and any sponsoring organization.

BPE 899 Masters Thesis Research (1-12)

Research and independent study for the master's thesis. Fall, Spring or Summer. Credit hours to be arranged.

BPE 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral dissertation. Fall, Spring or Summer. Credit hours to be arranged.

BTC - BIOTECHNOLOGY

BTC 132 Orientation Seminar:BTC (1)

One hour of lecture or discussion per week. Occasional tour of laboratories or field trips. Introduction to campus facilities, personnel, lower-division curriculum, and upper-division study options to facilitate transition of students into the program and assist them in making informed decisions on course selection and future career directions. Fall.

BTC 298 Rsrch Apprenticeship/Biotech (1-3)

Full- or part-time engagement as volunteer or employee on research project having a biotechnology focus consistent with the student's educational and professional goals. Tenure at SUNY-ESF or outside institution. Faculty member in the BTC program will serve as student's sponsor. Study plan outlining the apprenticeship's educational goals completed prior to its commencement. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Grading satisfactory/ Unsatisfactory. Fall, Spring, Summer. Prerequisite(s): Permission of Instructor.

BTC 401 Molecular Biol Techniques (3)

Two hours lecture and three hours laboratory per week. Theories behind techniques in molecular biology are introduced in lecture. Laboratory includes the extraction and quantification of genomic and plasmid DNA, agarose gel electrophoresis, restriction digestion, ligation, bacterial transformation, DNA sequencing and PCR. Additional topics in molecular biology are presented by the students. Fall. Prerequisite(s): One year of Introductory Biology, one year of Introductory Chemistry, Genetics. Note: Credit will not be granted for both BTC 401 and EFB 601.

BTC 420 Internship in Biotechnology (1-5)

Full- or part-time employment or volunteer work with an agency, institution, clinic, professional group, business, or individual involved in activities consistent with the student's educational and professional goals. The extent of the internship activities shall be commensurate with the credits undertaken. A resident faculty member must serve as the student's academic sponsor. A study plan outlining the internship's educational goals must be completed prior to its commencement. Grading will be based on a written report from the student and submitted to the sponsoring faculty member and on an evaluation of the student's performance written by the site supervisor to the sponsoring faculty member. Fall, Spring, Summer. Prerequisite: Consent of a faculty sponsor.

BTC 425 Plant Biotechnology (3)

Two hours of lecture and three hours of laboratory per week. The use of transgenic plants to improve the human condition and remediate environmental problems is a rapidly growing field of study. Students are taught the principles of gene structure and regulation, gene cloning, transformation of plant species, and current applications. Format includes lectures, discussions, student presentations, and a laboratory project. Spring. Note: Credit will not be granted for both BTC 425 and EFB 625.

BTC 426 Plant Tissue Culture Methods (3)

Two hours of lecture and discussion and three hours of laboratory per week. Introduction to plant tissue culture for biotechnology research and as a propagation method. Emphasis will be on learning laboratory instrumentation and techniques for establishing cell cultures, producing transgenic cell lines, and regenerating whole plants. Fall. Prerequisites: One course in botany, microbiology, or genetics; or permission of instructor. Note: Credit will not be granted for BTC 426 and FOR 626/EFB 626.

BTC 496 Topics in Biotechnology (1-3)

Experimental, interdisciplinary, or special topic coursework in biotechnology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit if topic changes. Fall or Spring.

BTC 497 Research Dsgn&Prof Develop (1)

One hour of discussion or seminar each week covering the scientific method, professional ethics and responsibilities of the practicing scientist. Employment opportunities, future career choices, safety considerations, and use of the scientific literature are covered. Students will select a research topic and prepare a proposal, which may be applied to BTC 498 or BTC 420. Spring. Pre- or co-requisite: Biotechnology major or permission of instructor.

BTC 498 Resrch Prob/Biotechnology (1-9)

Laboratory research experience with research time agreed upon by student and instructor. Independent research experience covering biotechnological topics. Specific topics determined through consultation between student and appropriate faculty member. Tutorial conferences, discussions, and critiques scheduled as necessary. Grading determined by the instructor and could include, but not required, evaluation of skills learned, data obtained, and laboratory notebook record keeping. A final written report is required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall or Spring. Prerequisite: Permission of instructor.

BTC 499 Senior Project Synthesis (1)

One hour of discussion or seminar each week. Students will learn to synthesize results gained from their own independent research and present those data in a scientific poster at a research symposium. Topics of professional preparation will also be discussed. Spring.

CME - CONSTRUCTION MANAGEMENT ENGINEERING

CME 106 Engr Materials/Sustainble Cons (3)

Two hours of lecture/discussion per week and one lab per week. Introduction to the principal structural materials used for building construction and their engineering properties and environmental impacts. The production and performance of these materials will be explored through class discussion and laboratory experiments. The application of each of the materials during sustainable construction processes will be emphasized. Spring.

CME 132 Orientation Seminar:SCME (1)

One hour of lecture and discussion per week. Introduction to campus resources available to ensure academic success in the area of Sustainable Construction Management and Engineering. Fall.

CME 142 Light Construction (3)

Three hours of lecture per week. An introduction to the construction process with an emphasis on the unique aspects of light construction. Introduces construction management principles related to material properties, building science, structural design, estimating, and scheduling. Fall.

CME 151 Intro to Financial Accounting (3)

Three hours of lecture/discussion per week. Financial accounting concepts that aid entrepreneurs, managers, investors, and creditors in planning, operating, and analyzing a business. Emphasis is on interpretation of financial statements. Fall.

CME 202 Intro/Prof Communications (1)

Three hours of lab per week. Introduction to intermediate-level use and understanding of software for word processing, spreadsheet analysis, and database management. Focused on developing the ability to prepare reports including preparation of documents, data analysis, and written presentations. Fall.

CME 215 Sustainable Construction (3)

Three hours of lecture/discussion per week. Overview of sustainable design and construction concepts and practices. The emergence of green building, issues, and rating systems. Sources of chemicals in buildings, indoor air quality, and human comfort. Basic energy principles and energy-efficient technologies. Selection of materials. Role of the contractor in the management and construction of green projects. Spring.

CME 226 Statics&Mechanics of Materials (4)

Four hours of lecture/discussion per week. Equilibrium systems of forces in two and three dimensions. Analysis of structural components for stresses and deformations. Stability and design of beams and columns made of common engineering materials. Design methods and safety considerations. Fall. Prerequisite: APM 103, FOR 110

CME 252 Intro to Managerial Accounting (3)

Three hours of lecture/discussion per week. Introduction to the role of accounting information systems in measuring performance, influencing employee behavior, and facilitating planning decisions such as what products and services to offer, in which markets, and at what prices. Spring. Prerequisite(s): CME 151.

CME 255 Plan Interpn&Quantity Takeoff (3)

Three hours of lecture/discussion per week. Introductory course in construction plan interpretation and quantity takeoff. Will address how to read and interpret construction plans and introduce basic quantity takeoff skills. Spring.

CME 303 Construction Mngmnt Internship (1-4)

Field experience. Full or part-time employment with an organization that involves the student in an educational experience in a professional establishment. A resident faculty member must serve as the student's academic sponsor. Students shall report their activities to their instructor upon completion of the course. Fall and Spring.

CME 304 Envrn Perform Measures/Bldgs (3)

An overview of how building rating systems for green construction have developed, their present application, and future directions for growth. The course will explore the process for development of individual standards, the different building certification systems that have been developed using these standards, and long-term development and code adoption of such certification systems.

CME 305 Sustainable Energy Sys/Bldgs (3)

Three hours of lecture/discussion per week. Exploration of construction management-related issues in creating a more sustainable energy use in our building stock. Integrating sustainable energy sources in construction as well as issues related to using energy more efficiently. Fall.

CME 306 Engr Materials/Sustainble Cons (3)

Two hours of lecture/discussion per week and one lab per week. Introduction to the principal structural materials used for building construction and their engineering properties and environmental impacts. The production and performance of these materials will be explored through class discussion and laboratory experiments. The application of each of the materials during sustainable construction processes will be emphasized. Spring.

CME 322 Mechanical Processing (3)

Two hours of lecture and three hours of laboratory per week. Primary log reduction methods and industry practices. Lumber grading. Wood cutting principles. Machining practice in secondary wood-using industries. Experience in the operation of certain primary and secondary machining equipment. Fall.

CME 327 Site Investigatns & Solutions (3)

Three hours of lecture/discussion per week. Principles of geotechnical engineering, site investigation methods, methods for improving sites, and the role of geotechnical engineering in construction contracts. Fall.

CME 330 Building Code/New York State (3)

Three hours of lecture/discussion per week. Introduction to the Building Code that legally governs the design and construction of all building types within New York State. The course includes a basic understanding of the Code including history and origin, legal enforcement, basic definitions, and terminologies. Fall.

CME 331 Construction Safety (3)

Occupational Safety and Health Practices in the construction industry with coverage of the U. S. Department of Labor, Occupational Safety and Health Regulations (CFR 1910 and 1926 Standards). Detailed study of Construction Safety and Hazardous Communications programs, personal protective equipment, tools, electrical power, ladders, and scaffolding, floor and wall openings, cranes and power equipment. Special problems related to concrete work, erection and demolition. OSHA 30 Hr. card earned. Fall. Note: Credit will not be granted for both CME 331 and CME 531.

CME 332 Mech/Elect Equipment (3)

Three hours of lecture per week. The course introduces the basic concepts of mechanical systems design and construction for residential and commercial buildings. Simplified design and construction estimates are performed for heating, cooling, plumbing, sanitation, electrical, and lighting systems. Relevant code requirements are stressed. Fall.

CME 335 Cost Engineering (3)

Three hours of lecture/discussion per week. Statistics, cost of money, rates of return, cash flow, budget development, cost tracking, productivity and progress, constructability and value engineering, change control and risk analysis. Fall. Prerequisite: APM 391, upper division standing or permission of instructor. Note: Credit will not be granted for both CME 335 and CME 535.

CME 342 Light Construction (3)

Three hours of lecture per week. An introduction to the construction process with an emphasis on the unique aspects of light construction. Introduces construction management principles related to material properties, building science, structural design, estimating, and scheduling. Fall.

CME 343 Construction Estimating (3)

Three hours of lecture/discussion per week. Basic estimating/bidding theory and process. The processes for reviewing and interpreting contracts, specifications, and blueprints and their role in the estimating/bidding process. How to perform a quantity takeoff, be able to create a final estimate/bid including the appropriate General Conditions and Markups. Several projects based upon the concepts are assigned on the material listed above as well as utilizing either a spreadsheet or Timberline Precision Computer Estimating. Fall. Prerequisite: CME 255 or permission of instructor Note: Credit will not be granted for both CME 343 and CME 543.

CME 350 Const Methods&Equipment (3)

Three hours of lecture/discussion per week. The study of production, methods of operation and costs of heavy construction equipment. Analysis of heavy construction operations. Economics of equipment use. The fundamentals of decision making involved in the selection of methods and equipment that will result in the most effective and efficient performance on a project. Spring. Note: Credit will not be granted for both CME 350 and CME 525.

CME 371 Surveying for Cnstrct Managers (1)

Overview of the use of surveying techniques for managing construction projects. Introduction to the processes used to create horizontal and vertical control for progressing work. Fundamental principles used for construction layout. Fall. Hybrid- 1 hour synchronous online lecture most weeks, with several 3 hour in-person labs. Online synchronous class sessions will only run for the first hour of the scheduled 3 hour class time

CME 388 Wood And Fiber Ident Lab (2)

Six hours of laboratory per week. Wood and papermaking fiber identification using both gross and microscopic features. Fall. Prerequisite: CME 387 to be taken concurrently or previously.

CME 389 Wood Identification Lab (1)

Three hours of laboratory per week. Identification of principal commercial timbers of United States on gross characteristics. Spring. Prerequisite: CME 387.

CME 390 Fiber Identification Lab (1)

Three hours of laboratory per week. Identification of woody and nonwoody papermaking fibers. Spring. Prerequisite: CME 387.

CME 400 Intro to Forest Products (3)

Three hours of lecture per week. Characteristics of the products of the forest tree and manufacture of wood products. Spring.

CME 403 ConstructionMgmt Internship II (1-4)

Field experience. Full or part-time employment with an organization that involves the student in an educational experience in a professional establishment. A resident faculty member must serve as the student's academic sponsor. Students shall report their activities to their instructor upon completion of the course. Fall and Spring. Prerequisite: CME 303

CME 404 Applied Structures (3)

Three hours of lecture/discussion/demonstration per week. Applications of statics/mechanics to common engineering structures. Analysis and design of wood, concrete and steel systems considering sustainability and life-cycle analysis. Spring. Prerequisite(s): CME 226, Statics and Mechanics of Materials.

CME 405 Bldg Info Modelng/Cons Mgt (3)

Three hours of lecture per week. An introduction to the basic concepts of building information modeling as a construction approach, and an exploration of its application to construction management. Emphasis on the use of building information modeling for estimation, scheduling, clash detection, and project communication. Spring. Prerequisite(s): CME 255 Plan Interpretation and Quantity Takeoff. Co-requisite: CME 343 Construction Estimating.

CME 440 Capstone Planning (1)

One hour of discussion, project instruction, and planning for a Capstone project per week. Based on a typical real-world project, this class allows the students to experience the concept of integrated project management by participating in the early stage business of project management. It requires the students to utilize the knowledge and skills to generate corresponding construction management products in the early stages of a project (even when the project is still under design). The course covers organizational structure, construction estimating, business model, construction scheduling, value engineering, and sustainability. Fall. Prerequisites: CME 343; CME 453; senior standing or permission of instructor

CME 444 Materials Marketing (3)

Three hours of lecture and discussion per week. Fundamentals of marketing forest products, building and construction industry materials, including products, markets, distribution, segmentation, pricing, promotion and sales. Specific focus is on the unique nature and issues of forest products and building materials; vertical and horizontal integration, distribution channels, market segmentation and product positioning strategies. Fall. Prerequisite: FOR 207 Introduction to Economics or equivalent.

CME 453 Construct Plan/Scheduling (3)

Three hours of lecture per week. The use of common types of schedules: Gantt, Activity on Node, Precedence Diagram, PERT and Linear. Identification of activities and performance duration analyses of these activities. Updating of schedules, resource planning and assignment, cost planning and scheduling are all covered. Schedule development is performed both manually and with industry-accepted software. Spring. Prerequisite(s): APM 391, CME 343 or permission of instructor. Note: Credit will not be granted for both CME 453 and CME 653.

CME 454 Capstone in Construction Mngmt (3)

Three hours of discussion/project instruction and/or implementation for a Capstone project per week. It utilizes a comprehensive real-world project opportunity to allow the students to experience the main stages and components of construction project management. It requires the students to apply the knowledge and skills obtained from previous courses to the project. The course mainly focuses on organizational structure, construction estimating, bidding process and documents, construction scheduling, value engineering, and sustainability. Spring. Prerequisites: CME 343, CME 440, CME 453 and senior standing or permission of instructor. Note: Credit will not be granted for both CME 454 and CME 654.

CME 455 Construct Contracts/Specs (3)

Three hours of lecture/discussion per week. The types of contracts used in the construction industry. Analysis of the contractor, designer and owner duties and obligations as determined by the construction contract documents. Study of concepts, language, formats and procedures for project manual organization practice and the general conditions of the contract for construction. Spring. Prerequisite(s): Upper division standing or permission of instructor. Note: Credit will not be granted for both CME 455 and CME 658.

CME 456 Adv Skills for Construct Mngmt (3)

This is a seminar-type course, taught by a number of instructors. Each of them will have a 4-5 weeks to discuss specific topics such as emerging technologies to enhance the analysis, design, construction, performance, and asset management for construction projects such as augmented reality (AR), virtual reality (VR), digital twins, drones, and Internet of Things (IoT); construction equipment management and selection for construction applications; composite, hybrid, or new materials for construction applications; emerging trends in project delivery, project cost estimation and control, and procurement of construction services; conflict resolution and negotiations; and sustainable construction. Spring.

CME 488 Prof Cons Project Mgt Pres Sem (1)

One hour of lecture/seminar/preparation per week. A preparatory course for participation in a professional construction management proposal process including proposal development and professional presentation of the proposal. The course culminates in participation at a regional construction management competition sponsored by the Associated Schools of Construction Region 1. Fall. Prerequisites: Junior or Senior standing and permission of the instructor.

CME 490 CertAssoc Constructor ExamPrep (1)

One hour lecture per week. Discussion of content and administration of the Certified Associate Constructor (CAC) exam, a comprehensive review of CAC-type problems, and a targeted review of specific topics on the CAC exam. Fall. Prerequisite: Senior standing, or permission of the instructor.

CME 495 Undergrad Exp/Coll Teach (1-3)

Undergraduate students gain experience as teaching assistants. They assist the instructor with the teaching and learning experience, assist students with learning course concepts, and mentor students on how to succeed in an undergraduate course. Responsibilities vary by section and instructor. Fall and Spring. Prerequisites: Permission of instructor. The student must have previously completed, with grade of B or better, the course in which they will assist.

CME 497 Senior Ethics Seminar (1)

One hour of lecture/discussion per week. Student papers/ presentations are directed toward professional issues in ethics and career preparation, Fall. Prerequisite(s): Senior status in SCME.

CME 498 Research or Design Prob (1-3)

Conferences, library, laboratory and/or field research on a specific problem in wood products engineering. Written report required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Permission of instructor and advisor.

CME 504 Envrn Perform Measures/Bldgs (3)

Three hours of lecture per week. Environmental Performance Measures for Buildings - Three hours of lecture/discussion per week. Overview of building rating systems for green construction, their development, present application, and future directions for growth. Explores the process for development of individual standards, different building certification systems that have been developed using these standards, and long-term development and code adoption of such certification systems. An experiment-based, analytical, or evaluative project is required. Fall. Prerequisite(s): Graduate standing, or upper division standing with approval of instructor. Note: Credit will not be given for both CME 304 and CME 504.

CME 505 Sustainable Energy Sys/Bldgs (3)

Three hours of lecture/discussion per week. Exploration of construction management-related issues in creating a more sustainable energy use in our building stock. Integrating sustainable energy sources in construction as well as issues related to using energy more efficiently. An experiment-based, analytical, or evaluative project is required. Fall. Prerequisite(s): Graduate standing, or upper division standing with approval of instructor. Note: Credit will not be given for both CME 305 and CME 505.

CME 525 Const Methods&Equipment (3)

Three hours of lecture/discussion per week. Analysis of heavy construction operations and related environmental concerns. Production calculations, means and methods selection and operating costs of heavy construction equipment are addressed. The economics of equipment use are analyzed. The use of a digitizer in earthwork quantity takeoff is explored. The outcome of the course is to select the most cost efficient and performance efficient method and equipment. A term paper is required. Spring. Note: Credit will not be granted for both CME 525 and CME 350.

CME 531 Construction Safety (3)

Three hours of lecture per week. Occupational Safety and Health practices in the construction industry. An overview of the US Department of Labor, Occupational Safety and Health Regulations, 29 CFR 1910 and 29 CFR 1926. Comprehensive review of: general safety and health requirements, hazard communication, confined space entry, lockout/tagout programs, workplace violence, personal protective equipment, fire protection, signs and barricades, rigging, small tools - hand and power, welding and cutting, electrical, fall protection, scaffolding, cranes, mobile equipment, excavation and trenching, steel erection, stairways and ladders and permissible exposure limits. A term paper is required. Fall. Note: Credit will not be granted for both CME 531 and CME 331.

CME 532 Mech/Elect Equipment (3)

Three hours of lecture per week. The course introduces the basic concepts of mechanical systems design and construction for residential and commercial buildings. Simplified design and construction estimates are performed for heating, cooling, plumbing, sanitation, electrical, and lighting systems. Relevant code requirements are stressed. An experiment-based project is required. Fall. Note: Credit will not be given for both CME 332 and CME 532.

CME 535 Cost Engineering (3)

Three hours of lecture/discussion per week. Statistics, cost of money, rates of return, cash flow, budget development, cost tracking, productivity and progress, constructability and value engineering, change control and risk analysis. Prerequisite: Upper division standing or permission of instructor. Note: Credit will not be granted for both CME 535 and CME 335.

CME 543 Construction Estimating (3)

Three hours of lecture/discussion per week. Definition and explanation of estimating/bidding theory and process. The processes for reviewing and interpreting contracts, specifications and blueprints as well as their role in the estimating/bidding process. Perform a quantity takeoff. Create a final estimate/bid, including the appropriate General Conditions and Markups. Several projects based on the concepts listed above as well as utilizing either a spreadsheet or Timberline Precision Estimating. A term paper describing how the relevant topics of the course fit a specific industry application, and production of an additional project based on Timberline Precision estimating software or equivalent are required. Spring. Prerequisites: CME 255 Plan Interpretation and QTO or basic estimating experience and permission of the instructor. Note: Credit will not be granted for both CME 543 and CME 343.

CME 565 Sustainable Innovatns/Res Cons (3)

Three hours of lecture per week. Principles of sustainable residential construction; the adaptation of biological, ecological, and cultural elements into building performance standards, practical building specifications, standards and systems. Spring.

CME 605 Bldg Info Modelng/Cons Mgt (3)

Three hours of lecture/discussion per week. Introduction to the basic concepts of building information modeling as a construction approach, and exploration of its application to construction management. Emphasis on building information modeling for estimating, scheduling, clash detection, and project communication. An experiment‐based, analytical, or evaluative project is required. Spring. Prerequisite(s): Graduate standing Co-requisite: CME 543 Note: Credit will not be given for both CME 405 and CME 605.

CME 643 Estimating/Green Global Econ (3)

Three hours of lecture per week. Building upon the estimating skills developed through undergraduate coursework and professional experience this course will look at how to address global estimating concerns such as monetary value between various currencies, how the purchase of commodities futures effects material pricing, the linkages between financial, real estate development and policies and their effects on the construction markets. How to price multi-year projects addressing the previous issues and how to construct an estimate that will convey the information relative to green construction costs to the client in a proper manner will also be addressed. Fall or Spring. Prerequisites: CME 543 or equivalent or 3 to 5 years of professional estimating experience and permission of instructor.

CME 653 Construct Plan/Scheduling (3)

Three hours of lecture/discussion per week. The use of Gantt, Activity on Node, Precedence Diagram, PERT and Linear schedules. Identification of activities and duration analyses of these activities. Update schedules, plan and assign resources, plan cost and schedule. Schedule development is performed both manually and with industry accepted software. A term paper describing how the relevant topics of the course fit a specific industry application and an additional project utilizing the software are required. Fall.

CME 654 Construction Project Mgt (3)

Three hours of lecture/discussion per week. How to define and properly identify company organizational structures. Project delivery systems, integration of estimating, bidding, scheduling and cost control into the management process. How safety, quality control, value engineering, procurement, labor relations and insurance and bonding requirements are integral parts of a construction project. A term paper describing how the relevant topics of the course fit a specific industry application is required. Spring. Prerequisite(s):CME 543, CME 653, or equivalent experience and permission of the instructor. Note: Credit will not be granted for both CME 654 and CME 454.

CME 658 Construct Contracts/Specs (3)

Three hours of lecture/discussion per week. The types of construction contracts used in the construction industry from the Owner, Contractor, Subcontractor and Supplier viewpoints. Types of required insurance and the remedies available to contractors are presented. The process of bidding and negotiating from the legal perspective is covered along with contract administration. Specifications are introduced by type and the requirements of each type are discussed, based on current industry-accepted standards. A term paper describing how the relevant topics of the course fit a specific industry application is required. Spring. Prerequisite: Upper division standing or permission of instructor. Note: Credit will not be granted for both CME 658 and CME 455.

CME 664 Urban Project Management (3)

Three hours of lecture per week. Building upon project management skills developed through undergraduate coursework and professional experience this course will look at the unique challenges of construction projects in urban settings. Topics to be addressed include but are not limited to: site logistics and their importance to a successful project, the influence of permits and codes on the project, the growing use of technology to solve urban project problems, the issues related to labor, subcontractors and suppliers in this high intensity setting. The importance of communication and project documentation will be addressed as well. Fall or Spring. Prerequisites: CME 654 or equivalent professional experience and permission of instructor.

CME 686 Wood-Water Relationships (3)

Two hours of lecture and three hours of laboratory per week. Relationship between wood moisture content and the environment, electrical and thermal properties, theories of moisture sorption, hygroscopic swelling and shrinking, thermodynamics of moisture sorption, mechanism of moisture movement as it relates to activation theory. Laboratory exercises will complement the theoretical topics discussed in the lecture. Fall. Prerequisite: Permission of instructor.

CME 770 Biodegradation of Wood (3)

Two hours of lecture and 1 hour of laboratory/demonstration/discussion per week. Biology of lignicolous fungi and other microorganisms concerning their effects on wood properties. Anatomical, biological and chemical aspects of the major types of wood decay. Spring. Prerequisite: Introductory biology and permission of instructor.

CME 797 Seminar (1-3)

Discussion of assigned topics in the fields related to Sustainable Construction Management and Wood Science. Spring and Fall.

CME 798 Resrch/Sustain Cons Mgt&Wd Sci (1-12)

Independent research topics in Sustainable Construction Management and Wood Science. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. Credit hours to be arranged.

CME 898 Prof Experience/Synthesis (1-6)

A supervised, documented professional work experience in the Master of Professional Studies degree program. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, or Summer. Pre- or co-requisite(s): Approval of proposed study plan by advisor, Faculty, and any sponsoring organization.

CME 899 Masters Thesis Research (1-12)

Research and independent study for the master's thesis. Fall, Spring or Summer. Credit hours to be arranged.

CME 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral dissertation. Fall, Spring or Summer. Credit hours to be arranged.

ECH - CHEMICAL ENGINEERING

ECH 132 Orientatn&Intro to Chem Eng I (1)

One hour lecture per week or three-hour lab/field trip per week. Introduction to chemical engineering as a general field of study and broad career path. Topics covered include broad field and applications of chemical engineering. sustainability, engineering ethics, laboratory and process safety, resumes and interviewing, and teamwork.

ECH 133 Orientatn&Intro to Chem Eng II (1)

One hours of lecture or three hours of workshop per week. Introduction to chemical engineering as a general field of study and broad career path. Topics covered include basic engineering calculations, statistics, engineering design, computer programming (MATLAB) and process simulators, ethics, sustainability and professional responsibility. The place of experiential learning such as research experience or industrial internships and co-op programs will be covered.

ECH 202 Prin Mass/Energy Balance (3)

Three hours of lecture per week. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Prerequisites: FCH152, PHY211 Co-requisites: APM 206

ECH 212 Engr Thermodynamics (3)

Principles of classical thermodynamics applied to engineering practice. First and second laws; heat effects; property functions and their correlation; physical and chemical equilibrium; fugacity; solutions and mixtures; power and refrigeration cycles. Thermodynamic analysis of chemically reacting processes and systems via case studies and computer simulation applied to various types of reactor systems. Prerequisites: FCH152, ECH202.

ECH 304 Chemical Engineerng Internship (1)

Field. Twelve weeks full time employment approved by the department with an industrial or research partner acquired through on-campus interviews or other means. The student and the supervisor set goals and expectations for the internship. The students and supervisors also provide feedback on the performance of the student.

ECH 306 Professional Synthesis (1)

Seminar. Students will develop a synthesis of their work experience from either ECH 304 and present their results both orally and in a written report. Prerequisite: ECH 304 or ECH 305

ECH 312 Chemical Engrn Thermodynamics (3)

Three hours of lecture per week. Thermodynamic properties of pure fluids and mixtures of fluids; vapor-liquid equilibrium, theory and applications of solution thermodynamics, chemical reaction equilibria, and colloidal systems. Prerequisite: ECH 212 Engineering Thermodynamics Credit will not be given for both ECH 312 and ECH 512

ECH 322 Fluid Mechanics (3)

This course covers fluid statics, principles of continuity and momentum equation, energy balance and Bernoulli's equation, and friction in fluid flow. Students will learn how to apply energy balance and momentum balance to flow systems including laminar and turbulent pipe flows, steady and unsteady flow of liquids and gases in pipelines, ducts, and porous media. Students will learn pumps, their characteristics and calculations. Flow measurement devices, Non-Newtonian fluids and flow, and movement of particles in fluid media will also be covered. Prerequisites: ECH 202, APM 485

ECH 323 Transport Phenomena (3)

Three hours of lecture per week. Principles of heat and mass transfer as applied to the bioprocess industries. Topics include conduction, convective heat and mass transfer, diffusion of both steady-state and transient situations, analogies for heat and mass transfer, boundary layers, porous media transport, heat and mass transfer analyses. Discussion of specific bioprocess examples. Prerequisites: ECH202, ECH322.

ECH 324 Unit Operations Laboratory (3)

1.5 hours of lecture and 4.5 hours of laboratory per week. Experiments on fluid mechanics like pressure drop and flow rate measurement in pipe flow, downstream units such as centrifugal pump operation, membrane filtration, adsorption/chromatography, centrifugation/sedimentation, extraction, and other process operation including heat exchange, drying, etc. Data acquisition and parametric analysis. Planning and execution of laboratory experiments. Report writing and seminar presentation. This course is a junior-level course in the PSE and BPE fields of study, which makes use of campus resources available to ensure academic success. The course is designed for students to gain practical knowledge in the areas of transport phenomena and unit operations by performing experiments. The skills and information learned in this class will help students in many of their future courses and in their professional careers. Prerequisites: ECH 212.

ECH 341 Chem Reaction Engnrng Kinetics (3)

Three hours of lecture per week. Fundamental concepts in chemical engineering reactions, basic reaction rate theory, steady-state approximation, transition-state theory, reaction mechanisms of chemical reactions, analysis of kinetic data. Prerequisites: APM 485 and ECH 312.

ECH 355 Engr Design Economics (3)

Three hours of lecture per week. Steps of process design, engineering economic analysis, estimation of capital investment, operating costs, profitability measures, evaluation of alternatives, inflation. Modeling and computer simulation of process units and systems; use of software. Design exercises and case studies. Prerequisites: APM 485 and ECH 202

ECH 371 Process Control (3)

Presents an introduction to the principles of process control. Linear analysis, LaPlace transforms, and nonlinear simulation are presented and applied to feedback, and feedforward control. Examples of process simulation, accuracy and stability of control are drawn from paper industry processes. Prerequisite: APM 485

ECH 380 Process Simulation Modeling (3)

Three hours of lecture per week. This course will provide the basics of design and modeling of chemical and bioprocess systems. Student will learn use of software packages (e.g., SuperPro Designer, Aspen Plus) to design, model and simulate chemical and bioprocess flow sheets, model complex process simulations under continuous or batch mode, accessing databases for properties of chemicals, equipment sizing, material and energy balances of integrated processes, throughput analysis, detailed cost analysis, overall techno-economic evaluation and sensitivity analysis. Spring. Prerequisites: BPE 300 and ECH202, OR Instructor's Permission Note: Credit will not be given for both ECH 380 and ECH 580

ECH 422 Unit Process Operations (3)

Three hours of lecture per week. Topics include fluidization, equilibrium stage operation, distillation, evaporation, gas absorption, design of packed and tray towers, use of process simulation software (e.g. CHEMCAD). Prerequisite: ECH 322

ECH 442 Chem Reaction Eng&Prcss Safety (3)

Main topics of coverage include conversion and reactor sizing, isothermal and non-sothermal reactor peration/design for flow and batch systems, multiple reactions, introduction to heterogeneous reactor design, sustainability and stability, reactor runaway, reactive hazard and process safety.

ECH 454 Product Design in Chem Eng (3)

Three hours of lecture per week. Quality by design of chemical engineering products range from specialty chemicals to devices that perform chemical transformations. This course integrates the steps of product design from brainstorming and concept selection through design and manufacturing. Students will be taught and practice using the basic tools and principles of chemical / biochemical product design, including TRIZ, house of quality, robust design, design for manufacturability, FMEA and Six Sigma. Other topics include multi-generational product planning, sustainability and life cycle analysis, basic economic evaluations, risk management, an introduction to entrepreneurship and new business development, as well as intellectual property and freedom-to-operate assessments. Case studies drawn from industry will also be illustrated. Prerequisites: ECH 322, ECH 341, APM 395

ECH 455 Capstone Chemical Engnrng Lab (3)

1.5 hours of lecture per week and 4.5 hours of laboratory per week. Experimental design, data acquisition, and statistical analysis and interpretation of data. Professional communications with lab reports and presentations. The course is designed to help students acquire practical engineering knowledge in the areas of transport phenomena and unit operations by designing and performing experiments on material covered in earlier courses. Prerequisites: ECH 324, ECH 422, and ECH 442.

ECH 457 Chemical Engnrng Plant Design (3)

Two hours of lecture and three hours of studio per week. Design project and procedure; open-ended design options; chemical engineering principles; unit operations; safety considerations; and economic analysis. Process simulation and computer-aided design for process synthesis and plant layout. Formulation and solution of original design problem(s) under realistic (e.g., socioeconomic, process, environmental, safety, etc) constraints. Prerequisites: ECH 355, ECH 422, and ECH 442.

ECH 498 Research Problem in Chem Eng (1-4)

Individual study, lecture and/or lab, 1 to 12 hours per week. The student is assigned a research problem in chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on discovery of results of commercial importance. The information obtained in the literature survey, along with the data developed as a result of the investigation, is to be presented as a technical report. Prerequisites: consent of instructor

ECH 512 Chem Eng Thermodyn & Colloids (3)

Three hours of lecture per week. Thermodynamic properties of pure fluids and mixtures of fluids; vapor-liquid equilibrium, theory and applications of solution thermodynamics, chemical reaction equilibria, and colloidal systems. Statistical mechanics preliminaries. Spring. Credit will not be given for both ECH 312 and ECH 512

ECH 580 Process Simulation Modeling (3)

Three hours of lecture per week and one hour of discussion every two weeks. This course will provide the basics of design and modeling to conduct commercial scale feasibility and techno-economic analysis of agricultural, chemical and bioprocess systems. Student will learn use of software packages (e.g., SuperPro Designer, Aspen Plus) to design, model and simulate chemical and bioprocess flow sheets, model complex process simulations under continuous or batch mode, accessing databases for properties of chemicals, equipment sizing, material and energy balances of integrated processes, throughput analysis, detailed cost analysis, overall techno-economic evaluation and hot spot analysis. Spring. Prerequisites: Mass and Energy Balance, Heat Transfer & Unit Operations, OR Instructor's Permission Note: Credit will not be given for both BPE 380 and BPE 580

EFB - ENVIRONMENTAL AND FOREST BIOLOGY

EFB 100 Survey of Biology (4)

Three hours of lecture and three hours of laboratory per week. Introductory exploration of biological principles at molecular, cellular, organismal and ecological levels. Key topics include: the scientific method, biological molecules, cell structure and processes, cell division, genetics, evolution, phylogenetics and classification of life, plant and animal form/function, population dynamics, interspecific interactions, global biodiversity, ecosystem processes. Possibility of weekend field trips. Spring. This course will not replace any of the following course sequence: EFB101, EFB102, EFB103 or EFB104 (or equivalent).

EFB 101 Gen Bio I:Organismal Bio&Ecol (3)

Three hours of lecture per week. Introductory exploration of biological principles at ecosystem, population, and organismal levels. Emphasis on form, function, diversity, ecology and evolution of living organisms. Fall. Co-requisite: EFB 102.

EFB 102 General Biology I Laboratory (1)

Three hours of laboratory per week. Major concepts of organismal biology and ecology will be reinforced with hands-on laboratory exercises and required field trips exploring the form, function, diversity, ecology, and evolution of living organisms. Fall. Co-requisite: EFB 101.

EFB 103 Gen Bio II:Cell Bio & Genetics (3)

Three hours of lecture per week. Organization and function of living cells. Key topics include biological molecules, organelle structure and function, gene expression, cell division, metabolism, photosynthesis, cell signaling, genomics, and population genetics. Spring. Co-requisite: EFB 104.

EFB 104 General Biology II Laboratory (1)

Three hours of laboratory per week. Major concepts of cell biology and genetics will be reinforced with hands-on laboratory exercises using analytical and experimental techniques such as light microscopy, chromatography, electrophoresis, enzyme assays, aseptic culture techniques, and transformation of bacterial cells. Spring. Co-requisite: EFB 103.

EFB 105 Adk Field Studies in Env Bio (1)

One week intensive based at the Cranberry Lake Biological Station. Focus is on basic field and laboratory identification of a variety of Adirondack taxa. Experimental design, sampling methodology, statistical analysis, and scientific communication are explored through group research projects and a final symposium. Summer. Prerequisite: High school students only

EFB 120 The Global Envirnmnt & Society (3)

Three hours of lecture per week. Interdisciplinary overview of large-scale environmental issues and their relation to societal strategies. Focus is on human population patterns, pressures on physical and biotic resources, and sustainable design. Topics include energy-use, causes and socioeconomic implications of climate change, pollution, biodiversity loss, ecological restoration, environmental justice, and biological conservation. Fall and Spring.

EFB 132 Orientation Seminar:EFB (1)

One hour of lecture, discussion and/or exercises per week. Introduction to campus resources available to ensure academic success. Introduction to EFB as a field of inquiry. Fall.

EFB 200 Physics of Life (3)

Three hours of lecture and discussion per week. Introduction to basic principles of physics from a perspective of biological function, structure and adaptation. Fall.

EFB 202 Ecol Monitor&Bio Assessmnt (3)

Forty-five hours of lecture, laboratory and field instruction per week for three weeks. An introduction to the biodiversity of northeastern North American terrestrial, wetland, and aquatic communities with a focus on vascular plants and invertebrate and vertebrate animals, incorporating practical field exercises designed to acquaint the student with problem solving. Summer, Cranberry Lake Biological Station. Students must register for summer session, to which appropriate tuition and fees apply in addition to travel and lodging costs.

EFB 210 Diversity of Life I (3)

Two hours of lecture and 3 hours of laboratory instruction per week. Introductory exploration of the diversity of life at local, regional and global scales. Hands-on laboratory exercises explore the form, function, diversity, ecology, and evolution of living organisms, focusing on viruses, fungi and plants. Fall. Prerequisite(s): One year of introductory biology.

EFB 211 Diversity of Life II (3)

Two hours of lecture and 3 hours of laboratory instruction per week. Introductory exploration of the diversity of life at local, regional and global scales. Hands-on laboratory exercises explore the form, function, diversity, ecology, and evolution of living organisms, focusing on microbes, protistans and animals. Spring. Prerequisite(s): EFB 101 and 102 or equivalent year of introductory Biology.

EFB 217 Peoples, Plagues and Pests (3)

Three hours of lecture/discussion per week. Impacts of selected diseases and pests on the development and course of human civilizations. Emphasis is on the impacts of plagues and pests on non-western civilizations. Spring.

EFB 220 Urban Ecology (3)

Two hours lecture/discussion, three hours of outdoor laboratory per week. Explores the city from an ecosystems perspective. Addresses the role and importance of science, engineering, the design professions, and community participation in creating livable communities. Environmental equity and justice are addressed. Fall.

EFB 222 Scuba & the Science of Diving (3)

Introduction to the science of diving. Incorporates skill sets that can lead to scuba certification. Students will learn fundamentals of diving as they apply to physics and physiology. Students will learn to perform basic scuba diving, nitrox gas diving, and use of a drysuit. These are required skills to progress in scientific diving and will prepare students for entry level diving and additional scuba classes. Available SDI certifications are Open Water Diver, Computer Nitrox, and Dry Suit Diver. Fall

EFB 245 Forest Health Colloquium (1)

One hour per week of discussion. An introduction to contemporary issues in forest health with a focus on the ecology and management of long-term and emerging threats to the forests of the northeastern U.S. Spring, odd years.

EFB 296 Spec Topics-Env&For Biol (1-4)

Experimental, interdisciplinary or special coursework at the freshman or sophomore levels. Subject matter and course format vary from semester to semester or offering on the basis of needs and objectives of the course. Fall or Spring.

EFB 298 Rsrch Internship/Envrn Biology (1-3)

Full- or part-time engagement as volunteer or employee on research project having environmental biology focus consistent with the student's educational and professional goals. Tenure at SUNY ESF or outside institution. EFB-based faculty member serves as student's sponsor. Study plan outlining the apprenticeship's educational goals completed prior to its commencement. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Grading Satisfactory/Unsatisfactory. Fall, Spring, Summer. Prerequisite(s): Permission of Instructor

EFB 303 Intro Envrn Microbiology (4)

Three hours of lecture and three hours of laboratory per week. An introduction to the biology of microorganisms and a study of their interactions with other organisms and their environment. Topics include microbial physiology, nutrient cycling, microbial evolution, microbial ecology, and pathogenesis. Laboratory topics include microscopy, aseptic technique, and bacterial diagnostics. Fall. Prerequisites: Two semesters of General Biology (EFB101/102 and 103/104 or equivalent), and one semester of General Chemistry.

EFB 305 Indigenous Issues&the Envrnmnt (3)

Three hours of lecture and discussion per week. Introduction to perspectives of indigenous people on environmental and natural resources management issues, including tribal forestry, fisheries, biocultural restoration, conservation strategies, climate change and treaty rights. Integrates scientific and indigenous worldviews and knowledge systems. Spring. Note: Credit will not be granted for both EFB 305 and EFB 605.

EFB 306 Wildlife Field Techniques (3)

Field, laboratory, lecture. The study of theory and application of common field techniques for monitoring wildlife populations. Concepts and methods include ethical care and use of wildlife in field research; identification of New York mammals by tracks, photos, and in-hand specimens; assessment of habitat quality; monitoring of elusive forest species; techniques for capturing, handling, and measuring wild animals; radio telemetry; acoustic surveys. Satisfies field study elective requirement in all Environmental Biology majors. Room, board, transportation and course fees will apply. Summer Prerequisites: Two semesters of General Biology (EFB101,102,103,104) or equivalent

EFB 307 Principles Of Genetics (3)

Three hours of lecture and discussion per week. A general course covering concepts of genetics and evolution basic to upper-division biology and biochemistry courses. Includes the inheritance and analysis of Mendelian and quantitative traits, the chemical nature of the gene and its action, genetic engineering, the genetic structure of populations and their evolution. Numerical methods for characterizing and analyzing genetic data are introduced. Spring. Pre-requisites are two semesters of General Biology; co-requisite EFB308 (Principles of Genetics Laboratory) or equivalent

EFB 308 Prin Of Genetics Lab (1)

Three hours of auto-tutorial laboratory per week. Experiments with plants and animals and computer simulation exercises demonstrate the basic principles of inheritance of Mendelian traits and changes in populations caused by major forces in evolution or by breeding procedures. Numerical methods for characterizing quantitative traits and for testing hypotheses are introduced. Spring. Co-requisite: EFB 307.

EFB 311 Principles of Evolution (3)

Three hours of lecture or discussion per week. An introduction to the fundamental processes driving evolution (genetic drift, gene flow, mutation, sexual selection, and natural selection), the evolution of life-histories, trade-offs, and phenotypic plasticity. Macroevolutionary concepts covered include speciation, extinction, co-evolution, and the reconstruction of phylogenies. Spring. Prerequisites: EFB 307 and EFB 320, or equivalents.

EFB 320 General Ecology (4)

Three hours of lecture and one three-hour field trip/laboratory per week. An introduction to plant and animal ecology, including concepts and techniques in population ecology, community dynamics, physiological and behavioral ecology, biogeography, ecosystem ecology, nutrient cycling and energy flow. Ecological management applications, human ecological impacts and problems are considered. Fall.

EFB 322 Scuba Diving Intl Foundations (3)

In person discussion and in water training/computer learning modules. This is the second in a sequence of three scientific diving courses instructed in collaboration between SUNY ESF and Scuba Diving International (SDI). This course will develop and refine student skills with recreational diving equipment configurations, and expand on gas planning techniques within a no-decompression context. Students will refine navigational skills that help them in an underwater environment. Students will have the opportunity to obtain up to three diving certifications(SDI Foundations, Computer Nitrox, and Dry Suit Diver). Students must be Open Water Dive certified to enroll. Spring Prerequisites: Open water dive certification

EFB 325 Cell Biology (3)

Three hours of lecture per week. Morphology and physiology of cells. Emphasis on macromolecule structure and function, cell division, gene expression, cell signaling, biochemical pathways, transport, metabolism, and motility. Spring. Prerequisite: One year of introductory biology, one semester of organic chemistry, Genetics.

EFB 326 Plant Evol,Diversificatn&Cons (3)

Two hours of lecture and one three-hour laboratory per week. Evolutionary survey of the origin and diversification of land plants through geological time. Major land plants including bryophytes, lycophytes, pteridophytes, gymnosperms and angiosperms with emphasis on representative fossil and living taxa. Life histories and reproductive strategies, anatomical and morphological adaptations, species extinction and extinction events, and phylogenetic relationships within and among phyla. Highlights rare or endangered taxa in each phylum and related conservation strategies and management. Lab focused on analyses of plant structures, reproductive mechanisms, evolutionary adaptations, and identification of a variety of living and preserved specimens. Spring. Prerequisite: Two semesters of General Biology (EFB101,102,103,104) or equivalent

EFB 327 Adirondack Flora (3)

Two hours of lecture, and eight hours of field work and discussion each day for two weeks. An integrated field and laboratory course in the identification of vascular plants and recognition of ecological characteristics of major plant species and communities of the Adirondack Mountain region. Satisfies elective field study requirement in Environmental and Forest Biology. Appropriate for upper and lower division undergraduate students seeking instruction in plant identification and ecology. Summer, Cranberry Lake Biological Station. Prerequisite: General botany or general biology.

EFB 336 Dendrology I (3)

Two hours of lecture per week and one three-hour laboratory/field trip. Field study, identification, natural history and elementary silvics of important forest trees of North America. Fall.

EFB 337 Field Ethnobotany (3)

Two hours of lecture per week and six to eight hours of field work and discussion each day for two weeks. A field-based introduction to the identification and traditional cultural uses of plants in the Adirondack region for food, medicine and fiber. Topics include plant identification, traditional ecological knowledge and use of ecological and ethnobotanical methods. Satisfies elective field course requirement in programs offered by Department of Environmental and Forest Biology. Cranberry Lake Biological Station. Summer. Students must register for summer session, to which appropriate tuition and fees apply in addition to travel and lodging costs. Prerequisite: EFB 226 General Botany or equivalent.

EFB 340 Forest/Shade Tree Path (3)

Two hours of lecture per week and three hours of auto-tutorial laboratory. Major diseases of forest, shade and ornamental trees; and deterioration of forest products, with emphasis on disease identification, principles of disease development, effects of disease on the host, and practical control measures. Spring.

EFB 342 Fungal Diversity & Ecology (3)

Two hours of lecture, and eight hours of fieldwork and discussion each day for two weeks. An integrated field and laboratory course designed to provide an introduction to the collection, identification and ecology of fungi and fungal-like organisms. Included in the course are Oomycetes (Kingdom Straminipila) and Myxomycetes (Kingdom Protista), as well as the more familiar groups of Kingdom Fungi. Satisfies field study elective requirement in Environmental and Forest Biology. Summer, Cranberry Lake Biological Station. Students must register for summer session, to which appropriate tuition and fees apply in addition to travel and lodging costs. Prerequisite: General biology or general botany.

EFB 344 Forest Health Seminar (1)

One hour per week of presentation and discussion. In-depth analyses of contemporary issues in forest health with a focus on the ecology and management of long-term and emerging threats to the forests of the northeastern U.S. Prerequisites: Two semesters of general biology, or equivalent.

EFB 350 Microbial Consortia (3)

Two hours of lecture/discussion and a three-hour lab per week. This class provides an introduction to the biology of lichens, slime molds, gliding bacteria (Myxobacteria) and bacterial biofilms. Emphasis is on understanding the role of each component in the functioning of these microbial consortia either as complex multi-species ecosystems (lichens and biofilms), or as single species "superorganisms" (slime molds and Myxobacteria). Against this background of cooperation and collaboration, students will be introduced to the anatomy, morphology, systematics and evolution, physiology, and ecology of these overlooked groups through weekly lectures/discussions. Lab will focus on methods used to study these organisms and on characters used in species level identifications. Current initiatives in the conservation of lichens will also be discussed. Spring. Prerequisites: One year of Introductory Biology and either EFB 210 or EFB 211.

EFB 351 Forest Entomology (3)

Two hours of lecture and three hours of laboratory per week. Basic insect diversity, ecology and pest management with an emphasis on insect pests of forested ecosystems. Designed for students in Environmental Biology, Forest Health and Forest Resources Management. Fall, even years. Note: Credit will not be granted for both EFB 351 and EFB 551.

EFB 352 Entomology (3)

Two hours of lecture and three hours of laboratory per week. Basic insect diversity, ecology and pest management with an emphasis on common insect pests of the northeastern U.S. Designed for students in Environmental Biology and Forest Health. Fall, even years. Note: Credit will not be granted for both EFB 352 and EFB 552.

EFB 355 Invertebrate Zoology (4)

Three hours of lecture and three hours of laboratory per week. Structure, function, classification and evolution of invertebrates. Emphasis on functional biology and ecological interactions. Spring.

EFB 360 Epidemiology (3)

Three hours of lecture/discussion per week. Introduction to the study of disease in populations and factors influencing disease occurrence. Case studies explore population measures of disease, clinical measures and causation. Emphasizes quantitative approaches, study design, ethics, intervention and implementation. Fall. Student enrolled in this course should have successfully completed one year of Introductory Biology and one semester of Introductory Statistics.

EFB 370 Population Ecology & Managemnt (3)

Two hours of lecture and discussion per week plus a 3-hour lab. An introduction to population ecology and genetics with consideration of their impact on population management. An integration of biological systems from molecular to ecosystem levels, with an emphasis on demystifying mathematical expression of complex ecological phenomena. We will draw on examples ranging from genetic diversity to human/wildlife conflicts to explore their influences on the maintenance of wild populations. Spring. Prerequisite: General Ecology or equivalent.

EFB 381 Vert Museum Techniques (2)

One hour of lecture and three hours of laboratory per week. Theory and practice of vertebrate museum methods, with emphasis on the preparation and curation of vertebrate specimens. Spring. Prerequisites: At least junior status and permission of instructor. Limited to 10 students.

EFB 384 Field Herpetology (3)

Two hours of lecture, and eight hours of field work and discussion each day for two weeks. An integrated field and laboratory course in the identification, natural history, ecology, and conservation of amphibians and reptiles of the Adirondack region. Satisfies field study elective requirement in Environmental and Forest Biology. Summer, Cranberry Lake Biological Station. Students must register for summer session, to which appropriate tuition and fees apply in addition to travel and lodging costs. Prerequisite: General biology or general zoology.

EFB 385 Comparative Vert Anatomy (4)

Three hours of lecture and three hours of laboratory per week. Analysis of vertebrate structure, with emphasis on comparative study of organ systems. Includes evolution of form and function, major adaptive patterns and phylogenetic relationships in vertebrates. Spring.

EFB 388 Ecology/Adirondack Fishes (3)

Two hours of lecture, and eight hours of fieldwork and discussion each day for two weeks. An integrated field and laboratory course in the identification of fish and recognition of ecological characteristics of major fish species and communities of Adirondack waters. Satisfies a component of the field study elective requirement in Environmental and Forest Biology. Summer, Cranberry Lake Biological Station. Students must register for summer session, to which appropriate tuition and fees apply in addition to travel and lodging costs. Prerequisite: General zoology or general biology.

EFB 390 Wildlife Ecology&Mgt (4)

Three hours of lecture and one hour of recitation per week. A study of the ecological principles governing wild animal populations and their habitats, and the relationship of these principles to management programs and decisions. Directed primarily toward students majoring in wildlife science, conservation biology, and forest resources management. Fall. Prerequisite or co-requisite: General ecology.

EFB 400 Toxic Health Hazards (3)

Three hours of lecture per week. Introduction to contemporary concepts of toxicology and to scientific basis for regulations and personal decisions about toxic health hazards. For students in natural or social sciences of environmental relevance. Topics include xenobiotic load, co-evolution of plant/animal defenses, chemical interactions, animal tests and risk assessment. Fall. Prerequisites: General biology and general chemistry. Note: Credit will not be granted for both EFB 400 and EFB 600.

EFB 402 Microbial Ecology (2)

Two hours of lecture per week. This course focuses on microbes in their environment including the environmental factors that shape microbial communities and how microbes, in turn, change their environment. An in-depth survey of contemporary topics in microbial ecology including nutrient limitations; carbon, nitrogen, sulfur, and metal cycling; microbial degradation of recalcitrant compounds; microbial influence on climate; and methods in microbial ecology including metagenomics and fluorescent microscopy. Spring (odd years). Credit will not be given for both 402 and 602. Prerequisites: EFB 303, a similar microbiology course, or instructor permission is required.

EFB 411 Rsrch Methds:Adirondack Ecosys (3)

Two hours of lecture/discussion and one three hour field trip per week. An introduction to biodiversity, forest and wildlife management, invasive species, climate science, and the role of humans in the context of the Adirondack Park. Biotic and abiotic drivers of the Adirondack ecosystem, field data collection methods and policy and sustainability are considered. Explores the role of science in natural resource decision-making and the uses and limitations of ecological data and planning tools. Requires concurrent registration with other Sustaining the Park courses. Fall, Newcomb Campus. Prerequisite(s): General Biology or equivalent coursework Co-requisites: EST 401, EST 402, EST 403, EST 404

EFB 412 Intro/Chemical Ecology (3)

Three hours of lecture with discussion per week. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology and behavior; and as they can be utilized for agriculture, pest management and animal husbandry. Spring. Prerequisite: Organic chemistry (one year). Note: Credit will not be granted for both EFB 412 and FCH 440.

EFB 413 Intro To Conservation Bio (3)

Two hours of lecture and one hour of discussion/recitation per week. As an introduction to the discipline of conservation biology, the course seeks to demonstrate how basic biological science can be integrated with social, economic and political perspectives to achieve the goals of biological conservation. Lectures will provide students with an understanding of processes that generate and erode biological diversity. Discussion/recitation exercises will provide students with hands-on experience and skill development in solving the sorts of complex problems typically encountered by conservation biologists. Fall.

EFB 414 Senior Synth/Cons Biol (3)

Three hours of discussion/seminar per week. Students research a topic in conservation biology, then practice critical thinking and discourse by presenting seminars and participating in discussions. The focus is on integrating knowledge from previous courses in biology, management, and policy for the wise use and conservation of biological diversity. Fall. Pre- or co-requisite: EFB 413.

EFB 419 Prob Solving/Conservation Biol (3)

Two hours of lecture/recitation and three hours of laboratory per week. "Hands-on" experience in problem-solving, using methods and concepts related to a wide range of biodiversity conservation issues. Includes management of genetic diversity, analysis and modeling of populations, ecosystem management, and the public policy process, and of methods of information management, analysis and communication used by conservation professionals. Spring. Prerequisite: EFB 413 or equivalent; major in Conservation Biology or permission of instructor.

EFB 420 Prof Internship/Envrn Biology (1-5)

Full- or part-time employment or volunteer work with an agency, institution, clinic, professional group, business, or individual involved in activities consistent with the student’s educational and professional goals. The internship may be paid or unpaid. The extent of the internship activities shall be commensurate with the credits undertaken. Tenure at outside institution under guidance of external supervisor. A resident faculty member must serve as the student’s academic sponsor. A study plan outlining the internship’s educational goals must be completed prior to its commencement. Grading will be based on a written report from the student submitted to the faculty sponsor, and on an evaluation of the student’s performance written by the site supervisor to the faculty sponsor. Grading Satisfactory/ Unsatisfactory. Fall, Spring, Summer. Prerequisite(s): Permission of Instructor.

EFB 422 Scientific and Research Diving (3)

This course combines foundational content, dry lab and pool training, and open water dives to equip students with the skills and knowledge to pursue a career in the aquatic sciences. Students will receive personalized training and hands-on learning, to master the skills and equipment used on research dives. The course will teach many scuba techniques applicable to scientific diving and situational and self awareness. Teamwork, situational awareness, communication, planning, and preparation will be practiced during a group field project. Additional fees to cover pool courses, equipment rentals, learning module materials and certification may apply. Fall. Prerequisites: EFB 322 Scuba Diving International Foundations

EFB 423 Marine Ecology (4)

Three hours of lecture and 3 hours of lab (labs, discussions, activities) per week. Introduction to marine organisms and systems, using the principles of population, community and ecosystem ecology. Hands-on demonstrations, discussions, presentations, interactive activities and lectures allow study of major marine habitats (e.g., intertidal, pelagic, coral reefs, deep sea), the increasing human impacts on marine environments, and potential solutions. Spring, even years. Prerequisites: One year general biology and one semester general ecology or equivalents. Note: Credit will not be granted for both EFB 423 and EFB 623.

EFB 424 Limnology:Study Inland Waters (3)

Three hours of lecture per week, with some additional hands-on activities during the semester. An introduction to the geology, physics, chemistry and biology of inland waters (lotic and lentic). The course focuses on inland waters as integrated ecosystems and explores the effects of natural and anthropogenic perturbations on these systems. Fall. Prerequisites: Senior status, introductory courses in physics and chemistry, and EFB 320, or permission of instructor. Note: Credit will not be granted for both EFB 424 and EFB 624.

EFB 425 Forest Health Senior Synthesis (3)

One hour per week of lecture, six hours per week of field and laboratory. Examines the varied ecological roles and impacts of pests, pathogens, climate and disturbance in managed and unmanaged northern forests. Students learn to sample, identify, and study forest insects, pathogens and trees using inventory, survey, analytic methods, and independent research. Prerequisites: One year of General Biology, and one semester of organismal diversity (EFB202, EFB210, EFB211 or equivalent)

EFB 427 Plant Anatomy & Development (3)

Three hours of lecture and three hours of laboratory instruction per week. This course offers a dynamic approach to the study of plant anatomy by understanding how cells, tissues and organs are formed using concepts and tools from genetics and molecular biology. Laboratory involves hands-on activities using current techniques. Fall. Prerequisite: one year introductory biology. Note: Credit will not be granted for both EFB 427 and EFB 627.

EFB 428 Mycorrhizal Ecology (3)

Two hours of combined lecture/discussion and 3 hours of laboratory per week. Introduction to mycorrhizal symbioses, their role in plant nutrient uptake, and function in plant community dynamics. Emphasis is on important historical and current literature, and on learning methodological approaches used in mycorrhizal research. Fall, even years. Prerequisites: General ecology or plant ecology, genetics. Note: Credit will not be granted for both EFB 428 and EFB 628.

EFB 429 Plant Physiology (3)

Two hours of lecture per week and three hours of lab. A critical study of the physiological processes of plants including water relations, photosynthesis, mineral assimilation, hormones, and responses to the environment. Spring. Credit will not be granted for both EFB429 and EFB629. Prerequisites: One full year of biology (EFB101/102 and EFB 103/104). One full year of chemistry (FCH 150/151 and FCH 152/153).

EFB 432 Research Internship in Env Bio (1-5)

This course is intended to enable students to receive academic credit in exchange for experiences that employ techniques or skills expected of an upper-division student in the biological sciences.

These must be overseen by a faculty/staff within the Department of Environmental Biology. A final paper of 5-10 pages outlining the student's experiences and skills gained or refined. The report should include any supporting materials developed during experience. Students may enroll in 1-5 credits per experience and a maximum of 6 credits during their tenure at SUNY ESF. Grading Satisfactory/Unsatisfactory. Fall, Spring and Summer. Permission of Instructor is required.

EFB 434 Ecosystem Restoration Design (4)

A summer field course followed by a weekly seminar and workshop during the Fall. Will travel in Mesoamerica. Will examine degraded and restored ecosystems. Will travel on public transportation and stay in low-cost hostels. Will use contemporary problems as source material for course projects. Continuation of restoration project designs and analysis from the field trip will be part of the coursework after returning to Syracuse. The course will explore restoration strategies in many different ecosystems. Will consider restoration needs in less developed countries, and how that shapes design and evaluation. Course fee. Fall. Prerequisite: Permission of instructor.

EFB 435 Flowering Plnts:Div,Evol&Systm (3)

Two hours of lecture and three hours of laboratory per week. Diversity, evolution, and systematics of flowering plants with emphasis on flower structures and reproductive strategies. Flowering plant identification skills are built from examination of a broad diversity of species from major globally distributed families with particular focus on flora of the Northeastern U.S. Fall. Prerequisite(s): General Biology I and II or equivalent and at least junior standing.

EFB 437 Plant Propagation (3)

Two hours of discussion and two hours of laboratory each week. Introduction to sexual (seed) and asexual (cuttings, budding, grafting, layering, tissue culture, etc.) techniques for reproducing plants. Laboratory and independent research projects will provide practical hands-on experiences. Spring. Prerequisite(s): EFB 101/102 and EFB 103/104 sequence or equivalent. Note: Credit will not be granted for both EFB 437 and EFB 637.

EFB 438 Ecolgy&Management of Waterfowl (3)

Three hours per week of lecture and discussion. An overview of the ecology of ducks, geese and swans from the perspective of life history events (i.e., breeding, migration, and wintering ecology). Contemporary strategies used in conservation of waterfowl populations and their habitats. Credit cannot be given for both EFB438 and EFB638. Prerequisites: General Ecology or permission of instructor

EFB 439 Forest Health Monitoring (3)

Three hours of lecture/discussion per week on theoretical and applied aspects of forest health monitoring including concepts, data acquisition, analysis, quality assurance, interpretation and reporting. Spring. Pre- or co-requisite(s): Courses in forest resources management, ecology, pathology and entomology.

EFB 440 Mycology (3)

Two hours of lecture and three hours of laboratory per week. Fundamentals of the morphology, taxonomy, life histories, ecology and symbiotic relationships of fungi. Fall. Note: Credit will not be granted for both EFB 440 and EFB 640.

EFB 444 Biodiversity&Geography/Nature (3)

Three hours of lecture per week. Earth history (plate tectonics, etc.), topography and geographic variation in environmental conditions influence species and communities. Major geographic patterns in biological diversity and strategies for conserving native species are presented. Fall, even years. Prerequisite: EFB 320 or permission of instructor. Note: Credit will not be granted for both EFB 444 and EFB 644.

EFB 445 Plant Ecology & Global Change (3)

Three hours of lecture and discussion per week. Impacts of global changes in climate, biodiversity, land-use, and biogeochemical cycles on structure and function of terrestrial plant communities and ecosystems. Examined scales range from ecophysiological processes occurring in individual leaves to global patterns of primary productivity and biodiversity. Spring. Prerequisite: EFB 320 General Ecology or equivalent. Note: Credit will not be granted for both EFB 445 and EFB 645.

EFB 446 The Ecology Of Mosses (3)

Two hours of lecture and one three-hour laboratory or field trip per week. A study of taxonomic diversity, ecological adaptations and the roles of bryophytes in ecosystems. Spring. Note: Credit will not be granted for both EFB 446 and EFB 646.

EFB 449 Wetlands Cons&Mgmt for Wldlife (3)

Three hours per week of lecture, discussion, and field demonstrations. Contemporary techniques in wetlands conservation and management with a focus on sustaining wetland-dependent wildlife. Includes a survey of conservation strategies used and stakeholders involved throughout North America and beyond. A half-day weekend field trip is required. Spring (even years). Credit will not be given for both EFB449 and EFB649. Prerequisites: General Ecology (EFB320 or equivalent) or permission of instructor.

EFB 453 Parasitology (3)

Two hours of lecture/discussion per week, three hours laboratory per week. Diversity, ecology, and impact of parasites of ecological, medical, and veterinary importance. Emphasis on identification, life history, control, host-parasite interactions and evolution, population patterns, and parasite communities. Fall. Prerequisite(s): One year of Introductory Biology, Ecology. Note: Credit will not be granted for both EFB 453 and EFB 653.

EFB 462 Animal Physiol:Envrn&Ecol (4)

Three hours of lecture and discussion per week and three hours of laboratory exercises. An introduction to the physiology of adaptation to the physical and biotic environments, including animal energetics, biology of body size and physiological constraints on animal life history. Spring. Prerequisites: One year of general biology. Note: Credit will not be granted for both EFB 462 and EFB 662.

EFB 463 Ecotoxicology (3)

Three hours of lecture and discussion per week. Introduction to principles of ecotoxicology and to contemporary scientific research. For students in natural or social sciences of environmental relevance. Topics include chemical fate in animals, and effects on individuals, populations, and ecosystems. Credit will not be given for both EFB463 and EFB663. Two semesters of General Biology; two semesters of General Chemistry; General Ecology

EFB 480 Prin Of Animal Behavior (3)

Three hours of lecture/discussion per week. Basic principles of animal behavior and the scientific process, including genetic, neural and physiological basis of behavior, behavioral ecology and behavioral responses to a changing environment. Proximate and ultimate mechanisms controlling the behavior of animals including humans. Fall. Prerequisite(s): EFB 101 or equivalent.

EFB 482 Ornithology (4)

Three hours of lecture and discussion, 3 hours of laboratory/field trip per week including weekend field trip experiences. Study of the evolution, ecology, behavior, taxonomy, populations, and breeding biology of the birds of North America. The course also offers exposure to the life histories and current topics of conservation and management of birds worldwide. Lecture, laboratory, and field trips. Spring. Prerequisites: General Ecology

EFB 483 Mammal Diversity (4)

Three hours of classroom instruction and three hours of laboratory per week. Describes the evolutionary development, ecology and diversity of mammals world-wide and within New York State. Laboratory exercises and discussions complement lectures, providing hands-on experience in identification, adaptive morphology, and techniques in field mammalogy. Fall. Prerequisites: Junior standing in EFB.

EFB 484 Winter Ecology (3)

Field and lecture course. This lecture and field course explores adaptations of animals and plants for surviving the winter in northern latitudes. The course presents species identification, natural history, behavior, ecology and winter strategies. One hour per week of asynchronous on-line instruction, plus ten-days of field instruction during one weekend in February and during March break in the Adirondack Mountains of New York. Credit will not be given for both EFB 484 and EFB 684. Travel, course and lodging fees will be applied. Spring. Prerequisites: General Ecology (EFB320) or Natural Resources Ecology (FOR232) required. Permission of instructor required.

EFB 485 Herpetology (3)

Two hours of lecture and three hours of laboratory per week. An introduction to the structure, function, ecology, behavior, development and distribution of amphibians and reptiles as they relate to the systematics of the various groups. Fall.

EFB 486 Ichthyology (3)

Two hours of lecture and three hours of laboratory per week. An introduction to the anatomy, physiology, ecology, behavior and taxonomy of fishes. Spring.

EFB 487 Fisheries Science & Mgt (3)

Three hours of lecture per week. Introduction to biology, ecology, quantitative assessments, conservation, and management of fish species targeted in fisheries. Includes models and empirical studies of population dynamics, life history theory, bioenergetics, population sampling, growth, mortality, production, exploitation, ecological effects, and approaches to fisheries management. A practicum (EFB 488) is optional. Fall. Prerequisite: Calculus and either Limnology or Ichthyology or permission of instructor. Note: Credit will not be granted for both EFB 487 and EFB 687.

EFB 488 Fisheries Science Practicum (1)

Three hours of laboratory per week with 2 weekend field trips. Practical experience in fisheries science, including introduction to collecting techniques, data collection, analysis, and use of models. A nominal fee is charged to defray costs on weekend trips. Designed as a complement to EFB 487. Fall, even years. Co-requisite: EFB 487 (may be taken in a previous year).

EFB 491 Applied Wildlife Science (3)

Two hours of discussion and three hours of laboratory per week, plus a field project and professional experience. Practical experience with tools used to monitor and manage wildlife populations. Designed for biology students wishing to pursue careers as wildlife biologists. Spring. Prerequisite: EFB 390.

EFB 492 Sr Synthesis/Aquatic&Fish Sci (1)

One hour of seminar per week. Students will develop a synthesis by defining a scientific hypothesis on an aquatic topic of interest, gathering/analyzing data from the literature or elsewhere, interpreting findings, and presenting their work both orally and in a written technical report. That synthesis will relate to prior coursework and current issues in aquatic sciences. Spring. Prerequisite: Senior standing in the Aquatic and Fisheries Science major.

EFB 493 Wildlife Habitats & Populatns (4)

Three hours of lecture/discussion and one three-hour laboratory per week; one Saturday field trip required. Application of ecological concepts, including succession and population biology to wildlife management planning and program assessment. Students are exposed to U.S. Fish and Wildlife Service habitat evaluation procedures and fundamentals of population modeling. Fall. Prerequisites: EFB 491 or permission of instructor. Note: Credit will not be granted for both EFB 493 and EFB 693.

EFB 494 Forest Health Capstone (1)

One hour of discussion or seminar per week. This course integrates student internships (EFB 420) or research experiences (EFB 498) with broader issues in forest health through readings and discussions of current literature and oral presentations. Students present a 1 hr seminar that details their internship or research experiences during the previous summer, and that relates this work to prior coursework and current issues in forest health. Fall. Prerequisite(s): EFB 420 or EFB 498

EFB 495 Undergrad Exp/Coll Teach (1-3)

An opportunity for qualified, senior undergraduate students to gain experience in fully supervised, college-level teaching of the type they can expect to perform in graduate school. Students assist the instructor in the preparation and presentation of laboratory or recitation material in an undergraduate course. A maximum of 6 credit hours of EFB 495, and 3 credit hours relating to any single assisted course, may apply toward graduation requirements. Fall and Spring. Prerequisites: Previous completion of the course being assisted (with a grade of B or higher), a GPA at ESF of 3.0 or higher, and permission of instructor.

EFB 496 Topics/Envrn&Forest Bio (1-3)

Experimental, interdisciplinary or special coursework in biology for undergraduate students. Subject matter and method of presentation varies from semester to semester. May be repeated for additional credit. Fall, Spring, Maymester or Summer. For sections taught during Maymester or summer session, appropriate tuition and fees apply in addition to travel and lodging costs.

EFB 497 Seminar (1)

One hour of presentations and discussion per week. A topic in environmental and forest biology will be emphasized and its importance to contemporary issues will be addressed. Fall or Spring.

EFB 498 Independent Research/Envrn Bio (1-5)

Independent research by advanced undergraduate student in topic related to environmental biology, conducted at SUNY-ESF or outside institution. EFB-based faculty member serves as student's research sponsor; EFB-based faculty member or scientist at outside institution serves as research supervisor. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Final written report to academic sponsor serves as basis for grade. Fall, Spring, Summer. Prerequisite: Permission of instructor.

EFB 500 Forest Biology Field Trip (1-3)

A five- to 10-day trip to: 1) agencies engaged in biological research, management and administration; or 2) regions or areas of unusual biological interest. A final report is required. Additional fees required to cover cost of travel and lodging during field portion of course. Tuition charges will apply to sections offered during Maymester and summer sessions. Fall, Spring, Maymester or Summer.

EFB 502 Ecology & Mgt/Invasive Species (3)

Three hours of discussion/lecture per week. Explores the growing problem of invasive species as a leading threat to global biodiversity. Topics include: invasion pathways and mechanisms, community resistance, biological control, effects on ecosystems, law and policy as management tools, prediction and risk assessment, and interactions with anthropogenic environmental change. Spring.

EFB 504 Plant-Herbivore Interactions (3)

Three hours of lecture/discussion per week. Introduction to major plant defensive strategies and counter-adaptation by herbivores. Costs and consequences of herbivory and evaluation of contemporary plant defense models. Direct and indirect linkage of plant-herbivore interactions with higher trophic levels, and effects on population and community dynamics. Plant-herbivore interactions and anthropogenic global change. Fall (Even years). Prerequisite(s): Introductory courses in ecology and evolution.

EFB 518 Systms Ecology: Eco Mdlng&Dsgn (3)

Three hours of lecture per week. Survey of systems ecology literature and techniques for ecological modeling and design. Students will develop computer simulations of natural and human systems. They will explore how ecological modeling can contribute to disciplines such as landscape architecture, ecological engineering and ecosystem restoration. Spring Prerequisite: one course in ecology.

EFB 523 Tropical Ecology (3)

One lecture (1.5 hr) per week coupled with a period of intensive hands-on field study over spring break in a tropical country. Principles of tropical ecology, nature conservation, and sustainable resource management are presented in class and during field trips to a variety of tropical terrestrial and aquatic ecosystems such as tropical montane and lowland rain forest, cloud forests, paramo, tropical dry forests, white-water rivers, and lagoons. Comparisons with north temperate ecosystems are made. Counts as Field-Experience Directed Elective in EFB. Spring. Appropriate fees apply in addition to travel and lodging costs. Prerequisite: One year of college biology and a general ecology course.

EFB 525 Limnology Practicum (2)

Three hours of field work or laboratory analysis each week. Two additional field trips on weekends; time outside of class devoted to an independent project. Students will become proficient in standard field and laboratory analyses used in limnology; field trips to diverse local aquatic habitats; development of an independent project. Fall. Prerequisites: EFB 424, 624 or equivalent must be taken concurrently or previously.

EFB 542 Freshwater Wetland Ecosys (3)

Three hours of lecture per week. An examination of the structure and function of various freshwater wetlands. Ecologic principles that broadly apply to all wetland ecosystems are examined and contrasted with terrestrial systems. The effect of management activities on, and the management potential of, wetlands are also examined. Spring. Prerequisite: EFB 320.

EFB 551 Forest Entomology (3)

Two hours of lecture and three hours of laboratory per week. Diversity, ecology and integrated management of insect pests of forested ecosystems. Additional topics include invasive species, climate change and current research topics. Intended for students in Environmental and Forest Biology and Forest Resources Management. Fall, even years. Note: Credit will not be granted for both EFB 351 and EFB 55l.

EFB 552 Entomology (3)

Two hours of lecture and three hours of laboratory per week. Basic insect diversity, ecology and pest management with an emphasis on common insect pests of the northeastern United States. Additional topics include invasive species, climate change and current research topics. Intended for students in Environmental Biology and Forest Health. Fall, even years. Note: Credit will not be granted for both EFB 352 and EFB 552.

EFB 554 Aquatic Entomology (3)

Two hours of lecture, three hours of laboratory/field work per week and a weekend field trip. An introduction to the identification, life histories and ecology of aquatic insects, with emphasis on genera found in the Northeastern United States. Includes a consideration of the functional role of insects in aquatic systems, and current avenues of research. Intended for seniors and graduate students pursuing interests in entomology, fisheries and wildlife, forestry, limnology and general ecology. Fall. Prerequisite: One course in entomology or permission of instructor.

EFB 566 Systematic Entomology (3)

Two hours of lecture and three hours of laboratory per week. Lectures introduce the identification and classification of the important orders and families of insects, along with the concepts and practice of sys-tematics. In laboratories students become familiar with pertinent taxonomic literature and keys, based in part on a required collection. Fall. Prerequisite: EFB 351 or EFB 352.

EFB 570 Insect Physiology (3)

Two hours of lecture and three hours of laboratory per week. Study of the life processes in insects; introduction to modern physiological instrumentation and laboratory methods. Spring. Prerequisite: EFB 325.

EFB 600 Toxic Health Hazards (4)

Three hours of lecture and one hour discussion/seminar per week. Introduction to contemporary concepts of toxicology and to scientific basis for regulations and personal decisions about toxic health hazards. For students in natural or social sciences of environmental relevance. Topics include xenobiotic load, co-evolution of plant/animal defenses, chemical interactions, animal tests and risk assessment. Additional reading assignments and discussions. Fall. Prerequisites: General biology and general chemistry. Note: Credit will not be granted for both EFB 400 and EFB 600.

EFB 601 Molecular Biol Techniques (3)

Two hours lecture and three hours laboratory per week. Theories behind techniques in molecular biology are introduced in lecture. Laboratory includes the extraction and quantification of genomic and plasmid DNA, agarose gel electrophoresis, restriction digestion, ligation, bacterial transformation, DNA sequencing and PCR. Additional topics in molecular biology are presented by the students. Fall. Prerequisites: One year of Introductory Biology, one year of Introductory Chemistry, Genetics. Note: Credit will not be granted for both BTC 401 and EFB 601.

EFB 602 Microbial Ecology (2)

Two hours of lecture per week. This course focuses on microbes in their environment including the environmental factors that shape microbial communities and how microbes, in turn, change their environment. An in-depth survey of contemporary topics in microbial ecology including nutrient limitations; carbon, nitrogen, sulfur, and metal cycling; microbial degradation of recalcitrant compounds; microbial influence on climate; and methods in microbial ecology including metagenomics and fluorescent microscopy. Spring (odd years). Credit will not be given for both 402 and 602. Prerequisites: EFB 303, a similar microbiology course, or instructor permission is required.

EFB 605 Indigenous Issues&the Envrnmnt (3)

Three hours of lecture and discussion per week. Introduction to perspectives of indigenous people on environmental and natural resources management issues, including tribal forestry, fisheries, biocultural restoration, conservation strategies, climate change and treaty rights. Integrates scientific and indigenous worldviews and knowledge systems. Spring. Note: Credit will not be granted for both EFB 305 and EFB 605.

EFB 611 Topics in Envrnmntl Toxicology (3)

Three hours of lecture, discussion or seminar per week. In-depth exploration of selected contemporary topics of environmental toxicology in areas such as toxic hazards of societal importance, pollutant monitoring and remediation, fate and ecological impacts of environmental pollutants, biological basis of toxic hazards, and ecological and human risk assessment and regulations. A major term paper and oral presentation required. Spring. Prerequisite: EFB 400, EFB 600 or an introductory course in toxicology.

EFB 612 Intro/Chemical Ecology (3)

Three hours of lecture with discussion per week. Centers on chemical signals among organisms from microbes to man as they affect ecology, physiology and behavior; and as they can be utilized for agriculture, pest management and animal husbandry. Spring. Note: Credit will not be granted for both EFB 612 and EFB 412/ FCH 440.

EFB 623 Marine Ecology (5)

Three hours of lecture and 3 hours of lab (labs, discussions, activities) per week. Introduction to marine organisms and systems, using the principles of population, community and ecosystem ecology. Hands-on demonstrations, discussions, presentations, interactive activities and lectures allow study of major marine habitats (e.g., intertidal, pelagic, coral reefs, deep sea), the increasing human impacts on marine environments, and potential solutions. Graduate students will meet in a separate laboratory and seminar section each week, have small group discussions of course topics, and present a short topical talk on a synthesis paper to the entire class. Spring, even years. Prerequisites: One year general biology, and one semester general ecology. Note: Credit will not be granted for both EFB 423 and EFB 623.

EFB 624 Limnology:Study Inland Waters (3)

Three hours of lecture per week, with additional hands-on activities during the semester. An introduction to the geology, physics, chemistry and biology of inland waters (lotic and lentic); effects of natural and anthropogenic perturbations are explored. Students develop a case study or exercise on a limnological issue. Fall. Prerequisites: Introductory courses in physics, chemistry, and ecology, or permission of instructor. Note: Credit will not be granted for both EFB 424 and EFB 624.

EFB 625 Plant Biotechnology (3)

Two hours of lecture and three hours of laboratory per week. Transgenic plants are currently being produced to improve agriculture, pharmaceuticals, and remediate environmental problems. Students are taught the principles of gene structure and regulation, gene cloning, transformation of plant species, and current applications. Format includes lectures, discussions, student presentations, literature review, and a detailed laboratory project. Spring. Prerequisites: EFB 307 and EFB 325 or equivalents. Note: Credit will not be granted for both BTC 425 and EFB 625.

EFB 626 Plant Tissue Culture Methods (3)

Two hours of lecture and discussion and three hours of laboratory per week. Introduction to plant tissue culture for biotechnology research and as a propagation method. Emphasis will be on learning laboratory instrumentation and techniques for establishing cell cultures, producing transgenic cell lines, and regenerating whole plants. In addition to the scheduled lab exercises, an independent micropropagation or transformation project will be required. Fall. Prerequisite: Permission of instructor. Note: Credit will not be granted for BTC 426 and FOR/EFB 626.

EFB 627 Plant Anatomy & Development (3)

Three hours of lecture and three hours of laboratory instruction per week. This course offers a dynamic approach to the study of plant structure by understanding how cells, tissues and organs are formed using concepts and tools from genetics and molecular biology. Laboratory involves hands-on activities using current techniques. Students will give oral presentation on a topic relevant to the course. Fall. Prerequisite: one year introductory biology. Note: Credit will not be granted for both EFB 427 and EFB 627.

EFB 628 Mycorrhizal Ecology (3)

Two hours of combined lecture/discussion and three hours of laboratory per week. Introduction to mycorrhizal symbioses, their role in plant nutrient uptake and function in plant community dynamics. Emphasis is on important historical and current literature, and on learning methodological approaches used in mycorrhizal research. Students will present and lead discussions on papers from the primary literature. An independent project is required. Fall, even years. Prerequisites: General ecology or plant ecology, genetics. Note: Credit will not be granted for both EFB 428 and EFB 628.

EFB 629 Plant Physiology (3)

Two hours of lecture per week and three hours of lab. A critical study of the physiological processes of plants including water relations, photosynthesis, mineral assimilation, hormones, and responses to the environment. Spring. Credit will not be granted for both EFB429 and EFB629. Prerequisites: One full year of biology (EFB101/102 and EFB 103/104). One full year of chemistry (FCH 150/151 and FCH 152/153).

EFB 634 Ecosystem Restoration Design (4)

A summer field course followed by a weekly seminar and workshop during the Fall. Will travel in Mesoamerica. Will examine degraded and restored ecosystems. Will travel on public transportation and stay in low-cost hostels. Will use contemporary problems as source material for course projects. Each student will work individually with the instructor to develop an approach to explore a novel research direction for ecosystem restoration. Continuation of restoration project project designs and analysis from the field trip will be part of the coursework after returning to Syracuse. The course will explore restoration strategies in many different ecosystems. Will consider restoration needs in less developed countries, and how that shapes design and evaluation. Course fee. Fall. Prerequisite: Permission of instructor.

EFB 635 Flowering Plnts:Div,Evol&Systm (3)

Two hours of lecture and three hours of laboratory per week. Diversity, evolution, and systematics of flowering plants with emphasis on flower structures and reproductive strategies. Flowering plant identification skills are built from examination of a broad diversity of species from major globally-distributed families with particular focus on flora of the Northeastern U.S. Students prepare professional presentations and lead discussion on current research issues in flowering plant diversity, evolution, and systematics. Fall. Prerequisite(s): General Biology I and II or permission of instructor.

EFB 637 Plant Propagation (3)

Two hours of discussion and two hours of laboratory each week. Two field trips. Introduction to sexual (seed) and asexual (cuttings, budding, grafting, layering, tissue culture, etc.) techniques for reproducing plants. Development, delivery and evaluation of lecture content, active-learning classroom activity, and laboratory content will introduce students to digital instructional technologies and techniques. Spring. Prerequisite(s): Permission of the instructor. Note: Credit will not be granted for both EFB 437 and EFB 637.

EFB 638 Ecolgy&Management of Waterfowl (3)

Three hours per week of lecture and discussion. An overview of the ecology of ducks, geese and swans from the perspective of life history events (i.e., breeding, migration, and wintering ecology). Contemporary strategies used in conservation of waterfowl populations and their habitats. Credit cannot be given for both EFB438 and EFB638. Prerequisites: General Ecology or permission of instructor

EFB 640 Mycology (3)

Two hours of lecture and three hours of laboratory per week. Fundamentals of the morphology, taxonomy, life histories, ecology and symbiotic relationships of fungi. Fall. Note: Credit will not be granted for both EFB 440 and EFB 640.

EFB 644 Biogeography (4)

Three hours of lecture per week. Earth history (plate tectonics, etc.), topography and geographic variation in environmental conditions influence species and communities. Major geographic patterns in biological diversity and strategies for conserving native species are presented. Students design and conduct independent biogeographic study utilizing information available in the literature. Fall, even years. Prerequisite: General ecology or permission of instructor. Note: Credit will not be granted for both EFB 444 and EFB 644.

EFB 645 Plant Ecology & Global Change (3)

Three hours of lecture and discussion per week. Impacts of global changes in climate, biodiversity, land-use, and biogeochemical cycles on the structure and function of terrestrial plant communities and ecosystems. Global change impacts are examined across a wide range of spatial and temporal scales, from ecophysiological processes occurring at the scale of a leaf, to global patterns of primary productivity and biodiversity. Spring. Prerequisite: EFB 320 General Ecology or equivalent. Note: Credit will not be granted for both EFB 445 and EFB 645.

EFB 646 The Ecology Of Mosses (3)

Two hours of lecture per week and one three-hour laboratory or field trip. A study of taxonomic diversity, ecological adaptations and the roles of bryophytes in ecosystems. Spring. Note: Credit will not be granted for both EFB 446 and EFB 646.

EFB 649 Wetlands Cons&Mgmt for Wldlife (3)

Three hours per week of lecture, discussion, and field demonstrations. Contemporary techniques in wetlands conservation and management with a focus on sustaining wetland-dependent wildlife. Includes a survey of conservation strategies used and stakeholders involved throughout North America and beyond. Practice in project development and supervision. A half-day weekend field trip is required. Spring (even years) Credit will not be given for both EFB449 and EFB649. Prerequisites: General Ecology or permission of instructor

EFB 650 Landscape Ecology (3)

Two hours of lecture/discussion and three hours of laboratory experience per week. Landscape Ecology focuses on spatial patterning - its development and relevance to ecological processes. Course introduces the foundations, issues, and analytical tools in Landscape Ecology through discussion of literature, GIS exercises, and an independent research project. Fall (even years). Prerequisites: Introductory course in Geographic Information Systems, or equivalent.

EFB 653 Parasitology (3)

Two hours of lecture/discussion per week, three hours laboratory per week. Diversity, ecology, and impact of parasites of ecological, medical, and veterinary importance. Emphasis on identification, life history, control, host-parasite interactions and evolution, population patterns, and parasite communities. Students write a review paper and present on a parasitic disease. Fall. Prerequisite(s): One year of Introductory Biology, Ecology. Note: Credit will not be granted for both EFB 453 and EFB 653.

EFB 654 Intro to R & Reproducble Rsrch (2)

Two hours of lecture/computer lab per week. Focuses on building foundational R skills for students without a background in computer science or engineering. The basics of R are covered: operators, data classes/structures, data import/export, plotting data, summarizing data, and merging data. Intermediate-level topics are also covered including conditionals, loops, and custom functions. Students will apply learned skills to original, student-provided data for the final project. Spring. Students are responsible for providing an original dataset to use in the class.

EFB 662 Animal Physiol:Envrn&Ecol (3)

Three hours of lecture, discussion and exercises per week, and an independent project. An introduction to the physiology of adaptation to the physical and biotic environments, including animal energetics, biology of body size, and physiological constraints on animal life history. Fall and Spring. Note: Credit will not be granted for both EFB 462 and EFB 662.

EFB 663 Ecotoxicology (3)

Three hours of lecture and discussion per week. Introduction to principles of ecotoxicology and to contemporary scientific research. For students in natural or social sciences of environmental relevance. Topics include chemical fate in animals, and effects on individuals, populations, and ecosystems. Credit will not be given for both EFB463 and EFB663. Two semesters of General Biology; two semesters of General Chemistry; General Ecology

EFB 681 Aquatc Ecosys Restore/Enhance (2)

One and three-quarter hours of lecture and discussion per week and three field experiences. Guiding principles for ecological restoration of freshwater aquatic ecosystems focusing on effects of nutrient loading, sedimentation, flow alteration, and habitat loss. Factors leading to loss of aquatic resources and effectiveness of techniques to restore habitat and fauna are analyzed. Student presentation of a relevant topic and field excursions to perturbed areas and recent restoration projects are required. Fall, odd years. Prerequisites: none. Directed toward graduate students in areas involving aquatic sciences and management.

EFB 684 Winter Ecology (3)

Field and lecture course. This lecture and field course explores adaptations of animals and plants for surviving the winter in northern latitudes. The course presents species identification, natural history, behavior, ecology and winter strategies. One hour per week of asynchronous on-line instruction, plus ten-days of field instruction during one weekend in February and during March break in the Adirondack Mountains of New York. Credit will not be given for both EFB 484 and EFB 684. Travel, course and lodging fees will be applied. Spring. Prerequisites: General Ecology (EFB320) or Natural Resources Ecology (FOR232) required. Permission of instructor required.

EFB 687 Fisheries Science & Mgt (3)

Three hours of lecture per week. Introduction to the biology, ecology, quantitative assessments, conservation, and management of fish species targeted in fisheries. Includes models and empirical studies of population dynamics, life history theory, population growth, mortality, production, exploitation, and management. Critical synthesis project required. Fall. Prerequisites: Calculus and either Limnology or Ichthyology or permission of instructor. Note: Credit will not be granted for both EFB 487 and EFB 687.

EFB 692 Ecol And Mgt Of Waterfowl (3)

Three hours of lecture per week. A detailed examination of waterfowl ecology and management. The course is structured around the annual cycle, focusing on strategies of survival and reproduction; management aspects are treated throughout the course. Fall and Spring. Prerequisite: EFB 482.

EFB 693 Wildlife Habitats & Populatns (4)

Three hours of lecture/discussion and one three-hour laboratory per week; one Saturday field trip required. Application of ecological concepts including succession and population biology to wildlife management planning and program assessment. Students are exposed to U.S. Fish and Wildlife Service habitat evaluation procedures and fundamentals of population modeling. Fall. Note: Credit will not be granted for both EFB 493 and EFB 693.

EFB 696 Topics/Envrn&Forest Bio (1-4)

Experimental, interdisciplinary or special coursework in biology for graduate students. Subject matter and method of presentation varies from semester to semester. Fall, Spring, and Summer.

EFB 796 Topics/Envrn&Forest Bio (1-4)

Special instruction, conference, advanced study, and research in selected subject areas. A written report required. Check Schedule of Courses for details. Fall and Spring.

EFB 797 Seminar/Envrn&Forest Bio (1)

Seminar discussions of subjects of interest and importance in environmental and forest biology. Seminar offerings are available in most subdisciplinary areas. Check Schedule of Courses for details. Fall and Spring.

EFB 798 Resrch Prob/Env&For Bio (1-12)

Individual advanced study of selected special problems in environmental and forest biology. Offered by arrangement with individual faculty. A written report required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall and Spring.

EFB 898 Professional Experience (1-12)

Professional experience which applies, enriches and/or complements formal coursework. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Graded on an "S/U" basis. Fall, Spring and Summer.

EFB 899 Masters Thesis Research (1-12)

Investigation leading to the completion of a research-oriented thesis or to an application-oriented project. Graded on an "S/U" basis. Fall, Spring and Summer.

EFB 999 Doctoral Thesis Research (1-12)

Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring and Summer.

EHS - ENVIRONMENTAL HEALTH

EHS 150 US History & Envirnmntl Health (3)

Environmental health is the science of maintaining and improving human health by identifying, evaluating, and protecting against hazardous agents in the environment. This course will examine the impact the environment has had on human health and society over the course of US History. Students will examine how changes in medicine, awareness, social values, and economic factors contributed to major socio-political events, and how those events in turn affected human health and the environment. Case studies will focus on examining a particular historical event/period through a subfield of Environmental Health, and these events/time periods will be taught chronologically, supplemented by earlier and concurrent instruction in US History. This unique lens will give students another look at US History, and how deeply connected human health, society, and history have always been, as well as looking forward to challenges we may face, and how to continue improving the way we interact with the env

EHS 250 Foundations/Envrn Health (2)

One hour of lecture/discussion per week. Introduction to environmental health concepts. Course will introduce students to environmental risk, epidemiology, toxicology, policy, and regulation; agents of disease and human health risks including vector-borne pathogens, toxic metals, pesticides, and radiation. Course will also cover applications of environmental health with a focus on water and air quality, food safety, waste management and occupational health. Fall. Prerequisites: One year each of Biology with lab (EFB 101 and 102, EFB 103 and 104), General Chemistry with lab (FCH 150 and 151, FCH 152 and 153) and Calculus (APM 105 and 106).

EHS 320 Disease Prevention (3)

Two 50 minute lectures per week. History of infectious diseases, control measures, new and emerging diseases, prediction and monitoring of known and infectious diseases. Examination of the intersections of public and environmental health, disease control and prevention, and historical and emerging diseases, and tracking and prediction of outbreaks. Spring. Prerequisites: EHS 250 and EFB 303. Note: Credit will not be granted for both EHS 520 and EHS 320

EHS 350 Environmental Health Managemnt (3)

Three 50 minute lectures per week. Principles of communicable disease and contamination control, food protection, vector control, water supply safety, wastewater and solid and hazardous waste containment and remediation, air pollution control, and control of environmental hazards in specific or specialized environments. Understanding the laws and regulations governing these practices, and current protocols to maintain public and environmental safety. Spring. Prerequisites: EHS 250 and EWP 190 or the equivalent. Note: credit will not be granted for both EHS 350 and EHS 550.

EHS 360 Environmental Sampling Methods (3)

Two 50 minute lectures and one 3 hour lab per week. Overview of different methods used for sampling air and water quality, soils, environmental microbes, and non-chemical environmental stressors (i.e. radiation, temperature, stress, noise) with an emphasis on their impact on human health. Spring. Credit will not be granted for both EHS 360 and EHS 560. Pre-requisites: EHS 250, FCH 150, and 152 or equivalents. Co- or pre-requisite: APM 391.

EHS 420 Prof Internship/Env Health (1-5)

40 hours of work with the sponsor per credit. Full or part time position as an employee or volunteer in a profession setting with an environmental health focus. Internship will be structured in collaboration between ESF faculty advisor and on-site supervisor. Requires a plan outlining learning goals and objectives, supervisors assessment and final report by student. Students shall

report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, Summer

EHS 440 Occupational Health and Safety (3)

Three 50 minute lectures per week. In-depth examination of workplace environmental health issues. Topics include safety issues, ergonomics, fire protection, hazardous materials, and terrorism preparedness. Overview of legislation of these issues, as well as managing in workplace. Spring. Credit will not be granted for both EHS 640 and EHS 440. Pre or co-requisite of EHS 250 and pre or co requisite of EHS 350 or equivalent.

EHS 480 Hazardous Waste Management (3)

Two 80 minute lectures per week. In-depth examination of hazardous wastes from source to disposal and chemical fate; covers medical, nuclear, industrial sources and reduction, prevention, containment, transportation, remediation. History, risk assessment, regulation and safety are included. Fall. Pre and co-requisite(s): Pre or co-requisite of EHS250 and prerequisite of one year of Organic Chemistry (FCH 221/222 and 223/224 or equivalent). Note: Credit will not be granted for both EHS 680 and EHS 480

EHS 520 Disease Prevention (3)

Two 50 minute lectures per week plus one hour of recitation. History of infectious diseases, control measures, new and emerging diseases, prediction and monitoring of known and infectious diseases. Examination of the intersections of public and environmental health, disease control and prevention, and historical and emerging diseases, and tracking and prediction of outbreaks. Spring. Permission of instructor required. Credit will not be granted for both EHS 520 and EHS 320.

EHS 550 Environmental Health Managemnt (4)

Three 50 minute lectures per week plus a one hour recitation. Principles of communicable disease and contamination control, food protection, vector control, water supply safety, wastewater and solid and hazardous waste containment and remediation, air pollution control, and control of environmental hazards in specific or specialized environments. Understanding the laws and regulations governing these practices, and current protocols to maintain public and environmental safety. Be familiar with past and ongoing issues in environmental health, and discuss the efficacy of current regulations in depth through regularly scheduled student presentations. Spring. Permission of instructor required. Note: Credit will not be granted for both EHS 350 and EHS 550.

EHS 560 Environmental Sampling Methods (4)

Two 50 minute lectures, one 50 min recitation, and one 3 hour lab per week. Overview of different methods used for sampling air and water quality, soils, environmental microbes, and non-chemical environmental stressors (i.e. radiation, temperature, stress, noise) with an emphasis on their impact on human health. Spring. Credit will not be granted for both EHS 360 and EHS 560

EHS 640 Occupational Health and Safety (4)

Three 50 minute lectures per week plus one hour recitation. In-depth examination of workplace environmental health issues. Topics include safety issues, ergonomics, fire protection, hazardous materials, and terrorism preparedness. Overview of legislation of these issues, as well as managing in workplace. Spring. Permission of instructor required. Note: Credit will not be granted for both EHS 640 and EHS 440

EHS 680 Hazardous Waste Management (4)

Three 50 minute lectures per week plus a one hour recitation. In-depth examination of hazardous wastes from source to disposal and chemical fate; covers medical, nuclear, industrial sources and reduction, prevention, containment, transportation, remediation. History, risk assessment, regulation and safety are included. Fall. Permission of instructor required. Credit will not be granted for both EHS 680 and EHS 480.

ENS - ENVIRONMENTAL SCIENCE

ENS 132 Orientation Seminar:EnvSci (1)

One hour of lecture or discussion each week. Introduction to campus facilities, personnel, lower-division curriculum, and upper-division study options within the Environmental Science program. Fall.

ENS 200 Climate Chng Sci&Sustainablty (1)

Climate Change Science and Sustainability is an introduction to climate science, the evidence of modern climate change, and an evaluation of some of the proposed solutions. The course integrates NASA and other web-based climate change media and products with outside readings.NASA's spatial and temporal climate change resources are the basis for most learning activities, which will enable students to continue their exploration of personal and societal climate change solutions.

ENS 232 Prof Development Env Science (1)

One hour of lecture, discussion, or activity each week. This course will continue to guide and support Environmental Science students in both personal and professional growth. Course topics include time management and study skills, choosing an "option area", research methods, (literature review, field skills, project development), finding and solidifying experiential learning opportunities (e.g., internships, research projects), current topics/issues in Environmental Science, and effective interaction for group work. Spring. Prerequisite: ENS 132 or equivalent.

ENS 250 Fndtns of Environmental Health (3)

Three hours of lecture/discussion per week. Introduction to environmental health. Foundations in environmental risk, epidemiology, toxicology, policy, and regulation. Agents of disease include vector-borne pathogens, toxic metals, pesticides, and radiation. Applications of environmental health focus on water and air quality, food safety, waste management and occupational health. Spring. (Course description may be revised prior to registration.)

ENS 260 Environmental Sampling Methods (3)

Principles of water, soil, and air sampling to detect and quantify environmental contaminants, including sampling techniques, statistical considerations, and data analysis, interpretation, and reporting. (Course description may be revised prior to registration.)

ENS 296 Spec Topics/Envrnmntl Science (1-3)

One to three hours of class meetings per week. Special topics of current interest to lower division undergraduate students in environmental science. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring. Permission of the instructor.

ENS 350 Environmental Health Mgt (3)

Principles of communicable disease and contamination control, food protection, vector control, water supply safety, wastewater and solid and hazardous waste renovation, air pollution control, and controlling environmental hazards in special environments. (Course description may be revised prior to registration.) Prerequisite: One year biology, one year chemistry, calculus I & II.

ENS 420 Internship in Env Science (1-5)

Full or part time position as an employee or volunteer in a professional setting with an environmental science focus. Internship will be structured in collaboration between ESF faculty advisor and on-site supervisor. Requires initial plan outlining learning goals and objectives, supervisor's assessment and final report by student to be graded by faculty advisor. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, Summer. Prerequisite: Permission from instructor.

ENS 460 Renewable Energy Capstone (2)

One half hour meeting per week. Students will synthesize information from courses in the Renewable Energy minor by performing research and preparing a scientific report on topics related to renewable energy and energy. The research will consist of literature review/analysis, modeling, field work or laboratory research. Spring. Prerequisite: ENS 450

ENS 470 Environmental Risk Assessment (3)

Three hours of lecture per week. Identification of environmental hazards to human and other life forms; application of statistical tools and methods required for quantifying risk and their applicability and limitations; regulatory requirements governing risk assessment reporting; and effective public communication of environmental risks. Fall. Prerequisite: APM 106, APM 391, EFB 103, FCH 152

ENS 480 Hazardous Materials Management (3)

In-depth examination of hazardous wastes from source to disposal and chemical fate; covers medical, nuclear, agricultural, industrial sources and reduction, prevention, containment, transportation, remediation. History, risk assessment, regulation and safety are included. (Course description may be revised prior to registration.) Prerequisite: One year Biology, One year Chemistry, Calculus I & II

ENS 494 Capstone Seminar (1)

1 hour of lecture/discussion per week. Support and instruction for completion and presentation of the senior synthesis project for Environmental Science. Topics include research skills and literature review, data analysis, scientific writing including editing, and oral presentation. Research or internship must be nearly or fully completed.

ENS 498 Resrch Prob/Envrn Science (1-5)

Independent research in topics in environmental science for undergraduate students. Selection of subject area determined by the student in conjunction with an appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Final written report required for departmental record. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and/or Summer. Prerequisite(s): Consent of instructor.

ENS 519 Spatial Ecology (3)

Two hours of classroom instruction and three hours of laboratory, field trip, workshop, or group studio per week. Geographical modeling is the simulation of natural systems in a spatial context, interfacing the traditional tools of ecological modeling with those of Geographic Information Systems. Students in this course learn the fundamentals of ecological modeling and develop a spatial model using GIS tools to address their own research questions. Spring. Prerequisites: EFB 518 or computer programming course; GIS course. Co-requisite: GIS course (if not already completed).

ENS 596 Spec Topics/Envrn Science (1-3)

Experimental or special coursework in Environmental Science for beginning graduate students, fifth year, and seniors with appropriate academic background. Subject matter and methods will vary. Fall or Spring.

ENS 601 Water Resources Mgt (3)

Three hours of lecture and discussion per week. This course provides an introduction to interdisciplinary water management. It draws upon subject matters from many areas, including water policy, planning, economics, hydrology, law, engineering and water quality. Fall.

ENS 607 Wetland Practicum (2-3)

Two hours of lecture and three hours of group learning per week. Provides students with a working knowledge of wetland management, emphasizing wetland delineation, functional assessment and mitigation with module problems with reports required for each module. Two credits for completion of two modules; three credits for completion of three modules. Fall.

ENS 696 Specl Topics/Env Sci&Pol (1-3)

Experimental and developmental courses in new areas of interest to environmental studies faculty and graduate students not covered in regularly scheduled courses. Fall and Spring.

ENS 796 Adv Topics/Env Sci&Policy (1-3)

Lectures and discussions, seminars, conferences and group research on advanced topics of special or current interest, in fields of interest to environmental studies faculty and graduate students. Fall and Spring.

ENS 797 Envrn Science Seminar (1-3)

Discussion of current topics and research related to environmental science. Fall and Spring.

ENS 798 Problems/Envrn Science (1-12)

Individualized, special study of environmental science and policy subjects and issues. Comprehensive oral or written report required for some problems. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer.

ENS 898 Professional Experience (1-12)

Professional experience which applies, enriches and/or complements formal coursework. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Graded on an "S/U" basis. Fall, Spring and Summer.

ENS 899 Masters Thesis Research (1-12)

Research and independent study for the master's degree and thesis. Fall, Spring and Summer.

ENS 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral degree and dissertation. Fall, Spring and Summer.

ERE - ENVIRONMENTAL RESOURCES ENGINEERING

ERE 132 Intro/Envrnmntl Resrces Engr (1)

One hour of lecture and discussion per week. Introduction to the Environmental Resources Engineering (ERE) Department and campus resources available to ensure academic success for ERE majors. Introduction to engineering science and design as a profession through assignments, presentations, and discussion. Fall.

ERE 133 Intro to Engineering Design (3)

Two hours of lecture and three hours of group instruction per week. An introduction to the engineering profession, including design, communication, ethical and professional behavior, teamwork and data analysis. Learning is reinforced through study, conduct and critique of design exercises related to environmental resources engineering. Spring.

ERE 275 Ecological Engineering (3)

Two hours of lecture and one hour of group instruction per week. Theory and practice of ecological engineering with strong focus on sustainability and design, monitoring, and construction of ecosystems and the built environment. Key concepts, empirical models, and case studies, including applications of water/wastewater treatment, air resources and solid waste management. Spring. Prerequisites: one semester of calculus, biology, and chemistry. ERE students only or by permission of instructor.

ERE 311 Ecological Engr in the Tropics (3)

One hour of discussion per week with intensive spring break field study in a Caribbean country. Principles of ecological engineering for ecosystem restoration and pollution control. Field trips to pristine and degraded ecosystems including: humid tropical cloud forests, coastal mangrove, dry mountain forests, and coral reefs to identify target functions for nature and society, observe degradations, and develop sustainable restoration designs. Spring. Prerequisite(s): one course in calculus, biology, and chemistry. Note: Credit will not be granted for both ERE 311 and ERE 511.

ERE 335 Numerical & Computing Methods (3)

Three hours of lecture/discussion per week. Introduction to numerical and computing methods for engineers. Writing computer code to analyze and solve engineering problems using state-of-the-art software packages. Fall. Prerequisite: MAT 485.

ERE 339 Fluid Mechanics (4)

Three hours of lecture per week plus one lab session. An introduction to fluid mechanics within the context of civil and environmental engineering. This includes hydrostatics, Bernoulli's Equation, control volume analysis, drag, dynamic similitude, pipe flow, and open channel flow with some brief coverage of hydraulic machines and flow in porous media. Fall. Prerequisites: APM206 and GNE172 or equivalents

ERE 340 Engr Hydrology&Hydraulics (4)

Three hours of lecture and lab per week. Covers watershed hydrology and analysis of rainfall, evapotranspiration, infiltration, and runoff processes as well as hydraulic processes involved with pipe networks, open-channels with flow controls, and groundwater systems. Spring. Prerequisites: Fluid mechanics. Note: Credit will not be granted for both ERE 340 and ERE 540

ERE 351 Basic Engr Thermodynamics (3)

Three hours of lecture per week. Principles of energy conservation and conversion: first and second laws. Relation to PVT behavior, property functions, equilibria and heat and mass transfer, and applications to energy and power systems. Introduction to engineering problem analysis and computer methods. Spring.

ERE 365 Principles of Remote Sensing (4)

Three hours of lecture and three hours of laboratory and discussion per week. A qualitative and quantitative introduction to the fundamentals of acquiring, analyzing and utilizing remote sensing data. Introductory concepts and methods in digital image processing and photogrammetry. Spring. Prerequisite: ERE 371 Surveying for Engineers. Note: Credit will not be granted for both ERE 365 and ERE 565.

ERE 371 Surveying For Engineers (3)

Two hours of lecture and three hours of lab per week. The principles of plane surveying and position determination for engineers. Subject matter areas include introduction to the theory of measurement and errors, reference surfaces, coordinate systems and datums, horizontal and vertical measurements, traversing and computations, the analysis and treatment of systematic and random errors, foundations of global positioning systems. Laboratory fieldwork and computations culminate in a topographic map. Fall. Prerequisite: Calculus.

ERE 380 Energy Systems Engineering (3)

Three hours of lecture per week. Covers fundamentals of thermodynamics and power needed for engineering systems analysis and applies methods such as life cycle analysis, sustainability analysis, and environmental impact analysis to non-renewable and renewable energy systems. A portion of the class is spent on open-ended problem solving and engineering design. Spring. Prerequisite: Physics II, Calculus II, ERE 275 Ecological Engineering

ERE 405 Sustainable Engineering (3)

Three hours of lecture/discussion per week. Will explore and attempt to develop solutions to societal and environmental problems in a changing world that is facing climate change, premium fuel depletion, and regional water shortages. Evaluation of system sustainability using a multidisciplinary framework. Introduction to sustainability metrics, including emergy evaluation and life cycle assessment. Application of emergy evaluation. Spring.

ERE 412 River Form and Process (3)

Two hours of lecture and 3 hr of laboratory per week. Theories of river classification are presented and tested using field gathered data. Classified river form and suggested evolution sequences are used to discuss governing fluvial processes. Computational river hydraulics is used to estimate sediment transport, and a design sequence is employed to consider issues of channel stability and restoration. 612 students will perform the additional work of writing a 15 page research paper. Fall. Prerequisites: Physical or engineering hydrology Note: Credit will not be granted for both ERE 412 and ERE 612.

ERE 430 Engr Decision Analysis (3)

Three hours of lecture per week. Classical engineering economics: time value of money, nominal and effective interest, and present worth, annual worth, rate of return, and benefit-cost ratio comparison techniques. Identification and evaluation of alternative investment and borrowing decisions, including the role of inflation, depreciation, taxes and uncertainty. Investment theory including the potential risks and rewards associated with investments options. Simulation and optimization techniques to aid in management decisions. Spring.

ERE 440 Water and Wastewater Treatment (3)

Three hours of lecture per week plus two laboratory exercises and one field trip. Design principles and practice of unit operations and processes for water and wastewater treatment. Study of the engineering concepts and design procedures for water and wastewater treatment. Fall. Prerequisite(s): ERE275 Ecological Engineering; ERE 339 Fluid Mechanics Note: Credit will not be granted for both ERE 440 and ERE 640.

ERE 444 Hydro-Meteorology (3)

Three hours of lecture per week. Atmospheric physics, moisture dynamics, and thermodynamics emphasizing feedback loops with precipitation. Quantitative descriptions of stability and dynamics and the development of fronts, cyclones, and thunderstorms. Weather station sensors and data-logger programming. Testing of analysis products, numerical weather models, quantitative precipitation forecasts, and radar precipitation data. Spring. Prerequisites: Physics 1, Calculus II, permission of instructor.

ERE 445 Hydrologic Modeling (3)

Three hours of lecture per week. An exploration of deterministic and stochastic hydrologic models, model development, and the use of computer programming to construct, calibrate, manipulate, and interpret hydrologic models. Theoretical and analytical approaches to describing hydrologic processes, including precipitation, evapotranspiration, infiltration, surface runoff, percolation, and groundwater discharge. Stochastic techniques include frequency, trend, and regression analyses. Spring. Prerequisite(s): Introductory computer programming, Probability and Statistics, one year of Calculus. Note: Credit will not be granted for both ERE 445 and ERE 645.

ERE 465 Environmental Systems Engrng (3)

Mathematical models of environmental systems are presented and combined with optimization procedures, decision theory, uncertainty analysis, and engineering economics to develop integrated approaches to the planning, design, and sustainable management of complex environmental systems. Students will be exposed to a variety of optimization algorithms for a wide range of environmental applications. Fall. Prerequisite(s): APM206 Corequisite(s): APM395

ERE 468 Solid & Hazardous Waste Engr (3)

Three hours of lecture and discussion. Introduction to solid and hazardous waste regulations. Analysis and design of solid and hazardous waste management systems, including generation, storage, transport, recycling, biological, physical, chemical and thermal treatment; energy recovery; land disposal; environmental protection systems and monitoring. Field trips. Fall. Pre- or Co-requisites: ERE 340 and ERE 440. Note: Credit will not be granted for both ERE 468 and ERE 568.

ERE 480 Fate & Trnsprt of Contaminants (3)

Three hours of lecture per week. The fundamental physical, chemical, and biological principles of fate and transport of contaminants. Application of the fundamental principles to analyze complex contamination problems in surface waters, subsurface environment, atmosphere, and engineered environments. Contemporary contamination issues. Prerequisites: Calculus II (APM 206), General Chemistry II (FCH 152), and Ecological Engineering (ERE 275), or equivalent. Note: Credit will not be granted for both ERE 480 and ERE 580.

ERE 485 Fundamentals/Engineering Prep (1)

Discussion of content and administration of the Fundamentals of Engineering (FE) Exam, a comprehensive review of FE-type problems, and a targeted review of specific topics on the FE Exam. Spring. Prerequisite(s): Senior standing or consent of instructor.

ERE 488 Engineering Project Management (1)

Project management strategies for the engineering profession. Readings, exercises and discussion emphasizing professional responsibility and ethical practices; project management; technical communication and teamwork. Team-based scoping and planning of engineering design projects. Fall. Prerequisite: Senior status ERE students only.

ERE 489 Env Res Engr Plan&Design (3)

Two hours of lecture and three hours of laboratory. A capstone course to integrate engineering coursework with the engineering design process to solve interdisciplinary environmental problems. Semester-long project provides experience in problem analysis, teamwork, project management, engineering ethics, and professional communication. Spring. Prerequisites: Senior standing in Environmental Resources Engineering, ERE 488.

ERE 496 Special Topics (1-3)

Lectures, readings, problems and discussions. Topics in environmental or resource engineering as announced. Fall and/or Spring.

ERE 498 Rsrch/Env Resources Engr (1-3)

Independent research in topics in environmental resources engineering for the highly motivated undergraduate student. Selection of subject area determined by the student in conference with appropriate faculty member. Tutorial conferences, discussions and critiques scheduled as necessary. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring. Prerequisite: Permission of instructor.

ERE 508 Water-An Incredible Journey (3)

Three hours of lecture/discussion per week. Content covers the origin of water on Earth, physical and chemical characteristics of water, global distribution of water, historical development of drinking water supply systems, potable water treatment technology, water resources management strategies, global potable water quality challenges, impact of climate change on water resources, role of water in controlling and determining the quality of human health, and the solar system and exoplanet search for water. Spring. Prerequisites: General Chemistry I and II

ERE 511 Ecological Engr in the Tropics (3)

One hour of discussion per week with intensive spring break field study in a Caribbean country. Principles of ecological engineering for ecosystem restoration and pollution control. Field trips to pristine and degraded ecosystems including: humid tropical cloud forests, coastal mangrove, dry mountain forests, and coral reefs to identify target functions for nature and society, observe degradations, and develop sustainable restoration designs. ERE 511 students will perform the additional work of writing a 15-page research paper. Spring. Prerequisites: 1 course in calculus, biology, and chemistry. Note: Credit will not be granted for both ERE 311 and ERE 511.

ERE 519 Green Entrepreneurship (3)

Three hours of lecture/discussion per week. Explore challenges and goals of creating a start-up venture in environmental science or technology. Recognize trends in the marketplace, and where commercial opportunities can be created. Analyze feasibility and potential to create a sustainable venture. Other topic areas include critical success factors and key start-up issues unique to science and technology firms. Spring. Pre- or Co-requisites: FOR 207 Introduction to Economics or equivalent; or permission of instructor.

ERE 520 Wastewater Resource Recovery (2)

Two hours of lecture, presentations and discussion per week. Introduction to technologies for recovery of bio-energy and nutrients from liquid wastes as well as the principles and applications of laboratory methods used in development and assessment of wastewater resource recovery processes. Presentation and discussion of experimental results for comprehensive analysis of anaerobic digesters. Spring. Prerequisites: One of ERE 480; FCH 510; and FCH515.

ERE 521 Wastewater Rsrce Recovery Lab (1)

Three hours of laboratory exercises per week on average. Conduct experiments for comprehensive analysis of anaerobic digesters, including feedstock and digestate characterization, biogas monitoring, analysis of anaerobic digestion kinetics, and recovery of ammonia and phosphate in digestate. Student groups prepare for presentations in ERE 520 class. Spring. Co-requisites: ERE 520.

ERE 527 Stormwater Management (3)

Three hours of lecture per week. One Saturday field trip. Techniques for urban stormwater and erosion control and analysis of associated water quality impacts. Review of applicable regulations and design standards. Students will engage in individual and team-oriented activities such as lecture, discussion, observation, computation, reading and writing. In addition, students are required to participate in a Saturday field trip where examples of stormwater management facilities will be reviewed. Students will, in small teams, generate a design for a stormwater management alternative at a local site. Fall. Prerequisite: ERE 340 or equivalent as determined by instructor.

ERE 530 Numerical & Computing Methods (3)

Three hours of lecture/discussion per week. Programming skills and computing techniques using state-of-the-art software packages. Applications of programming and computing methods for solving geospatial, ecological, and/or water resource engineering problems. Fall. Prerequisite(s): Differential Equations.

ERE 533 Ecological Modeling (3)

Three hours of lecture, discussion and experimentation per week. Development, use, and interpretation of mechanistic numerical models applied to ecological systems. Students will develop a model on a topic of their choice throughout the semester. Fall. Prerequisite: ERE 335 or equivalent coding class

ERE 540 Engr Hydrology&Hydraulics (3)

Three hours of lecture per week. Covers watershed hydrology and analysis of rainfall, evapotranspiration, infiltration, and runoff processes as well as hydraulic processes involved with pipe networks, open-channels with flow controls, and groundwater systems. Problem sets, modeling exercises and a research project report are required. Spring. Prerequisites: Fluid Mechanics. Note: Credit will not be granted for both ERE 340 and ERE 540

ERE 545 Environmental Soil Physics (3)

2 hours lecture, 3 hours lab per week. Soil water content and potential, steady water flow in saturated soil, heat flow in soil, transient water flow. Field methods to obtain data for analysis and modeling. Application of analytical and numerical solutions to describe heat and water fluxes in the soil-plant-atmosphere continuum, unsaturated zone hydrology, and solute transport. Fall. Prerequisite: PHY 211, APM 485, ERE 339, or equivalent.

ERE 551 GIS for Engineers (3)

Two hours of lecture and three hours of laboratory per week. Introduction to fundamental concepts in geographic information systems (GISs) with a focus on engineering applications. Fundamental concepts and development of geographic information systems including models and georeferencing systems used to represent and characterize spatial data. Data processing including collection and preprocessing, data management, spatial analysis and manipulation, and data output. Necessity and utility of spatial data in engineering design analysis. Fall. Prerequisite: Calculus. Co-requisite: ERE 371 or equivalent.

ERE 553 Intro to Spatial Information (1)

Three hours of lecture per week for the first third of the semester. An introduction to spatial terminology and methods for determining and expressing position. Examination of accuracy and precision in the context of horizontal measurements. Issues with subsequent use of measurements for producing maps and performing analysis. Fall.

ERE 555 RADAR Remote Sensing (3)

ERE 555 Radar remote sensing. Two hours of lecture and three hours of lab per week. Theory and applications of Synthetic Aperture RADAR (SAR) Remote Sensing and advanced Polarimetric SAR (PolSAR) for environmental monitoring. Fundamental concepts of SAR imaging systems such as target and sensor parameters, geometric correction, and scattering mechanisms, and advanced topics of Polarimetric SAR such as polarization descriptor and scattering operators, speckle noise filtering, Polarimetric decomposition, PolSAR image supervised and unsupervised classification.

Selected real-world applications of PolSAR data for land cover mapping (e.g. agriculture, forest, wetlands, and water bodies), sea and ocean surface, and sea ice detection and discrimination. Spring. Prerequisite: ERE 365 or equivalent.

ERE 556 UAV Photogrmmtry&Remote Sensng (3)

Two hours of lecture and discussion, and three hours of lab per week. Introduction to Unmanned Aerial Vehicles (UAV) with focus on data processing and photogrammetric analysis. Introduction to UAV systems including types and classification, regulatory issues, sensors and platforms. Data collection and processing including mission planning, photogrammetric triangulations and bundle adjustment, sensor positioning and orientation, 3D surface reconstruction and image matching, robotic mapping and ortho generation. Emerging UAV trends and technologies such as power and payload issues as well as outlook and societal, technological, regulatory, and market challenges. Spring. Prerequisite: Completion of an introductory geospatial course, ERE 365, ESF 300, or FOR 557, or equivalent.

ERE 564 i-Tree Tools Practicum (3)

Three hours of lecture and field demonstration per week. Use i-Tree models to complete an urban forest inventory, an assessment of associated ecosystem services, and engineering designs for improved sustainability. Forest structure data are obtained from field visits and remotely sensed or archived products. Models simulate structure-function relations using governing scientific principles in order to estimate forest services such as filtering air pollution, sequestering carbon dioxide, managing storm water, mitigating the urban heat island, and improving building energy use efficiency. Prerequisites: General biology I, general chemistry I, Precalculus

ERE 565 Principles of Remote Sensing (4)

Three hours of lecture and three hours of laboratory and discussion per week. A qualitative and quantitative introduction to the fundamentals of acquiring, analyzing and utilizing remote sensing data. Introductory concepts and methods in digital image processing and photogrammetry. Spring. Prerequisite: ERE 371 Surveying for Engineers or permission of instructor. Note: Credit will not be granted for both ERE 365 and ERE 565.

ERE 566 Intro/Global Positioning Sys (1)

Three hours of lecture per week for the last third of the semester. An introduction to the theory and practice of performing global positioning system (GPS) measurements. Comparison of accuracy potential for different GPS equipment and techniques. Exploration of error sources that reduce the accuracy of GPS measurements. Collection of GPS data. Fall.

ERE 568 Solid & Hazardous Waste Engr (3)

Three hours of lecture and discussion. Introduction to solid and hazardous waste regulations. Analysis and design of solid and hazardous waste management systems, including generation, storage, transport, recycling, biological, physical, chemical and thermal treatment; energy recovery; land disposal; environmental protection systems and monitoring. Field trips. Fall. Prerequisites: ERE 440 and ERE 340 Note: Credit will not be granted for both ERE 468 and ERE 568.

ERE 570 Hydrology in a Chng Climate (3)

Three hours of lecture/discussion per week. Drawing on a growing body of academic literature focused on better understanding the degree of uncertainty in future climate, this class provides the technical background to interpret and apply predictions of future climate changes (as primarily related to hydrology) in different locales and at different scales. Specific topics include: frequency analysis under non-stationary conditions, misconceptions in linkages between hydrology and climate, accessing and manipulating climate model files (netcdf), and strategies for decision making under uncertainty. Spring. Prerequisite: basic programming knowledge and prior hydrology/water resources class

ERE 575 Ecological Engr/Water Quality (3)

Three hours of lecture/seminar/discussion per week. Design and analysis of ecological treatment systems for water quality improvement. Hands-on construction, operation and/or monitoring of engineered ecosystems through group project activities beyond class meeting times in on-campus labs and a greenhouse. Focusing on constructed wetlands, with minor topics selected by students. Prerequisite: ERE 275 Ecological Engineering or equivalent

ERE 580 Fate&Transport of Contaminants (3)

Three hours of lecture per week. The fundamental physical, chemical, and biological principles of fate and transport of contaminants. Application of the fundamental principles to analyze complex contamination problems in surface waters, subsurface environment, atmosphere, and engineered environments. Graduate students will write a research paper on contemporary contamination issues. Prerequisite: Calculus, General Chemistry, and Introduction to Ecological/ Environmental Engineering, or equivalent. Note: Credit will not be granted for both ERE 480 and ERE 580.

ERE 612 River Form and Process (3)

Two hours of lecture and 3 hr of laboratory per week. Theories of river classification are presented and tested using field gathered data. Classified river form and suggested evolution sequences are used to discuss governing fluvial processes. Computational river hydraulics is used to estimate sediment transport, and a design sequence is employed to consider issues of channel stability and restoration. 612 students will perform the additional work of writing a 15 page research paper. Fall. Prerequisites: Physical or engineering hydrology Note: Credit will not be granted for both ERE 412 and ERE 612.

ERE 620 Systems Microbio & Biotech (3)

Three hours of lecture and three hours of laboratory and discussion per week. Laboratory techniques, public databases, and computational methods commonly used for probing dynamic microbial systems. Bioinformatics analysis of sequence data and computer programming in high performance computing environment. Team-based project activities beyond class meeting times. Spring. Prerequisite: Either microbiology/genetics or computer programming.

ERE 621 Spatial Analysis (3)

Three hours of lecture and discussion per week. Spatial statistics and modeling as applied to various data formats: single point data, continuous data and area data. First and second order effects, complete spatial randomness, tessellation, kernel, covariograms and variograms, kriging, distance measures, correlation/correlogram. Fall. Prerequisite(s): APM 391, ERE 335 or permission of instructor.

ERE 622 Digital Image Analysis (3)

Three hours of lecture and discussion per week. Elements of digital image processing and analysis systems: Digital image representation, visual perception, sampling and quantization, pixel connectivity, Fourier transforms, image enhancement, filtering, image segmentation, edge detection, thresholding, representation schemes, descriptors, morphology, recognition and interpretation. Spring. Prerequisite(s): APM 391, ERE 335 or permission of instructor.

ERE 640 Water and Wastewater Treatment (3)

Three hours of lecture per week plus two laboratory exercises and one field trip. Design principles and practice of unit operations and processes for water and wastewater treatment. Study of the engineering concepts and design procedures for water and wastewater treatment. Fall. Prerequisite(s): General chemistry, microbiology, water quality, and fluid mechanics or hydraulics Note: Credit will not be granted for both ERE 440 and ERE 640.

ERE 644 Hydro-Meteorology (3)

Three hours of lecture per week. Atmospheric physics, moisture dynamics, and thermodynamics emphasizing feedback loops with precipitation. Quantitative descriptions of stability and dynamics and the development of fronts, cyclones, and thunderstorms. Weather station sensors and data-logger programming. Testing of analysis products, numerical weather models, quantitative precipitation forecasts, and radar precipitation data. Spring. Prerequisites: Physics, Calculus II, permission of instructor

ERE 645 Hydrologic Modeling (3)

Three hours of lecture per week. An exploration of deterministic and stochastic hydrologic models, model development, and the use of computer programming to construct, calibrate, manipulate, and interpret hydrologic models. Theoretical and analytical approaches to describing hydrologic processes, including precipitation, evapotranspiration, infiltration, surface runoff, percolation, and groundwater discharge. Stochastic techniques include frequency, trend, and regression analyses. Spring. Prerequisite(s): Introductory computer programming, Probability and Statistics, 1 year of Calculus. Note: Credit will not be granted for both ERE 445 and ERE 645.

ERE 665 Environmental Systems Engrng (3)

Mathematical models of environmental systems are presented and combined with optimization procedures, decision theory, uncertainty analysis, and engineering economics to develop integrated approaches to the planning, design, and sustainable management of complex environmental systems. Students will evaluate and present a variety of optimization algorithms for a wide range of environmental applications. Fall. Prerequisite(s): APM206 Corequisite(s): APM395

ERE 674 Meth/Ecol Treatment Analysis (3)

Two hours of lecture/seminar/discussion and three hours of lab per week. Introduction to the components and design principles of engineered ecosystems for water quality improvement. Common lab exercises for a comprehensive analysis of an engineered ecosystem, including water quality, reaction kinetics, hydraulic characteristics, vegetation, soil and gravel, and microbial community. Discussion on experimental procedures and data analysis. Spring.

ERE 692 Remote Sensing of the Envrnmnt (3)

Three hours of lecture/discussion per week. Understanding of various remote sensing systems, their applications, and advanced digital image processing techniques. Analysis of satellite and airborne-acquired remote sensing data. Spring. Prerequisite(s): ERE 365 or equivalent introduction to remote sensing.

ERE 693 GIS-Based Modeling (3)

Three hours of lecture/discussion per week. Geographical, temporal, environmental modeling concepts using GIS-based modeling languages and techniques. Various modeling concepts and techniques including spatial interpolation, suitability/capability modeling, hydrologic modeling, diffusion modeling, calibration, optimization, accessibility modeling, and rainfall-runoff modeling. Fall. Prerequisite(s): ERE 551 or equivalent.

ERE 697 Intro Engineering Project Mgt (1)

An introduction to Engineering Project Management focused on the definition of a project and project management, a projects' relationship and value within an organization, the standardized project management lexicon, the role/responsibilities and characteristics of an effective project manager (including items such as professional duty, ethics, communication, collaboration, etc), and an overview of the project management process - initiating, planning, executing, monitoring and controlling, and closeout. Prerequisite: Bachelor of Science (B.S.) degree in Engineering

ERE 698 Prncpls&Pract/Engr Prjct Mgt (2)

A continuation of study of project management process functions including: project initiation, resource planning and scheduling, cost estimating, risk registry, procurement, monitoring and control, and project closeout. Course also covers project management functions including: quality, health and safety, stakeholder and supply chain management, and management of change. Effective roles and responsibilities will be explored related to ethics, collaboration, leadership, communication, and the project management function in digital/virtual environments and a cross-cultural, global setting. Prerequisite: ERE 697 - Introduction to Engineering Project Management.

ERE 699 Engineering Planning & Design (6)

An intensive, project-team design experience with analysis of real world, interdisciplinary problems and development of design solutions. Projects will address problem framing, stakeholder analysis, conceptual and detailed engineering design, options analysis, and life-cycle financial analysis culminating in written and oral reports supporting the selected project design. Utilization of sound project management skills including engineering ethical, political, health & safety, manufacturability and sustainability considerations, along with collaborative teamwork, and professional communication. Prerequisite: ERE 698 - Principles and Practices of Engineering Project Management.

ERE 797 Resrch Methods/Env&Res Engr (1-3)

One to three hours of discussion/seminar per week. Introduction to research facilities, opportunities, and responsibilities of graduate scholarship. Discussion of ERE research topics, including journal reading, proposal formulation, funding, and engineering tools. Use of scholarly resources including e-journals, web, proposal development, and presentations. Fall and Spring.

ERE 798 Resrch/Env Resources Engr (1-12)

Independent research topics in Environmental Resources Engineering. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. Credit hours to be arranged.

ERE 897 Professional Experience (1)

Individual and/or small-group professional mentoring/advising with the ERE M.E. Program Director focusing on professional development, aligned with individual student academic/ professional goals. Students will develop an Individualized Study Plan (ISP) that will serve as a charter between the student and the Program Director specifying metrics and milestones to be achieved throughout the semester including creation of a Professional Development Plan. Prerequisite: Bachelor of Science (B.S.) degree in Engineering.

ERE 898 Prof Exp/Synthesis Eng (1-6)

A supervised, documented professional work experience in the Master of Professional Studies degree program. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. Prerequisite: Approval of proposed study plan by advisor, Department, and any sponsoring organization.

ERE 899 Masters Thesis Research (1-12)

Research and independent study for the master's degree and thesis. Fall, Spring and Summer.

ERE 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral degree and dissertation. Fall, Spring and Summer.

ESF - COLLEGE-WIDE

ESF 109 Honors Sem/Envrn Sci &Forestry (1)

One hour of lecture/discussion per week. Sequential presentations by ESF faculty and staff members. Exploration of science, engineering, design, management and social science applied to regional, national and global issues. A written report and presentation is required. Fall. Prerequisite: Admission to the lower division Honors Program.

ESF 122 Ecology/Economic Process (3)

An approach to economics as a natural, rather than a social science. Examination of the ecology of human-dominated ecosystems including cities, agricultural areas, and fisheries. Review of basic ideas of value, classical, neoclassical, and biophysical economics. Examines an alternative model emphasizing analysis of energy and material flows and their control. Case studies will focus on the developing economies of the tropics. Prerequisite(s): High School Living Environment (Biology) Co-requisite(s): High School Economics

ESF 200 Information Literacy (1)

One hour of lecture/discussion per week, in-person or online. Introductory course for students of all levels and all curricula to the basic research process for information retrieval and management. Explore the breadth of value and complexity of academic publications, grey literature, and Indigenous Knowledge. Students will build understanding of systems of information and knowledge creation and oppression and practice skills to recognize authority, validity, and bias in those systems. Students will gain practical experience with the use of information in creating new knowledge and participating ethically in communities of learning.

ESF 209 Honors Sem:Envrn Sci&Forestry (1)

One hour of presentation and discussion per week. Sequential presentations by students, or faculty, or both. Exploration of science, engineering, design, management and/or social science applied to regional, national and global environmental issues. A presentation and/or a written report may be required. Fall. Prerequisite: Admission to the lower division Honors Program.

ESF 296 Spec Topics/Envrn Sci & Fsty (1-3)

One to three hours of class meetings per week. Special topics of current interest to students campus wide; or an experimental course in its first iteration. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring. Permission of the instructor

ESF 298 Research Apprenticeship (1-3)

Full- or part-time engagement on a research project having a environmental science or similar focus. A final deliverable in the form of a report, presentation, or other culminating synthesis of the research will be required. Periodic check-ins with the instructor of record will also be necessary to ensure satisfactory progress is being made. Fall, Spring, and Summer Prerequisite: Permission of instructor. ESF in the High School students only.

ESF 300 Intro/Geospatial Info Tech (3)

Two hours of lecture and three hours of laboratory per week. A theoretical and practical course providing an introduction to the uses and limitations of geospatial information technologies, including geographic information systems (GIS), global positioning systems (GPS) and remote sensing, for environmental science and natural resources management applications. Fall and Spring.

ESF 321 Study Abroad (1-25)

Local registration placeholder for various study abroad programs. Fall and/or Spring and/or Summer.

ESF 496 Spec Topics/Envrn Sci & Fsty (1-3)

One to three hours of class meetings per week. Special topics of current interest to students campus wide; or an experimental course in its first iteration. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring.

ESF 499 Honors Thesis/Project (1-5)

Guided independent study in a topic related to the student's undergraduate major, resulting in a thesis/project. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Students will give an honors presentation of their work. Fall and Spring.

ESF 503 Sem/Univ Outreach&Public Svc (1-3)

One- to three-credit seminar examines processes and strategies designed to enhance the scholarship and practice of university-based outreach and public service with an emphasis on relationships with K-12 schools and community organizations. Spring.

ESF 696 Spec Topics/Envrn Sci & Fsty (1-3)

One to three hours of class meetings per week. Special topics of current interest to students campus wide; or an experimental course in its first iteration. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring. Permission of the instructor

ESF 797 Grad Seminar on Info Resources (1)

One hour of lecture/discussion per week. Searching for and evaluating information resources. Using citation management software. Preparing to write the research proposal and write and defend subsequent thesis/dissertation.Student presentations on information tools, thesis/dissertation research topics, formation of problem statement. Fall.

ESF 899 Master's Degree in Progress (0)

Master's research, writing, and/or defense of thesis. (S/U) Summer only.

ESF 999 Doctoral Degree in Progress (0)

Doctoral research, writing, and/or defense of dissertation. (S/U) Summer only.

EST - ENVIRONMENTAL STUDIES

EST 132 Orientation Seminar:EST (1)

One hour of lecture, discussion and/or exercises per week. Introduction to campus resources available to ensure academic success. Introduction to Environmental Studies as a field of inquiry, and the three option areas that the department offers. Fall.

EST 133 Intro to Environmental Studies (3)

Three hours of lecture, discussion and analytical activities per week. Gateway course for EST majors. Introduction to the study of environmental problems in the social sciences and humanities. Topics: pollution, conservation, preservation, human health, ecosystem health, limits to growth, sustainability, ecosystems, population, energy, risk and traditional knowledge. Fall.

EST 135 Intro to Climate Justice (3)

Two hours of lecture and one hour seminar per week. An introduction to the concept of climate justice - an area of scholarship, policy and activism that investigates the unequal impacts of climate change and the ways to address them. The course provides an overview of the key theories and approaches to studying (via research) and pursuing (via activism) climate justice, which are underpinned by real-world examples ranging from Syracuse and CNY to global issues. Assignments include reaction papers, a group poster presentation, and a final project with a flexible, written or non-written format. Upon the completion of the course, students will be able to interpret climate change as a quintessentially social - and not just an environmental - issue, and suggest potential ways to rectify climate injustices in different social settings. Spring.

EST 140 Int/Native People,Land,Cult (3)

Three hours of lecture/discussion per week. Introductory survey of the history, geography, economy, and culture of Native Americans from prehistory to present, with special attention to the Great Lakes region/upstate New York and environmental topics. Draws on texts, films, guest speakers, and other resources. Spring.

EST 200 Cultural Ecology (3)

Three hours of lecture/discussion/oral presentations per week. Students develop skills and fluency in preparing, delivering and evaluating multicultural and traditional environmental management and decision-making. Emphasis is on situations encountered in the environmental professions. Case studies pose ethical questions, which challenge students to apply theory and analysis to each case. Topics also include interactions of culture and environment, relationship between traditional and scientific knowledge and co-management as multicultural decision making. Self-evaluation and peer evaluations are emphasized. Fall or Spring.

EST 201 Am Hist:Recnstructn to Present (3)

Three hours of lecture/discussion per week. History of changes occurring in America post 1865 including land use, government, economic and international relations. Spring.

EST 202 Am Hist:Discovery to Civil War (3)

Three hours of lecture/discussion per week. A survey of American history considering the origin and development of American institutions and ideals, from the discovery of the New World through the Civil War. Students are introduced to works of major historians and to various interpretations of American history.

EST 203 Introduction To Sociology (3)

Three hours of lecture per week. General introductory principles and methods of sociology including group dynamics and development, different structural arrangement of social groups, community development and adjustment processes, relationships with the natural environment. Spring.

EST 204 Diversity&Knowledge of the Env (3)

Three hours of lecture and discussion or online. This interdisciplinary course provides a in-depth understanding of non-western perspectives of environmental knowledge. The course is focused on what it means to study the environment at ESF in the context of Syracuse, New York and the Onondaga Nation of the Haudenosaunee Confederacy. The course seeks to increase student competency to interrogate place, histories, and power dynamics, as well as socialization and agency in times of climate change. It will cultivate analytical skills, and develop student ability to analyze power relationships and carry out an (eco)systemic analysis. The course also explores how issues of the environment are connected with issues of society and place. Throughout this course, students will read about issues that join personal life with the political and economic lives of others, in the US and globally. In addition, the course will provide context for the recent diversity efforts on ESF and SU campuses and be

EST 205 Identity, Culture, & the Env (3)

Two hours of lecture and one hour of seminar per week. This course explores ways in which popular culture—including social media, art, craft, and fashion and affinity group activism—frames identity, power, and social structures in the U.S. Uses foundations of cultural studies and sociology to examine how institutional and societal structures in the U.S. lead to inequities across groups and shape individual meaning making and re/actions to systems of power, privilege, oppression, and opportunity. Fall and Spring.

EST 220 Urban Ecology (3)

Two hours lecture/discussion, three hours of outdoor laboratory per week. Explores the city from an ecosystems perspective. Addresses the role and importance of science, engineering, the design professions, and community participation in creating livable communities. Environmental equity and justice are addressed. Fall.

EST 221 Intro/American Government (3)

Three contact hours per week. Describes American political system and its roles and functions in society. Examines how political processes change over time, including the role of rhetoric and argumentation in policy development. Explores critical analysis of political phenomena. Fall.

EST 231 Environmental Geology (3)

Three hours of lecture and discussion per week. Environmental Geology is an applied field of study that uses geological information to assist in resolving human conflicts related to land use issues, environmental damage, and resource use. Topics include natural resources, energy, environmental pollution, waste disposal, geological hazards and climate change. Spring.

EST 245 Foundations/Envrn Communicatn (3)

Three hours of lecture/discussion per week. Survey of environmental communication, including nature representions in popular culture, and the role of mass media on public perceptions of environmental issues. Topics also include strategic communication, public participation in environmental decision-making, and environmental risk perception. Exposure to communication theory and social scientific and humanities-based approaches. Fall.

EST 255 Research Methods/Envrn Studies (3)

Three hours of lecture, discussion and analytical activities per week. An introductory methods course focused on research techniques used in environmental and natural resources social science research. This course reviews quantitative and qualitative methodologies for environmental studies research including but not limited to questionnaires, in-depth interviews, rhetorical critiques and content analyses. Spring. Pre- or Co-requisite: EWP 290

EST 296 Spec Topics/Envrn Studies (1-3)

Experimental, interdisciplinary or special coursework at the freshman or sophomore levels. Subject matter and course format vary from semester to semester or offering on the basis of needs and objectives of the course. Fall or Spring.

EST 312 Sociology of Natural Resources (3)

Three hours of lecture per week. The concepts and principles of sociology as applied to natural resource questions. Concepts of community, forest dependent communities, shared identity and social structures of resource based groups. The forest as an integrated social and biological community. Spring

EST 321 Government & Environment (3)

Three contact hours per week. Examines the relationship between government and the environment, primarily in the U.S. Introduces environmental policy, including the policy making process. Reviews legal framework and current issues in several thematic areas (e.g., air, water, hazardous waste, and endangered species protection). Spring

EST 333 Inquiry-Based Science Educatn (3)

An online asynchronous course that engages future science teachers in the methods, learning theories, practices, and instructional approaches relevant to science education. Students learn strategies, master techniques, and gain practice-based experience in the promotion of inquiry-based, learner-centered classrooms. They design equitable and authentic science learning experiences for diverse student populations. Students create lessons reflecting educational standards, while using impactful approaches to enhance the learning environment. Spring. Credit will not be granted for both EST 333 and EST 533.

EST 353 Behavior Change & Env (3)

This course explores the critical role of human feelings and behaviors in creating environmental problems and solutions, and addresses how individuals and publics think about and react to environmental challenges, what psychologies apply, and what communication and education techniques environmental practitioners can employ to encourage sustainable behaviors and actions. The course begins with a self-inventory of environmental beliefs, then an overview of environmental psychologies, behavior theory, research, and methods, and ends with practical applications. Fall.

EST 361 History/Am Envrn Movement (3)

Three hours of lecture and discussion per week. The historic and cultural origins and evolution of this complex, multifaceted social phenomenon called the environmental movement and its influence on public policies, values and lifestyles. The events, personages, philosophies and historical/cultural processes that marked and continue to drive various, competing attitudes toward nature, even within the United States environmental movement. Fall.

EST 366 Environmental Ethics (3)

This course covers key concepts in the field of environmental ethics and focuses on the ways in which our worldviews influence how we interact with the environment. We will learn some of the key ideas that have informed Western and non-Western environmentalism and environmental ethics. The course applies this knowledge to ethically analyze some of this century's key environmental issues. Includes one lecture and one discussion seminar per week. Fall.

EST 370 Intro/Pers Env Interp Methods (3)

Two hours of lecture and 2 hours of recitation per week. One required Saturday field trip. Personal interpretation teaches a variety of face-to-face techniques used to connect the public with environmental science by providing an introduction to history of interpretation, popular interpretive and environmental education activities and curriculum, evaluation of programs, and lesson plans. Explores and illustrates the research and philosophy of environmental interpretation. Fall. Prerequisite(s): EFB 320, junior or senior standing, or permission of instructor Note: Credit will not be granted for both EST 370 and EST 570.

EST 390 Social Processes & Envrn (3)

Three hours of lecture/discussion per week. Explores alternative ways of explaining the relationship between social processes and environmental conditions. Analyzes classical and modern social theories and applies their insights to questions of human-environment interaction. Introduces qualitative social science research methods and the social construction of environmental meaning. Fall or Spring.

EST 395 Public Communcatn/Science&Tech (3)

Three hours of lecture/discussion per week. Survey of public communication of science and technology (PCST). Considers the structure, meanings, and implications of PCST, including contexts in which it occurs. Topics also include motivations and constraints of those who produce PCST, and function of PCST in contemporary society. Exposure to communication theory and social scientific research methods and analysis. Spring. Prerequisite(s): EST 245 and junior standing, or permission of the instructor.

EST 400 Senior Paper (3)

Individual study of an environmental topic resulting in a formal report that meets the requirements for an environmental studies synthesis experience. These requirements are identified in course meetings. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Enrollment is restricted to environmental studies seniors. Fall and Spring.

EST 401 Envrn Ethics&Culture/ADK Park (3)

Introduction to the ethics of land-use conflicts in the Adirondacks, NY. This course links the philosophical history of ethics with contemporary principles of environmental ethics and advocacy. Topics include agency, ethics, value theory, morality and responsibility in the context of ongoing regional debates. Requires concurrent registration with other Sustaining the Park courses. Fall, Newcomb Campus. Prerequisite(s): none. Co-requisites: EFB 411, EST 402, EST 403, EST 404.

EST 402 Divrs Perspctvs:Experience ADK (3)

Two hours of lecture and three hours per week of immersion in Adirondack issues including introduction to diverse stakeholders and perspectives through non-governmental, agency, and community meetings; interaction with an array of regional experts through special panel discussions; and field trips to and private tours of historic and cultural sites and institutions. Requires concurrent registration with other Sustaining the Park courses. Fall, Newcomb Campus. Prerequisite(s): none. Co-requisites: EFB 411, EST 401, EST 403, EST 404.

EST 403 Sustainable Devl:ADK Park Stdy (3)

A place based study of the concepts of sustainable development and their application. Students will learn of the role of historical precedence and current context in approaching planning and policy for a sustainable future. The course will combine lecture, discussion, student led seminars and writing that illustrates both skills in analysis and synthesis. Class will meet once a week for three hours for fourteen weeks at the ESF Newcomb campus, and may require occasional field trips. Requires concurrent registration with other Sustaining the Park courses. Fall, Newcomb Campus. Prerequisites: none. Co-requisites: EFB 411, EST 401, EST 402, EST 404.

EST 404 Past Exp/Synthesizing ADK Park (3)

Three hours of lecture/seminar/discussion per week. Synthesis of experiences, content and insights gained during the "Sustaining the Adirondack Park" residential semester, including Capstone research and production of an independent position paper and collaborative comprehensive management plan. Requires concurrent registration with other Sustaining the Park courses. Fall, Newcomb Campus. Prerequisite(s): none. Co-requisites: EFB 411, EST 401, EST 402, EST 403.

EST 407 Assessment for Env Programs (3)

Three hours of lecture per week. This course utilizes systems thinking to identify, critique, and develop innovative approaches and frameworks for evaluation of environmental education and messaging programs. Students will discuss and conduct program evaluation, assessments of knowledge, skills, attitudes and beliefs, program structuring, and theme development. Students will also explore creative approaches such as goal-oriented design, spontaneous interpretation and evaluation, non-verbal communication, and alternative assessments. The course places specific emphasis on planning and evaluation as strategic, interrelated and cyclical activities. Spring.

EST 415 Environmental Justice (3)

Three hours of seminar/discussion per week. This course introduces students to the unique environmental vulnerabilities that marginalized communities are at heightened exposure to, within a multitude of contexts, including: toxics siting, public health disparities and food access. It examines political and economic conditions that promote environmental inequality and explores the history of environmental exploitation of vulnerable populations. Additionally, it evaluates contemporary issues along with community and public responses to threats.

EST 426 Community Plng&Sustainability (3)

Three hours of lecture and demonstration per week. Presents ecological planning and development concepts and theory guiding local and global initiatives for sustainable development. Overlapping themes are considered and linked: the relationship between landscape patterns reflecting wealth, poverty and environmental quality; the role of efficiency in reducing environmental impacts; and the questions of environmental equality, and the quality of development. Fall.

EST 427 Environmental &Energy Auditing (3)

Three hours of lecture, demonstration, and discussion per week. Presents environmental and energy auditing concepts and theory guiding local and regional initiatives for greenhouse gas production and energy use reduction. This course utilizes a practicum approach through use of inventory and analysis tools by student teams for project application. Spring. Note: Credit will not be granted for both EST 427 and EST 627.

EST 444 Creative Responses to the Env (3)

Online asynchronous format. Future environmental leaders and educators learn to draw from informal and formal education theory to inspire creativity and facilitate learning. Students produce audience-centered creative media such as videos, podcasts, children’s books, performance pieces, musical compositions, and film scripts, drawing on environmental themes reflecting environmental education pedagogy. Fall.

EST 450 Sustainable Enterprise (3)

Three hours of classroom/presentation per week. Economic, social, and environmental dimensions of sustainability and their interdependence. Influences on organizations to adopt sustainable approaches to operations and activities. Tools to validate organizational sustainability. Transdisciplinary emphasis. Fall. Note: This course is cross-listed at SU School of Management as LPP/SHR 450.

EST 460 Land Use Law (3)

Three hours of lecture and discussion per week. This course provides an understanding of U.S., state and local laws affecting land use in New York in the context of current environmental policy debates. Students learn to recognize and analyze legal issues involving land use in varying contexts. Spring. Prerequisites: EST 221 or permission of the instructor. Note: Credit will not be granted for both EST 460 and EST 660.

EST 470 H2O in Middle East:Issues&Opps (3)

Three hours of lecture/discussion per week. Seminar on water issues and initiatives in Israel, Jordan, and the Palestinian Territories. Participants explore a variety of perspectives on the biophysical, historical, and sociocultural roots of transboundary and other water-related issues in the region, as well as an array of top-down (technological, managerial) and bottom-up (community-based, participatory) approaches to developing solutions. Designed for students interested in environmental and natural resource policy, water resources, international relations, conflict resolution, and related fields. Each week, students write short commentaries on required readings; the essays serve as starting point for class discussion. Over the course of the semester, students develop and submit a research paper on a related topic. Spring. Note: Credit will not be granted for both EST 470 and 670.

EST 471 Non-Personal Envrn Interp Meth (3)

Three hours of lecture per week. Applications of environmental interpretation theory and methods applied to nature center programming, science education, and various fields of resource management emphasizing procedures for creating non-personal interpretive media (e.g., brochures, wayside exhibits, etc.). Focus on service-learning through involvement with an outside interpretive agency. Spring. Prerequisite(s): EST 370 or permission of instructor. Note: Credit will not be granted for both EST 471 and EST 671.

EST 472 Natural Hist Museums&Modrn Sci (3)

Three hours lecture per week and one week field trip. Examination of the major roles of contemporary natural history museums as places of research and public education. Emphasis on research, exhibits, collections and programs. Organized instructional visit to natural history museums during a 1-week trip. Travel expenses apply. Prerequisite(s): EST 471 or permission of the instructor

EST 474 Adv Interp&Envrnmntl Education (3)

Three hours of lecture, discussion, and practical exercises per week. This course provides in-depth experience in planning and implementing environmental education and interpretation (EE&I) programs. Students may receive their Certified Interpretive Guide credential from the National Association for Interpretation. Learners will practice engagement with EE&I community partners, such as parks, nature centers, zoos, non-profit organizations and historical sites. With these partners, students will design and offer EE&I programs and lessons. Advanced readings from the research-based literature will offer critical examination of challenges in EE&I, including climate change education, and diversity, equity, and inclusivity in EE&I. Spring. Prerequisite(s): EST 370 and junior or senior status; or permission of instructor. Note: Credit will not be granted for both EST 474 and 674.

EST 491 Env Studies Field Trip (1-3)

A five- to 10-day trip to visit with: 1) agencies, organizations, or institutions engaged in environmental research, education, communication interpretation, management, or administration; or 2) regions or areas of unusual environmental interest. A final report is required. Additional fees required to cover cost of travel and lodging during field portion of course. Tuition charges will apply to sections offered during Maymester or other summer sessions. Instructor permission required. Fall, Spring, or Summer.

EST 492 Undergrad Exp/Coll Teach (1-3)

This course is an opportunity for qualified undergraduate students to gain experience in fully supervised, college-level teaching of the type they can expect to perform in graduate school. Students assist the instructor in the preparation and delivery of course materials and preparing laboratories (when applicable). A maximum of 6 credit hours of EST 492, and 3 credit hours relating to any single assisted course, may apply toward graduation requirements. (Fall and Spring). Prerequisites: Previous completion of the course being assisted (with a grade of B or higher), a GPA at ESF of 3.0 or higher, and permission of instructor. Prerequisite: Previous completion of the course being assisted (with a grade of B or higher), a GPA at ESF of 3.0 or higher, and permission of instructor.

EST 493 Envrn Comm Workshop (3)

Three hours of cooperative learning activities, lecture and discussion per week. A workshop format on a specified environmental program or issue introduces the theories and skills of alternative dispute resolution approaches, public participation structures and dynamics, public policy decision making and implementation, risk communication, leadership styles, and small group dynamics. Spring. Prerequisite: Senior status or permission of instructor.

EST 494 Sr. Seminar in Envrn Studies (1)

Two-hour seminar every two weeks. For all seniors in Environmental Studies. Students will prepare portfolios and give capstone presentations on their senior synthesis project and develop career goals and plans. Spring. Prerequisites: Limited to graduating seniors in the Department of Environmental Studies.

EST 495 Sel Readng/Envrn Studies (1-3)

An in-depth and independent exploration of selected readings from the environmentally related literature. Emphasis is placed on gaining insights and understanding from the readings, rather than producing an extensive bibliography. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Approval of study plan by instructor.

EST 496 Spec Topics/Envrn Studies (1-3)

Special topics of current interest to undergraduate students in environmental studies and related fields. A detailed course subject description will be presented as the topic area is identified and developed. Fall, Spring and Summer. Prerequisite: Permission of instructor.

EST 498 Intro Research Problems (1-3)

Guided individual study of an environmental topic. Emphasis is on the study procedure and the methods employed. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Approval of study plan by instructor.

EST 499 Envrn Studies Internship (1-12)

Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisites: Environmental Studies senior status and written approval of an internship contract by major professor, curriculum director and field supervisor.

EST 533 Inquiry-Based Science Educatn (3)

An online asynchronous course that engages future science teachers in the methods, learning theories, practices, and instructional approaches relevant to science education. Students learn strategies, master techniques, and gain practice-based experience in fostering inquiry-based, learner-centered classrooms. They also design equitable and authentic science learning experiences for diverse student populations. Students design lessons reflecting educational standards, while using creative approaches to enhance the learning environment. They conduct research, describe, critique, and make recommendations for improving an existing science program. Spring. Credit will not be granted for both EST 333 and EST 533.

EST 550 Envrn Impact Analysis (3)

Three hours of lecture per week. The law, administration and natural/social science basis of the environmental impact assessment process in the federal government and New York state. Fall. Prerequisite: Graduate matriculation or permission of instructor.

EST 555 Public Relations Mgt/Env Profs (3)

Explores the public relations profession from a management perspective. Includes foundations of ethics, law, and theory. Focuses on public relations functions relative to culture and society. Examines professional communication processes and practices. Provides practice in public relations skills of preparing audience-centered materials and managing media relations. Offered online. Fall or Spring. Prerequisite: Graduate students status or permission of instructor.

EST 570 Intro/Pers Env Interp Methods (3)

Two hours of lecture and 2 hours of recitation per week. One required Saturday field trip. Personal interpretation teaches a variety of face-to-face techniques used to connect the public with environmental science by providing an introduction to history of interpretation, popular interpretive and environmental education activities and curriculum, evaluation of programs, and lesson plans. Explores and illustrates the research and philosophy of environmental interpretation. Discuss interpretive research, plan and lead lectures, and mentor/ evaluate undergraduates. Fall. Prerequisite(s): Graduate standing, or permission of instructor Note: Credit will not be granted for both EST 370 and EST 570.

EST 573 Electrn Tech/Interp&Envrn Educ (3)

Three hours of lecture per week. Explores research and practice in the use of electronic technologies in interpretive fields and environmental science fields. Demonstrates techniques used to engage the public with cultural and natural resources. Even years. Spring. Prerequisite(s): EST 370 or EST 570; junior, senior, or graduate standing.

EST 600 Foundations/Envrnmntl Studies (3)

Three hours of lecture/discussion per week. Examines frameworks for understanding and solving environmental problems. Familiarizes students with the epistemological foundations of environment-society relations. Considers multiple methodological and analytical strategies. Uses a case study method to exemplify key principles. Fall. Prerequisites: Undergraduate courses in general ecology, environmental science and policy or communication theory.

EST 603 Research Methods and Design (3)

Three hours of lecture/discussion per week. Comprehensive survey of research methods and design for Environmental Studies. Topics covered include the scientific method; research design;

quantitative, qualitative, and mixed research methods; sampling; data collection techniques; data analysis and interpretation; research ethics; and research proposal development. Fall.

EST 604 Survey Research Methods (3)

Three hours of lecture and discussion per week. Provides a critical overview of survey methods used to study human dimension of environmental problems. Explores fundamental theories, techniques, and applications of environmentally related social survey research processes. Design of original survey research and critical assessment of existing research. Spring. Prerequisite: Undergraduate basic statistics course.

EST 605 Qualitative Methods (3)

Three hours of lecture and discussion per week. Survey of the generally recognized paradigms and methods that qualitative researchers use to better understand, evaluate, and perhaps influence complex social phenomenon. Research proposal, pilot study, final report and oral presentation required. Spring.

EST 606 Envrn Risk Perceptn/Comm&Pol (3)

Online. Scientific and technological advancements entail both benefits and risks. How people perceive those benefits and risks will influence their acceptance or rejection of specific advances. In this research seminar you will learn about the factors that influence people's perception of risk, science and environmental change, and learn how communication shapes the possibilities for dialog and decision making. In this course you will be part of a research team, defining and carrying out a research project. Spring.

EST 608 Env Adv Camp & Conflict Res (3)

Online. Addresses complex dynamics, strategies, and tactics of (1) organized campaigns by grassroots to international organizations to advocate for particular environmental policy, and (2) processes that seek to resolve, manage, or prevent environmental conflicts when appropriate. The course includes synchronous and asynchronous discussions, readings, simulation activities, case study assessments, and semester-long research projects. Fall.

EST 609 Collaborative Governance Proc (3)

Intensive study in early January. Introduces the evolution of innovative multi-stakeholder processes that characterize collaborative governance (CG). Distinguishes CG from traditional public involvement and dispute resolution approaches, and explores its challenges and opportunities. Provides knowledge and introductory tools to design and be more productive participants in collaborative processes. Spring.

EST 612 Environmntl Policy &Governance (3)

Online. Three hours of lecture and related activities. Examination of the dynamic relationships present in the creation and implementation of environmental policies. Considers the roles of the state, the private sector, and nongovernmental organizations. Explores background and implications of recent trends in environmental governance. Spring

EST 613 Urbanization & the Environment (3)

This course provides a foundation for researching and writing about the social, political, economic, and material aspects of urban infrastructures and networks, resource development, urban environmental governance and decision-making as well as the practices of urban planners, engineers, and scientists in shaping urban space and processes. Spring.

EST 615 Environmental Justice (3)

Online. This course provides legal, policy and management tools to understand and advance environmental justice. The approach is interdisciplinary and includes analytical tools used in geography, environmental and public health, policy and law, and critical race theory. The course will expose students to the unique environmental vulnerabilities that marginalized communities are at heightened exposure to, including toxics siting, public health disparities and food access, while featuring pathways towards building sustainable and just societies. Fall.

EST 616 Global Persp on Env Justice (3)

Online. This course examines environmental and social justice conflicts from a global/international perspective. We discuss distributional justice issues of hazardous waste sites around the world and related procedural injustices in siting, operation, and human rights concerns. Through case studies and research, students analyze crucial processes and relations generating environmental inequalities at different scales and investigate how economies’ extractive activities generate conflicts and resistance across the world. Learning activities include participating on a course discussion board, conducting interviews, engaging in media analyses, peer review, mini group projects, journal reflections, and a final presentation. Spring.

EST 617 Measuring Envrnmntl Inequality (3)

Online. This graduate-level, seminar-style course focuses on how environmental inequalities are operationalized and measured in research and public policy contexts. The methods of measuring environmental inequality are based on what is necessary to move toward a world with socially and environmentally equitable outcomes: engagement with and cultivation of community capacity to understand and respond to environmental concerns; collaboration based on morally and empirically sound principles; and making a visible and positive difference for communities. Utilizing synchronous and asynchronous methods, this course reviews contributions by community-based and thought leaders; frameworks for structuring and maintaining community ties; and ethical considerations for working with indigenous and other historically colonized communities. It offers examples of operationalization with a focus on public health research. Spring.

EST 624 Nature,Recreation and Society (3)

Three hours of lecture/discussion per week. Introduces students to the theoretical underpinnings of tourism studies, and how "naturalness" contributes to the generation of environmental meaning. The course will examine linkages between society, recreation, tourism, and nature, and will attend to such concepts as sense of place, experience, power, and perception as they relate to nature and recreation. These concepts provide useful entry points into more critical investigations of tourism and recreation practices and motivations, and serve as points of departure for conversations about eco-imperialism, green-washing, and the marginalization and dispossession of local populations. Discussion related to the aforementioned critical investigations will be paired with attention to the experiential side of recreation, tourism, and nature. That is, how the act of pursuing nature and related natural adventure contributes to the development of identity, our knowledge of the reciprocal

EST 627 Environmental &Energy Auditing (3)

Three hours of lecture, demonstration, and discussion per week. Presents environmental and energy auditing concepts and theory guiding local and regional initiatives for greenhouse gas production and energy use reduction. This course utilizes a practicum approach through use of inventory and analysis tools by student teams for project application. Spring. Note: Credit will not be granted for both EST 427 and EST 627.

EST 635 Pub Part&Decision Making (3)

Online. Three hours of lecture/discussion, groupwork, and related learning activities. Provides a student with fundamental theories and techniques for developing and applying citizen participation strategies as they relate to environmental decision-making. Spring

EST 640 Envrn Thought and Ethics (3)

Online. 3 hours of lecture and discussion. Concepts and tools of environmental philosophy and ethics, with a focus on application to current issues in environmental problem-solving. Special attention to the role of language in questions of environmental ethics and decision making. Fall.

EST 645 Mass Media&Envrn Affairs (3)

Three hours of discussion per week. Introduces the mass media's role in environmental affairs. Relationships between media organizations, technology, content, and audiences frame examination of how nature and environmental issues and problems are engaged by the media and with what consequences. News and current affairs, advertising and entertainment genres are considered. Fall.

EST 650 Envrn Perception&Human Behavr (3)

Three hours of lecture and discussion per week. Application of environmental perception and human behavior paradigms and theories in understanding the causes and potential solution strategies to environmental issues. Interdisciplinary approach utilizes concepts, theories and research from disciplines including environmental psychology, sociology, anthropology, and risk perception to understand the myriad influences on human behavior as it relates to environmental impacts. Spring.

EST 652 Managing Sustainability (3)

Three hours of lecture, discussion, and/or field trips per week. Dynamics and interdependence of economic, social, and environmental systems. Sustainable management frameworks, tools, and metrics. Local, national, and international implications. Relevance of technology, ethics, law, and policy. Interdisciplinary emphasis. At least 1X Fall or Spring.

EST 660 Land Use Law (3)

Three hours of lecture and discussion per week. This course provides an understanding of U.S., state and local laws affecting land use in New York, in the context of current environmental policy debates. Students learn to recognize and analyze legal issues involving land use in varying contexts. Spring.

EST 670 H2O in Middle East:Issues&Opps (3)

Three hours of lecture/discussion per week. Seminar on water issues and initiatives in Israel, Jordan, and the Palestinian Territories. Participants explore a variety of perspectives on the biophysical, historical, and sociocultural roots of transboundary and other water-related issues in the region, as well as an array of top-down (technological, managerial) and bottom-up (community-based, participatory) approaches to developing solutions. Designed for graduate students in environmental and natural resource policy, water resources, international relations, conflict resolution, and related fields. Each week, graduate students write short critical commentaries on required readings; the essays serve as starting point for class discussion. Over the course of the semester, students develop and submit a research paper on a related topic. Spring. Note: Credit will not be granted for both EST 670 and 470.

EST 671 Non-Personal Envrn Interp Meth (3)

Three hours of lecture per week. Applications of environmental interpretation theory and methods applied to nature center programming, science education, and various fields of resource management emphasizing procedures for creating non-personal interpretive media (e.g., brochures, wayside exhibits, etc.). Focus on service-learning through involvement with an outside interpretive agency. Submit an interpretive article for publication, read and hold online discussions of research on hon-personal interpretation, and evaluate local interpretive media. Spring. Prerequisite(s): EST 570 or permission of instructor. Note: Credit will not be granted for both EST 471 and EST 671.

EST 674 Adv Interp&Envrnmntl Education (3)

Three hours of lecture, discussion, and practical exercises per week. This course provides in-depth experience in planning and implementing environmental education and interpretation (EE&I) programs. Students may receive their Certified Interpretive Guide credential from the National Association for Interpretation. Learners will serve as facilitative leaders for team engagement with EE&I community partners, such as parks, nature centers, zoos, non-profit organizations and historical sites. With these partners, students will design and offer EE&I programs and lessons. Students will prepare case studies to present advanced readings from the research-based literature regarding critical challenges in EE&I, including climate change education, and diversity, equity, and inclusivity in EE&I. Spring. Prerequisite(s): EST 570 and graduate standing; or permission of instructor. Note: Credit will not be granted for both EST 474 and 674.

EST 690 Internat'l Env Policy Consult (3-4)

Group research practicum. An innovative, collaborative, applied course and practicum in environmental policy consultation at the global level. May be linked via digital/ online technology with students in a parallel course at another, international institution. Students engage in a semester-long, consultancy project with an international organization engaged in environmental policymaking. Client organization and topic may vary annually. Students learn group consulting skills including issue definition and stakeholder identification; proposal preparation, team building and leadership skills; data collection, analysis and interpretation; report writing and presentation skills. Students fulfill the client's Terms of Reference, producing and delivering contributions towards final, agreed-upon deliverables. Fall or Spring. Instructor's permission required.

EST 691 Env Studies Field Trip (1-3)

A five- to 10-day trip to visit with: 1) agencies, organizations, or institutions engaged in environmental research, education, communication interpretation, management, or administration; or 2) regions or areas of unusual environmental interest. A final report is required. Additional fees required to cover cost of travel and lodging during field portion of course. Tuition charges will apply to sections offered during Maymester or other summer sessions. Instructor permission required. Fall, Spring, or Summer.

EST 695 Environmental Journalism (3)

Three hours of lecture per week. This course covers a range of topics related to journalism: interviewing, writing the lead, style, writing and organizing the story, layout, editing and revising, writing features and follow-up stories, covering speeches, etc. In addition, students explore how the media covers scientific and environmental issues. Students work on writing skills--from basic editing techniques to more sophisticated areas of style. Spring.

EST 696 Spec Topics/Envrn Studies (1-3)

One to three hours of lecture and discussion per week. Experimental and developmental courses in new areas of interest to environmental studies faculty and graduate students not covered in regularly scheduled courses. Fall and Spring.

EST 702 Env&Nat Res Prog Eval (3)

Three hours of lecture and discussion per week. The systematic analysis of public environmental programs with an emphasis on the evaluation of resultant environmental outcomes. Topics include evaluation contexts, objective setting, environmental monitoring, and analysis of agency organization and procedures. Spring.

EST 705 Environmental Policy Analysis (3)

Three hours of lecture/discussion per week. This course covers current and classic literature in environmental policy analysis, as well as a variety of approaches to policy analysis that are relevant for working through complex environmental issues. While tools and methods for policy analysis will be treated, the overall intention of the course is to provide students with the scholarly background to think analytically, critically, and creatively across a variety of environmental policy contexts. Fall. Prerequisite(s): A graduate-level course in environmental policy.

EST 708 Environment and Society (3)

Three hours of seminar/discussion per week This course is an advanced graduate seminar that covers social theory related to the environment. Students will be exposed to foundational literature in environmental sociology in the first part of the course, after which other social science literatures will be explored that analyze the relationship between environment and society, such as Political Ecology, Environment and Citizenship, Environmental Governance, Geographies of Energy, Sustainability Indicators and Standards, Ecological Modernization, and Environmental Justice, among others. Environmental issues and scholarship from both industrialized and developing country contexts, and that represent a variety of social science disciplinary perspectives, will be discussed. Spring. Prerequisite(s): EST 600 or consent of instructor.

EST 759 Sustainability-Driven Enterprs (3)

Three hours of project meetings and/or workshops per week. CAS in Sustainable Enterprise capstone. Sustainable approaches to complex organizational challenges, opportunities: organizational, industry, stakeholder analysis, sustainability objectives, strategies, and metrics. Multidisciplinary team consulting project. At least 1X Fall or Spring. Prerequisites: EST 652/ECS 650/BUA 650 and ECS 651/BUA 651

EST 770 Regen Approaches Sust Futures (3)

Three hours of seminar per week. A transdisciplinary approach to understand the interface of human and ecological systems, includes concepts and methods of ecologists, economists, and social scientists. Focus is on historical, conceptual and epistemological foundations. Draws on contemporary economic and policy thought, evolutionary biology, ecology, systems theory, social psychology, and environmental ethics. Spring.

EST 796 Adv Topics/Envrn Studies (1-3)

One to three hours of classroom instruction per week. Lectures and discussions, seminars, conferences and group research on advanced topics of special or current interest to environmental studies faculty and graduate students. Fall and Spring.

EST 797 Envrn Studies Seminar (1-3)

One to three hours of classroom instruction/discussion per week. Discussion of current topics and research related to environmental studies. Fall and Spring.

EST 798 Problems/Envrn Studies (1-3)

One to three hours of supervised individual activity per week. Individualized, special study of environmental studies subjects and issues. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Comprehensive oral or written report required for some problems. Fall, Spring and Summer.

EST 898 Professional Experience (1-12)

Variable number of hours of professional experience per week. Professional experience which applies, enriches and/or complements formal coursework. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Graded on an "S/U" basis. Fall, Spring, and Summer.

EST 899 Masters Thesis Research (1-12)

One to 12 hours of supervised individual activity per week. Research and independent study for the master's degree and thesis. Fall, Spring, and Summer.

EST 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral degree and dissertation. Fall, Spring and Summer.

EWP - ENVIRONMENTAL WRITING PROGRAM

EWP 190 Writing And The Envrnment (3)

Three hours of lecture, discussion, and workshops per week. Introduction to the conventions and skills of academic writing and oral communication, including critical thinking and reading, summary, research, analysis, informed argument, information literacy, oral response to texts and topics, and synthesis. The course includes frequent informal writing and oral communications assignments and formal writing projects requiring revision.

EWP 220 Public Presentation Skills (3)

Development of skills and fluency needed by environmental professionals in preparing,delivering and evaluating effectiveness of expository and persuasive oral presentations. Communication theory, rhetorical analysis, and visualizations of complex and technical data, self and peer evaluation, listening skills. Fall/Spring

EWP 222 Presentation Skills/Managers (2)

Three hours of lecture/discussion per week for 10 weeks. Development of skills needed by managers in preparing, delivering, and evaluating oral presentations for the professional workplace. Includes instruction on preparation and implementation of effective visual aids. Strategies for facilitating small group discussions and developing listening skills are emphasized. Fall.

EWP 290 Research Writing & Humanities (3)

Three hours of discussion and group work per week. Intended for students who have had an introductory writing course. Students will examine the views of nature and the environment as they are expressed by selected writers, poets, and essayists. Frequent informal and formal writing assignments, research and documentation, and an oral presentation are required. With an emphasis on critical writing, critical thinking, and critical reading, students will learn the literacy expectations of their disciplines. Spring. Prerequisite(s): EWP 190 or equivalent.

EWP 296 Spec Topics/Wrt,Lit&Pub Presnt (1-3)

Experimental, interdisciplinary or special course work at the freshman or sophomore levels. Subject matter and course format vary from semester to semester or offering on the basis of needs and objectives of the course. Fall or Spring.

EWP 300 Survey/Environmental Writing (3)

Three hours of classroom instruction per week. Students will explore forms of environmental writing including but not limited to journalism, poetry, memoir, field notes, historical research, natural histories and polemics. Students will analyze these writings rhetorically and create a range of texts including creative pieces, factually-based reporting, nature writing, and writing about science. Fall/Spring. Prerequisites: EWP 190 and EWP 290.

EWP 311 Urban Environmental Literature (3)

Three hours of discussion and lecture per week. A writing-intensive literature course designed to develop reading, writing, and critical thinking skills. We will be reading contemporary urban-based nature literature, both prose and poetry, and analyzing those works through the lens of eco-criticism. Students will develop historical awareness and critical thinking skills as they study the development of literary, political, and cultural voices within urban literature. Spring.

EWP 350 Eco-Cinema:Perspct&Pract (3)

Three hours of lecture/discussion and two-hour film screening each week. Environmental films are interpreted from cultural, historical, and political perspectives. The artistic process in filmmaking is emphasized. Students produce a short film or slide show with an environmental theme. Fall. Prerequisites: EWP 190 and EWP 290 or Equivalent

EWP 390 Literature of Nature (3)

Three hours of discussion and lecture per week. Examination of views of nature and the environment as seen through works of 19th and 20th century writers, poets, and essayists. Readings, discussions, and written assignments explore aesthetics, socio-political climate, and prevailing attitudes toward the environment that formed the backdrop for readings. Fall and Spring.

EWP 401 Capstone Experience (3)

Experiential learning for the Environmental Writing & Rhetoric (EWR) minor through a writing project based on a) a community-based internship b) tutoring or completing special project in the Writing Resource Center, or c) an independent creative writing project. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall and Spring. Prerequisites: Student must be registered for the EWR minor.

EWP 407 Writing/Env & Sci Professionls (3)

Three hours of lecture, discussion, and workshops per week. Focuses on principles and practice of writing skills required of environmental and science professionals. Emphasizes proficiency in determining purpose of a document; analyzing audience; selecting, developing and organizing information in an appropriate design; and writing clearly, precisely, and effectively. Fall and Spring. Prerequisite: EWP 290 and junior or senior status

EWP 420 Advanced Public Presntatn Skls (3)

Three hours of lecture/discussion/student presentations per week. Emphasizes both theory and practice in effectively delivering, interpreting, and responding to public presentations. Social, cultural, and political dimensions of public address are examined. Issues of diversity and power are discussed. Small group communication is viewed as a site for creative problem-solving. Audience analysis, adaptation, strategic arrangement, and concept development are explored. Fall and Spring. Prerequisite(s): EWP 220 or permission of instructor.

EWP 444 Prof Writing/Paper&Bioproc Eng (2)

Two hours of lecture, discussion, and workshops per week for 15 Weeks. Emphasizes writing practices required of paper and bioprocess engineers, including proposals and technical reports. Develop proficiency in determining the purpose of a document; analyzing audience; selecting, developing and organizing information in an appropriate design; and writing clearly, precisely and effectively. Spring. Prerequisite: EWP 290

EWP 450 Digital Storytelling (3)

Three hours per week. Lecture, practice, application of technical skills for shooting photographs and video, recording audio, digital communication skills and storytelling techniques. Design and production of digital media, including videos and podcasts, script writing and storyboarding for digital products that tell science and environmental stories. Fall and Spring.

EWP 490 Contemporary Literature/Nature (3)

Three hours of discussion and lecture per week. This writing-intensive literature course takes an ecocritical approach to nature literature, both poetry and prose, written by contemporary authors. Coverage includes ecofeminism, science literature, and native American literature. Spring.

EWP 494 Creative Non-Fiction/Sciences (3)

Three hours of classroom instruction per week. Students in the course will read and write creative nonfiction, a genre that reflects a harmonious movement among subjective experience, factual research, and public interest in science and the environment. The course focuses on the writing processes and techniques used to write ideas, theories, and experiences to a lay audience. Spring. Prerequisite: EWP 190. Note: Credit will not be granted for both EWP 494 and EWP 694.

EWP 495 Environmental Journalism (3)

Three hours of lecture per week. This course covers a range of topics related to journalism: interviewing, writing the lead, style, writing and organizing the story, layout, editing and revising, writing features and follow-up stories, covering speeches, etc. In addition, students explore how the media covers scientific and environmental issues. Students work on writing skills--from basic editing techniques to more sophisticated areas of style. Fall.

EWP 496 Special Topics (1-3)

Special topics of current interest to undergraduate students in writing, literature, and public presentation skills. A detailed course description will be presented as the topics area is identified and developed. Fall and Spring.

EWP 498 Independent Study (1-3)

Guided individual study of a topic in composition, literature and public presentation skills. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall and Spring.

EWP 597 Graduate Scholarly Writing (3)

Students learn advanced writing principles to produce a proposal, thesis, dissertation, or manuscript. Topics include the writing process, use of sources, and graphics. Scholarly writing style and mechanics are discussed with emphasis on organization, clarity, and conciseness. Spring.

EWP 620 Adv Public Pres Skls/Envrn Prf (3)

Three hours of lecture per week. Development of skills and fluency needed by environmental professionals in preparing, delivering and evaluating effectiveness of expository and persuasive oral presentations. Communication theory, rhetorical analysis, and visualizations of complex and technical data, self and peer evaluation, listening skills. Fall/Spring.

EWP 694 Creative Non-Fiction/Sciences (3)

Three hours of classroom instruction per week. Students in the course will read and write creative nonfiction, a genre that reflects a harmonious movement among subjective experience, factual research, and public interest in science and the environment. The course focuses on the writing processes and techniques used to write ideas, theories, and experiences to a lay audience. Spring. Note: Credit will not be granted for both EWP 494 and EWP 694.

FCH - CHEMISTRY

FCH 110 Survey of Chemical Principles (3)

Three hours of lecture per week. An introduction to chemistry organized around physical and chemical properties of matter. Emphasizes the atomic structure of elements, bonds in chemical compounds, atomic ratios in molecules as the basis for the stoichiometry of reactions, ionic and organic compounds, chemical reactivity, kinetics and thermodynamics. Fall.

FCH 111 Survey/Chemical Principles Lab (1)

FCH 111. Survey of Chemical Principles Laboratory. (1) Three hours of laboratory per week. Basic and applied laboratory techniques will be emphasized through experiments dealing with: the density of solids and liquids, stoichiometry, calorimetry, chemical reactivity, gas laws, kinetics, acid/base chemistry, and organic chemistry. Fall. Corequisite: FCH110

FCH 132 Orientation Seminar:FCH (1)

One hour of lecture and discussion per week. Introduction to campus resources available to ensure academic success. Introduction to chemistry as a field of inquiry. Introduction to laboratory safety. Fall.

FCH 150 General Chemistry I (3)

Three hours of lecture per week. This first semester general chemistry course is organized around the physical and chemical properties of matter. It introduces the atomic structure of elements, the kinds of bonds in chemical compounds, how atomic ratios in molecules form the basis for the stoichiometry of reactions, begins a treatment of thermodynamics and discusses the principles of chemical reactivity. Fall. Prerequisite(s): APM 104 (may be taken concurrently) or equivalent (ex. Precalculus).

FCH 151 General Chemistry I Lab (1)

Three hours of laboratory per week. Basic laboratory techniques will be emphasized through experiments dealing with the density of solids and liquids, atomic ratios and mass combining ratios, atomic structure and the periodic table, calorimetry, chemical reactivity, geometric structure of molecules, formation of coordination compounds, and paper chromatography. Fall. Corequisite: FCH 150.

FCH 152 General Chemistry II (3)

Three hours of lecture. The second course in general chemistry continues the development of chemical reactivity by focusing on chemical kinetics and chemical equilibrium. Aqueous phase processes are emphasized and are applied to precipitation and solubility equilibria, acid/base dissociation phenomena, and fundamental electrochemical reactions. Spring. Prerequisite: FCH 150 and APM 104 (or equivalent (minimum Precalculus)).

FCH 153 General Chemistry II Lab (1)

Three hours of laboratory per week. Concepts of chemical kinetics and equilibrium processes will be reinforced through experiments in titrimetric analyses, determinations of Ka and Ksp values, investigation of rate constants and reaction orders, buffer preparations, oxidation/reduction reactions and qualitative analyses. Spring. Prerequisites: FCH 150, FCH 151. Co-requisite: FCH 152.

FCH 210 Elements Of Organic Chem (4)

Three hours of lecture and four hours of laboratory per week including pre-laboratory instruction. Nomenclature, preparation, and important reactions of functional groups and classes of organic compounds including examples relevant to biology. Isomerism and stereochemistry topics of biomolecules. Quantitative study of weak acids and weak bases. Laboratory techniques include compound manipulations, extractions, distillations, chromatography, synthesis, and calculation of yields. Spring. Prerequisite: One year of General Chemistry.

FCH 221 Organic Chemistry 1 (3)

Three hours of lecture per week. The structure, properties and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 223, this course provides a full survey of common classes of carbon compounds. Fall. Prerequisite: FCH 150, FCH 151, FCH 152, FCH 153.

FCH 222 Organic Chemistry Lab 1 (1)

Four hours of laboratory including pre-laboratory instruction per week. Laboratory safety. Melting and boiling points, distillation, recrystallization, thin-layer and column chromatography, isolation of natural products, organic synthesis and spectroscopy. Fall. Co-requisite: FCH 221.

FCH 223 Organic Chemistry II (3)

Three hours of lecture per week. The structure, properties and fundamental reactivity of organic compounds will be studied with emphasis on the reaction mechanisms and stereochemistry. In combination with FCH 221, this course provides a full survey of common classes of carbon compounds. Spring. Prerequisite: FCH 221.

FCH 224 Organic Chemistry Lab II (1)

Four hours of laboratory including pre-laboratory instruction per week. Continuation of FCH 222. Simple physical and instrumental techniques applied to organic chemistry. Gas chromatography, polarimetry, spectroscopy. Introduction to classical literature synthesis. Topics from natural products chemistry including chemical ecology, biomimetic synthesis, and the synthesis of an anticancer drug from birch bark. Spring. Prerequisite: FCH 222. Co-requisite: FCH 223.

FCH 232 Career Skills for Chemists (1)

One hour of lecture per week. The objective of this course is to introduce a variety of important skills required for student success and, ultimately, career development as a practicing chemist. These skills include: Information literacy (library literature searching), communication (writing, presenting), ethics in science and academic integrity, finding employment and internships (resume and letter writing, interviewing skills). In addition, student will learn more about the B.S. Chemistry curriculum to set the stage for their choice of an "option" (Biochem, Polymer Chem, Environmental Chem. or ACS certified option) within the Chemistry Major. Fall

FCH 290 Chem Teach Asst Exp/Undergrads (1-3)

Undergraduate students will gain experience with the management, evaluation and assessment of undergraduate courses in chemistry. Assistants will assist the instructor with course activities and mentor students on how to succeed in the respective course. Teaching Assistant responsibilities vary by section and instructor. Fall and Spring. Prerequisite(s): Consent of Instructor.

FCH 296 Special Topics in Chemistry (1-3)

Experimental, interdisciplinary or special course work at the freshman or sophomore levels. Subject matter and course format vary from semester to semester or offering on the basis of needs and objectives of the course. Fall and Spring.

FCH 325 Organic Chemistry III (4)

Two hours of lecture, one six-hour laboratory per week. Classical and recent literature synthesis or organic compounds, employing advanced techniques. Fall. Prerequisite: Two semesters of elementary organic chemistry.

FCH 360 Physical Chemistry I (3)

Three hours of lecture per week. An introduction to the properties of gases and liquids, the laws of thermodynamics, phases, phase transitions, solutions and colligative properties, electrochemistry, and reaction equilibria. Fall. Prerequisite(s): MAT 295 and 296, and PHY 211 and 212, or their equivalents.

FCH 361 Physical Chemistry II (3)

Three hours of lecture per week. Includes discussion on principles of quantum mechanics, chemical kinetics, and basic spectroscopy. Spring. Prerequisite: FCH 360.

FCH 380 Analytical Chemistry I (2)

Two hours of lecture per week. This course will cover how to use basic statistics to report analytical data, evaluate data for quality, and identify common types of error; the underlying theoretical principles and important practical applications of chemical equilibrium in acid/base, complexometric, redox, and precipitation titrations; and solution behavior using electrochemical methods including potentiometry and ion-selective electrodes. Fall.

FCH 381 Analytical Chemistry II (3)

Two hours of lecture and one three-hour laboratory per week. Theory and practice of technology applications to UV/VIS, AAS, AES, XES, ASV, GLC and HPLC. Spring. Prerequisites: Two years of undergraduate chemistry and FCH 380, FCH 361 taken concurrently or permission of instructor.

FCH 382 Analytical Chemistry I Lab (1)

One three hour laboratory per week. Laboratory experiments will focus on: analyzing and interpreting the results of a chemical analysis and effectively communicate these results in written reports and other formats; and accurately and precisely using volumetric methods of chemical analyses to determine the concentrations of analytes in a solution. An emphasis will be placed on making serial dilutions, creating buffers, and performing titrations. Fall. Pre-requisite: General Chemistry I & II. Co-requisite: FCH 380.

FCH 390 Drugs From The Wild (3)

Three hours of lecture and discussion per week. This course is designed to give students a comprehensive understanding of the variety of medicinal agents available from natural sources. Economic and societal aspects will be explored as well as scientific ones. In addition to curative agents, discussions will include toxic substances, folk medicinal (including herbal) preparations, and the so-called "recreational drugs." Spring, odd years. Prerequisites: Introductory courses in chemistry and biology.

FCH 399 Intro/Atmospheric Sciences (3)

Three hours of lecture and discussions per week. Atmospheric composition, mass and structure; solar radiation and the global energy budget; atmospheric moisture budget, cloud and precipitation; photolysis, gas-phase oxidation, aqueous chemistry, and gas-to-particle conversion; physical and chemical mechanisms driving environment phenomena such as acid rain, the greenhouse effect, the ozone hole, remote and urban air pollution, and haze. Prerequisite(s):

General physics I, 1 year each of general chemistry and calculus. Co-requisite(s): General physics II.

FCH 410 Inorganic Chemistry (3)

Three hours of lecture and/or studio per week. This course serves as an introduction to the bonding, structure and reactivity of transition metals and main group elements. Topics will include but are not limited to covalent molecular structures, coordination chemistry, organometallic chemistry, catalysis, bioinorganic chemistry and solid state materials. The studio component focuses on the inorganic chemistry of artistic materials and traditional inorganic chemistry experiments. Fall. Prerequisite: One year of general chemistry, one year of organic chemistry.

FCH 430 Biochemistry I (3)

Three hours of lecture per week. General biochemistry with emphasis on the chemistry of amino acids, proteins, and nucleic acids. The first half of the course will cover the chemistry of amino acids, proteins, and protein structure. The second half of the course will be an introduction to nucleic acid structure and function. Credit will not be granted for both FCH 430 and FCH 530. Fall. Prerequisites: FCH150, FCH151, FCH221, FCH223 or equivalents.

FCH 431 Biochemistry Laboratory (3)

Two hours lecture and 6 hours of laboratory per week on the basic techniques used in biochemical research with an emphasis on proteins and enzymes. Techniques include spectrometry, chromatography, electrophoresis, amino acid analysis, coupled assays, and the isolation and characterization of enzymes. Credit cannot be given for both FCH 431 and FCH 531. Fall. Prerequisites: FCH150, FCH152,FCH221, and FCH223 or equivalents.

FCH 432 Biochemistry II (3)

Three hours of lecture per week. Topics discussed are: Biochemistry of metabolism, sugars, polysaccharides, glycolysis, pentose phosphate pathway, glycogen formation, gluconeogenesis, glyoxylate shunt, TCA cycle, electron transport and oxidative phosphorylation, fats, fatty acid metabolism, amino acid metabolism, purine and pyrimidine metabolism, and photosynthesis. Credit will not be given for both FCH 432 and FCH 532. Spring. Prerequisites: FCH150, FCH151, FCH221, FCH223, and FCH430 or equivalents.

FCH 495 Intro/Professional Chem (1)

The professional chemist's relationship with industry, government and universities. Employment opportunities for the chemist, professional organizations and unions will be discussed. The selection of a senior research topic and a literature survey will be required. Fall. Prerequisite: Senior status.

FCH 496 Special Problems In Chem (1-3)

An opportunity for a special problem, technique development, independent or unstructured study in an area related to the chemical profession. The work may be technical, professional, or interdisciplinary. Advisors outside this department may be solicited. A brief proposal must be presented for approval with specific arrangements outlined including faculty advisor and objectives of the study. Students shall report their activities to their instructor on a weekly basis for the duration of the course. A written report will be expected. Fall and Spring. Prerequisite: Upper-division status.

FCH 497 Undergraduate Seminar (1)

One hour per week. Literature surveys and seminars on topics of current research interest and recent advances in chemistry. Spring.

FCH 498 Introduction To Research (1-5)

3-4 hours per credit per week of laboratory and library research and report writing. Solution of a selected research problem using specialized techniques. A written report on data, procedures, results and conclusions. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall and Spring. Prerequisites: None. This course is the Senior Research requirement for all FCH undergraduates, of which five (5) credits are required in total.

FCH 502 Research Ethics (1)

One 55 minute class meeting per week. Discussions on the ethical responsibilities of being a scientific researcher. These in-depth discussions will focus on the following topics: conflicts of interest, safe laboratory practices, policies regarding human subjects and animal work, mentor/mentee responsibilities, peer review, research misconduct, responsible authorship and publication, and data sharing and ownership. Spring.

FCH 510 Environmental Chemistry I (3)

Three hours of lecture per week. Introduction to the processes that control chemical behavior in aquatic environments, including precipitation, dissolution, gas exchange, acid-base, oxidation-reduction, complexation and adsorption reactions. Emphasis will be on explanation and prediction of chemical behavior. Examples will be from the areas of fresh and marine waters, groundwater, wastewater, and geo-chemistry. Spring. Prerequisites: An introductory course in physical chemistry is required.

FCH 511 Atmospheric Chemistry (3)

Three hours of lecture/discussion per week. Graduate-level course in atmospheric chemistry. Atmospheric structure and composition. Catalytic cycles of ozone destruction and formation. Kinetic analysis of atmospheric reactions in gas and aqueous phase. Aerosols. Global climate change. Oxidation of sulfur oxides and nitrogen oxides. Fall. Prerequisite: One year of undergraduate physical chemistry or permission of instructor.

FCH 515 Meth/Envrn Chem Analysis (3)

One hour of lecture and six hours of laboratory per week. An introduction to sampling, analytical and quality control procedures necessary to obtain reliable water quality data. All analyses will be performed on a single aquatic system with the purpose of developing a final report characterizing the water quality of that system. Fall. Prerequisite: A course in quantitative chemical analysis.

FCH 520 Marine Biogeochemistry (3)

Three hours of lecture per week. Advanced level course for seniors and graduate students. Biogeochemistry of major ocean systems including coastal and pelagic environments. Chemical, biological, and geological approaches to understanding the functioning of the ocean will be covered. Fall (Even years only). Prerequisite(s): FCH 150, 152; EFB 101, 103; APM 205, 206 or equivalent.

FCH 524 Topics Nat Product Chem (3)

Three hours of lecture and discussion per week. A course intended to introduce the student to various types of secondary metabolites including several of past and current interest because of their pronounced biological activities. Modes of chemical reactivity and means of structure determination and syntheses are covered. Spring.

FCH 525 Oceanography (3)

Three lecture hours per week. Advanced-level course intended for seniors and entry-level graduate students. The four main oceanographic disciplines will be covered including physical, chemical, biological and geological oceanography. This course will highlight the interdisciplinary nature of oceanography and its importance in earth system dynamics such as energy and climate. Spring. Prerequisite(s): FCH 150, 152; EFB 101, 103; PHY211, 212 or equivalent.

FCH 530 Biochemistry I (3)

Three hours of lecture per week. General biochemistry with emphasis on the chemistry of amino acids, proteins, and nucleic acids. The first half of the course will cover the chemistry of amino acids, proteins, and protein structure. The second half of the course will be an introduction to nucleic acid structure and function. This course requires critical review of current topics in Biochemistry not required in FCH 430. Fall. Prerequisite: FCH150, FCH151, FCH221, FCH223 or equivalents.

FCH 531 Biochemistry Laboratory (3)

Two hours lecture and 6 hours of laboratory per week on the basic techniques used in biochemical research with an emphasis on proteins and enzymes. Techniques include spectrometry, chromatography, electrophoresis, amino acid analysis, coupled assays, and the isolation and characterization of enzymes. This course requires critical review of current topics in Biochemistry not required in FCH 431. Fall. Prerequisites: FCH150, FCH152, FCH221, and FCH223 or equivalents. Co-requisite: FCH530 or permission of instructor.

FCH 532 Biochemistry II (3)

Three hours of lecture per week. Topics discussed are: Biochemistry of metabolism, sugars, polysaccharides, glycolysis, pentose phosphate pathway, glycogen formation, gluconeogenesis, glyoxylate shunt, TCA cycle, electron transport and oxidative phosphorylation, fats, fatty acid metabolism, amino acid metabolism, purine and pyrimidine metabolism, and photosynthesis. This course requires critical review of current topics in Biochemistry not required in FCH 432. Spring. Prerequisites: FCH150, FCH151, FCH221, FCH223, and FCH530 or equivalents.

FCH 550 Polymer Sci:Synth&Mech (3)

Three hours of lecture per week. Introduction to the synthesis of polymers and the mechanism of polymerization processes. Fundamental principles of polymer chemistry. Step-growth polymerization and network formation (theory of gelation). Chain-growth homopolymerization and copolymerization by radical-, ionic-, and coordination type catalysts. Synthesis of block and graft copolymers. Structure of polymers and their application. Polymers and the environment, polymer recycling. Fall. Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 551 Polymer Techniques (3)

Two hours of lecture/discussion and four hours of laboratory per week; laboratory reports, final exam. Twelve experiments covering the main topics of polymer synthesis (four weeks), molecular weight determination (four weeks), and characterization (four weeks) are selected from areas such as the following: free-radical solution, bulk and emulsion polymerizations; ionic and condensation polymerizations, copolymerization and reactivity ratio determination; osmometry, viscometry, light scattering, gel permeation chromatography, polarized light microscopy, X-ray diffraction, differential scanning calorimetry, thermogravimetric analysis, dynamic mechanical analysis, stress-strain analysis; nuclear magnetic resonance spectroscopy, Fourier transform infrared spectroscopy, ultraviolet/visible spectroscopy. The lecture component will include discussions of the laboratory activities as well as related topics such as the preparation of monomers, safe handling methods for monomers, polymers, solv

FCH 552 Polymer Sci:Prop&Tech (3)

Three hours of lecture per week. Introduction to physical chemistry, physics, processing and technology of synthetic polymers. Polymer solutions, including molecular weight determinations, chain statistics, and thermodynamics. Polymer solid states, including rubber elasticity, viscoelasticity, the glassy state and the crystalline state. Properties, processing, and technology of films, fibers, elastomers, and composites. Spring. Prerequisites: One year of organic chemistry and one year of physical chemistry.

FCH 560 Chromatog/Separation Tech (3)

Three hours of lecture and discussion per week. A course designed to give the student a thorough understanding of analytical and isolation chemistry by modern chromatographic, distributive and molecular sieving techniques. The chemistry of the systems discussed will be stressed as well as the important physical aspects. Spring of even years. Prerequisites: Two semesters each of organic and general chemistry.

FCH 584 Spectro ID/Organic Compounds (3)

Three hours of lecture and discussion per week. The first-half semester will deal with common classes of organic compounds; the second-half semester will deal with more complex structures and introduce 2-dimensional NMR techniques. The use of complementary information from mass, infrared, nuclear magnetic resonance and ultraviolet spectrometry will be applied to identification of organic natural products. Fall. Prerequisites: One year of Organic Chemistry.

FCH 610 Air Quality (3)

Three hours of lecture and discussion per week. Pollution emissions; atmospheric photochemistry; dynamic/physical mechanisms; dynamic/physical-chemistry interactions; measurement campaigns; major chemical and meteorological databases; numerical modeling tools (box models, meteorological models, photochemical models); model uncertainties and evaluation; model application. Spring. Prerequisite: FCH 511 Atmospheric Chemistry or by instructor's permission

FCH 620 Chemical Kinetics (3)

Three hours of lecture/discussion per week. Graduate course in chemical kinetics. Building rate laws and analyzing experimental data. Transition state and RRKM theories. Kinetics in the aqueous phase and on surfaces. Kinetic modeling of complex reaction systems. Analysis of published papers in chemical kinetics. Spring of alternating years. Prerequisites: 1 year undergraduate physical chemistry.

FCH 630 Plant Biochemistry (3)

Three hours of lecture and discussion per week. Includes the biochemistry of photosynthetic electron transport and phosphorylation, photosynthetic carbon fixation, photorespiration, nitrogen fixation, nitrate reduction, photochrome, and plant hormones. The economic, ecological and environmental aspects of plant biochemistry will also be discussed. Spring. Prerequisites: FCH 530, FCH 532.

FCH 650 Stat Phys&Chem/Macromolecule (3)

Three hours of lecture per week. Topics to be discussed are chain statistics, polymer thermodynamics, scaling theory, colloidal particles, viscoelasticity and the glass transition. Spring, even years. Prerequisites: FCH 360 and FCH 552 or equivalent; consent of instructor.

FCH 796 Special Topics In Chem (1-3)

Lectures, conferences and discussion. Advanced topics in physical chemistry, organic chemistry or biochemistry. Fall and Spring.

FCH 797 Graduate Seminar (1)

Presentation and discussion of a selected topic in chemistry. Topics to be selected by participating faculty each semester. Fall and Spring.

FCH 798 Research In Chemistry (1-12)

Independent research in chemistry. One written report required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer.

FCH 898 Professional Exprnce/Synthesis (1-6)

A supervised, documented professional work experience in the Master of Professional Studies degree program. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, or Summer. Pre- or co-requisite(s): Matriculation in Department of Chemistry MPS degree program. Department chair approval required.

FCH 899 Masters Thesis Research (1-12)

Research and independent study for the master's degree and thesis. Fall, Spring and Summer.

FCH 997 Seminar (1)

Seminars scheduled weekly; an average of 20 to 30 seminars are given annually. Discussion of recent advances in chemistry. Credit is given only once to a student. Fall and Spring.

FCH 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral degree and dissertation. Fall, Spring and Summer.

FOR - FORESTRY (RESOURCES MANAGEMENT)

FOR 110 Environmental Physics (3)

Three hours of lecture per week. Introduction to principles of physics using examples from the natural environment and coupled human-natural systems.

FOR 132 Orientation Seminar: SRM (1)

Thirteen hours of lecture and six hours of field time. An introduction to forest and natural resource management and related career paths. Indoor and outdoor lectures expand student awareness of ESF's educational opportunities, properties, and faculty in FNRM. Fall.

FOR 205 Principles of Accounting (3)

Three hours of lecture per week. Principles and methods used in financial and managerial accounting. Includes interpretation and effective use of financial statements through study of the accounting model, the measurement processes, data classification and terminology. Fall and Spring.

FOR 207 Introduction To Economics (3)

Three hours of lecture per week. Coverage of basic theory in microeconomics and macroeconomics. Application of theory and economic models to problems at the firm and national policy levels. Exploration of topics in money and banking, globalization and economic development. Fall and Spring.

FOR 232 Natural Resources Ecology (3)

Three hours of lecture/discussion per week for the first 12 weeks. Then 1.5 hours of lecture/ discussion per week plus a 4.25-hour field trip for the last four weeks. The course provides an introduction to basic principles of ecology as they relate to terrestrial and freshwater ecosystems, and to natural resources. General topics for study include consideration of the physical environment, primary net production and energy flow through trophic levels, genetics and adaptation, ecosystem structure and function, competition and community dynamics, characteristics of freshwater ecosystems, and biogeochemical cycling and human impacts from local to global levels. Spring. Prerequisites: EFB 101/EFB 102 General Biology I w/lab, or equivalent (organismal biology).

FOR 296 Spec Topics-Res.Mgt/Fsty (1-3)

Experimental, interdisciplinary or special coursework at the freshman or sophomore levels. Subject matter and course format vary from semester to semester. Fall or Spring.

FOR 298 Research Internship in SRM (1-3)

Students will participate in research projects consistent with their educational and professional goals. A faculty member in the Department of Sustainable Resources Management will serve as the student's faculty sponsor. The student in consultation with the faculty sponsor will prepare a study plan outlining the educational goals of the apprenticeship. Students shall report their activities to their instructor on a weekly basis for the duration of the course. The faculty sponsor will generate a performance assessment and record of activities at the end of the apprenticeship. Grading Satisfactory/Unsatisfactory. Fall, Spring, Summer. Prerequisite(s): Permission of Instructor

FOR 304 Adirondack Field Studies (4)

Four-week field course with five hours of lecture and 30 hours of field laboratory per week. Introduction to silvics, forest ecology and natural and cultural history as a basis for understanding forest vegetation and other natural resources. Principles and methods for the measurement of spatial and vegetative attributes of forested landscapes. Course stresses development of field ability in common plant identification, overland navigation and timber, tree, forest and habitat measurements, and synthesis of field data. Summer.

FOR 313 Tree Structure and Function (3)

Three hours of lecture/discussion per week, including regular observations of trees near campus. Students will learn the fundamental biology of the structure and physiological function of trees, to prepare them to understand how and why trees are managed for human uses. Fall. Prerequisite- introductory biology.

FOR 321 Forest Ecology & Silviculture (3)

Two hours of classroom lecture with weekly three-hour trips and labs to forests across Central New York. Survey of forest tree and stand ecology (silvics) and silviculture concepts, applications and implications for treatment of forest stands for various values. Experiential learning emphasized through a strong field component of assessing vegetation, site quality and land use history variables, and treatment alternatives to create different forest conditions. For students outside forest resources management curriculum; not open to students taking FOR 332 and FOR 334. Fall. Prerequisite: Botany or general biology. Note: Credit will not be granted for both FOR 321 and FOR 521.

FOR 322 Nat Res Measuremnts & Sampling (3)

Two hours of lecture and three hours of laboratory. Principles and methods used in the measurement and quantitative analysis of natural resources, including vegetation, water, soils, recreation and wildlife. The application of sampling designs for estimating populations and inventory planning, and statistical analysis for quantifying sampling error. Fall. Prerequisite(s): FOR 304 or equivalent; APM 391 or equivalent

FOR 323 Forest Biometrics (3)

Three hours lecture per week. Statistical techniques for analyzing problems in forest resource management including hypothesis testing, analysis of variance, simple and multiple linear regressions, and weighted least squares regression. Spring. Prerequisite: APM 391 or equivalent.

FOR 330 Studies in Silviculture (3)

Three hours of lecture per week, with reading assignments, exams, and projects. Students gain an appreciation of silviculture and its use for influencing the character, composition, and development of forest stands, and the conceptual framework for those practices. Projects provide opportunities to explore techniques for analyzing forest stands and developing prescriptions. Fall

FOR 332 Forest Ecology (4)

Three hours of lecture/discussion and three hours of laboratory per week. Structure, function and dynamics of forest ecosystems at multiple scales, from trees to landscapes, including human interactions. Topics include ecophysiology, disturbance, succession, carbon and nutrient cycling, forest management, invasive species and climate change. Field data collection and analysis. Fall. Prerequisite(s): FOR 232, or EFB 101 and 102, or equivalent by permission of instructor.

FOR 333 Natural Resrc Managerial Econ (3)

Three hours of lecture per week Every natural resources manager must answer the question of how to use economic information to make better business and management decisions daily. Solutions require identifying alternative means of achieving given objective(s), then selecting the alternative that accomplishes this in the most resource efficient manner. Mandatory one-day weekend or two-day overnight weekend field trip. Required for Forest Resources Management, Natural Resources Management, and Sustainable Energy Management degree programs. This is a shared resource course with FOR533. Spring. Prerequisites: FOR 207 Introduction to Economics (or equivalent) and Principles of Accounting or Finance (or equivalent); or permission of the instructor. Note: Credit will not be granted for both FOR 333 and FOR 533.

FOR 334 Silviculture (4)

Three hours of lecture and three hours of lab per week. The practice of silviculture in managing stands to serve various landowner interests. Field trips and exercises provide opportunities to see examples of silvicultural methods under different management scenarios, and to learn and practice techniques for analyzing forest stands and developing prescriptions for their treatment. Fall. Note: Credit will not be granted for both FOR 334 and FOR 534.

FOR 338 Meteorology (3)

Three hours of lecture/discussion per week. This is a shared resource course with FOR 538. An introduction to the atmospheric physical processes important to understanding weather and weather forecasting at the surface of the earth and macro-, synoptic-, meso-, and micro-climates. The emphasis is on synoptic and microscale phenomena. Students will learn how to access weather data on the Internet and use the data to forecast weather. At the microscale, emphasis is on describing conditions and projecting change. Spring. Note: Credit will not be granted for both FOR 338 and FOR 538.

FOR 340 Watershed Hydrology (3)

Three hours of lecture per week. Principles of physical hydrology, including the basic principles of watershed hydrology, from the relationship between watershed hydrology and the global water cycle, to the specifics of groundwater flow, stream flow generation, and water quality management at the watershed scale. Spring. Prerequisites: FOR345 - Introduction to Soils Note: Credit will not be granted for both FOR 340 and FOR 540.

FOR 345 Introduction to Soils (3)

Two hours of lecture and three hours of lab per week. Introduction to the fundamentals of soil science in the context of soil as an ecosystem component. Fall. Prerequisite or Co-requisite: 1 semester of Introductory Chemistry. Note: Credit will not be granted for both FOR 345 and FOR 545.

FOR 360 Principles of Mgmt/Envrn Prof (3)

Three hours of lecture per week. This course focuses on the basic theories, concepts, principles and functions of modern management and administration, with an emphasis on the four functions of management: leading, planning, organizing, controlling. The four functions of management are applied to the public and private sectors, as well as for profit and not-for-profit organizations. Environmental management systems, corporate ethics and social responsibility and systematic problem solving are among the principal topics emphasized. Fall. Note: Credit will not be granted for both FOR 360 and FOR 560.

FOR 370 Forest Mgmt Dec Mkng&Plng (3)

Two hours of lecture/discussion and three hours of laboratory per week. Introduction to the components of forest management decision making and planning. The topics include forest regulation, growth and yield, and harvest scheduling given that a landowner's goals may include more than just commercial timber production. Spring. Prerequisites: FOR 322 and FOR 334. Note: Credit will not be granted for both FOR 370 and FOR 570.

FOR 372 Fund/Outdoor Recreation (3)

Three hours of lecture/discussion per week. Introduction to the programs and practices of federal, state and local agencies and private organizations involved in planning, administration and management of outdoor recreation areas. Emphasis is placed on common resource and social problems faced by area managers, and how they integrate solutions into their plans. Spring.

FOR 373 Sustainable Harvesting Pract (3)

Two hours of lecture and three hours of lab per week. Overview of forest roads and timber harvesting; planning, construction, and maintenance of forest roads; economic and environmental characteristics of harvesting systems; safety and health; wood procurement systems; and the role of forest operations in the broader context of forest management. Fall. Prerequisite: FOR 322 or FOR 334 or permission of instructor.

FOR 402 Prof Forestry Mentoring Prog (1)

One-hour session per week supplemented by a one-day internship with a professional forester. Sessions will focus on contemporary issues in forestry including a historical perspective of the forestry profession, what it means to be a forester today, the role of certification and licensing, and professional ethics. It will serve to increase the professionalism of the forestry students. Fall. Prerequisites: Junior status or permission of instructor.

FOR 403 Humans & the Envrn/New Zealand (4)

Three and one-half week study-abroad program examines the natural and cultural history and resource management of New Zealand's South Island. Through class lecture/discussion and field excursions, students obtain an understanding of integrated resource management and sustainability in protected areas. Spring.

FOR 404 Ecotourism Abroad (3)

Five 1-hour lectures plus 9- to 10-day field trip. This service learning course introduces students to the field of ecotourism through a short-term study abroad program held during spring break. Students will travel to several ecotourism destinations within a selected country, meet with destination managers, and complete a service learning project related to ecotourism. Additional fees required to cover cost of travel and lodging during field portion of course. Spring

FOR 411 Analytical&Tech Wrtng/Resrc Mg (3)

Three hours of lecture per week. Research, summary, and evaluation of scholarly and grey literature. Application of decision making process and written recommendation. Introduction to argument. Composition of a technical report related to management major. Proposal writing and development of brochures, posters, and/or presentations for defined audiences. Fall and Spring. Prerequisites: EWP 290 or equivalent, and junior or senior status in FNRM

FOR 421 Prctical Ethics for Rsrce Mgrs (3)

Introduction to the history and function of ethics and rhetoric in the context of natural resource management with a special emphasis on forestry. Particular attention will be paid to establishing an ethically sound position, aligning competing values and priorities among interested parties effectively communicating management decisions. Online synchronous lecture/discussion 3 hours/week. Fall and Spring.

FOR 433 Advanced Silviculture (3)

Two hours of lecture and three hour field/computer exercises. Advanced study of silviculture in managing stands to serve a variety of landowner objectives. Enhanced problem solving skills related to stand analysis and prescription making. Field and computer exercises provide practical experience in implementing and evaluating silvicultural prescriptions. Spring. Prerequisite: one prior course in silviculture.

FOR 442 Watershed Ecology & Management (3)

Three hours of lecture and discussion per week. Introduction to watershed ecology and stream ecosystems. Interactions and linkages among upland, riparian and stream processes. Management and restoration associated with multiple uses of forest and rangelands. Explore influences of spatial and temporal scale, watershed and network position, disturbance regimes, and global change. Fall. Note: Credit will not be granted for both FOR 442 and FOR 642.

FOR 458 Advanced Topics in GIS (3)

Two hours of lectures and three hours of labs per week. Lecture, demonstration, discussion, and lab exercises. Apply advanced geoprocessing techniques in resource analysis and modeling. Students complete a capstone project. Fall. Prerequisite(s): ESF300 or equivalent.

FOR 465 Natural Resources Policy (3)

Three hours of lecture/discussion per week. Examination of US and NYS government roles in natural resource policy, and how government policies influence the management of public and private lands. Analysis of institutions, participants, and drivers of public lands, forest, water, wetlands, wildlife, fisheries, and fire policies. Fall.

FOR 475 Recreation Behavior &Managemnt (3)

Three hours of lecture per week and a one-day field trip. Applies sociological and psychological concepts to: 1) individual preferences for recreation activities and settings, 2) description of recreation visitor behavior, 3) sources of management problems, 4) developing direct and indirect visitor management strategies, and 5) recreation planning decisions necessary to manage recreation settings and experiences. Students have the opportunity to apply concepts to personal recreation experiences. A one-day field trip is required. Fall. Prerequisite: FOR 372 or equivalent, enrollment in the Natural Resource Management major or Recreation Resources and Protected Area Management minor, or permission of instructor.

FOR 476 Ecotourism and Nature Tourism (3)

Three hours of instruction per week. Overview of ecotourism and nature tourism programs and efforts around the world. Community, business, and organizational structures necessary for managing ecotourism and nature tourism programs are discussed, as are related environmental, social, and economic impacts. One-day field trip. Fall. Prerequisite: FOR 372. Note: Credit will not be granted for both FOR 476 and FOR 676.

FOR 478 Wilderness & Wildlands Mgt (3)

Three hours of lecture per week. One, two-day, overnight field trip. Review of the state and federal legislation and agency policies that frame the planning and management of public lands designated as wilderness or wildlands. Emphasizes stewardship and management for protection of natural resources and human values. Concepts include carrying capacity, preservation of ecological conditions and processes, visitor management, dispersed recreation management, human values and benefits, and planning frameworks. Fall. Prerequisite: FOR 372 or equivalent. Note: Credit will not be granted for both FOR 478 and FOR 678.

FOR 480 Urban Forestry (3)

Three hours of lecture per week. Evaluation and management of urban greenspace resources, with emphasis on urban trees, in the context of other values and management processes in urban areas. Class practice in evaluating urban greenspace and tree resources. Fall. Prerequisite: Junior or senior status in any Forest and Natural Resources Management programs or permission of instructor for juniors and seniors in other programs. Note: Credit will not be granted for both FOR 480 and FOR 680.

FOR 481 Introduction to Arboriculture (3)

Two hours of lecture and one three-hour laboratory per week. Overview of the practice of arboriculture. Emphasis will be on site evaluation for species selection, planting, pruning, fertilization and removal of trees in an urban environment. Spring. Prerequisite: Botany or Ecology.

FOR 485 Business and Managerial Law (3)

Three hours of lecture/discussion per week. An introduction to the law governing business and management. Examination of sources of law, court systems and trials, constitutional foundations, criminal law, contracts, employer and employee law, business organization law, torts, personal property and motor vehicle law, landlord and tenant law, home ownership law, and wills and estates. Spring.

FOR 487 Environmental Law and Policy (3)

Three hours of lecture/discussion per week. Introduction to the approaches used in US environmental law. Analysis of common law and statutory designs and strategies used to address environmental problems. Examination of common law environmental remedies, Clean Air Act, Clean Water Act, Endangered Species Act, hazardous waste, and other environmental laws. Fall. Prerequisite: Junior or Senior standing. Note: Credit will not be granted for both FOR 487 and FOR 687.

FOR 489 Natural Resources Law & Policy (3)

Three hours of lecture/discussion per week. An introduction to the law governing the management of natural resources. Examination of the history and constitutional basis of natural resources law, wildlife and biodiversity law, protected lands law, water law, marine fisheries law, rangelands law, minerals law, and forest law. Spring. Prerequisites: Junior or senior standing. Note: Credit will not be granted for both FOR 489 and FOR 689.

FOR 490 Integrated Resources Mgt (3)

One hour of lecture, three hours of laboratory, and three hours of supervised work per week. This capstone course emphasizes the assimilation, integration, and interpretation of the biophysical and socioeconomic sciences. It provides students with the opportunity to integrate skills and knowledge accumulated from professional and supporting coursework. A written comprehensive management plan, also presented orally in the field and classroom, provides the central vehicle by which students demonstrate their abilities as future natural resource managers. Spring. Prerequisite: Senior status in Forest and Natural Resources Management.

FOR 492 Capstone Rsrch in Frst Eco Sci (3)

Weekly one-on-one meetings with instructor, and independent student research. A semester of student-led, faculty-mentored independent research in forest ecosystem science, ecosystem stewardship, or a related topic. As the first of the two-course capstone sequence for the B.Sc. in Forest Ecosystem Science, this semester of original research provides the basis for broader social-ecological synthesis in the form of an ecosystem stewardship plan (FOR 493). A brief (one-page) research prospectus approved by the faculty mentor and degree coordinator is required. Open to Forest Ecosystem Science majors only. Fall and spring, depending on section (instructor-specific). Prerequisites: Upper-division standing; APM 391; completed research prospectus

FOR 493 Capstone Synth in ForEco Stwrd (3)

Weekly one-on-one or group meetings with instructor, independent student work. Synthesis and application of independent research (FOR 492) through development of an ecosystem stewardship plan or strategy that addresses real-world challenges and opportunities to sustainability. FOR 493 is the second course in the capstone sequence for the B.Sc. in Forest Ecosystem Science, which culminates in a written report or article and oral or multimedia presentation. Open to Forest Ecosystem Science majors only. Fall and spring. Prerequisites: FOR 492 or by permission of FES Curriculum Coordinator

FOR 495 Undergrad Teaching Assistance (1-3)

Undergraduate students gain experience as teaching assistants. They assist the instructor with the teaching and learning experience, assist students with learning course concepts, and mentor students on how to succeed in an undergraduate course. Responsibilities vary by section and instructor. Fall and Spring. Prerequisite: Permission of instructor. Prior completion of course to be assisted with grade of B or better.

FOR 496 Special Topics in SRM (1-3)

Experimental and developmental courses in new areas of resource management/forestry or areas not covered in regularly scheduled courses. Topics may include but are not limited to the biological, physical, and social dimensions and the many and varied resources of forest lands and forestry. Specific detailed course descriptions for each course taught under the FOR 496 designation are available for student perusal. Fall, Spring and Summer.

FOR 498 Independent Study in SRM (1-6)

Independent research or study in resource management/forestry for selected undergraduate students. Selection of subject area, nature of the research or study, and number of credit hours determined by student in conference with appropriate faculty member; initiative in taking FOR 498 rests with the student. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Final written report is required for record. Fall, Spring and Summer. Prerequisite: Cumulative GPA of at least 2.50 and approval of the adviser and instructor.

FOR 499 Internship in Sust Rsrces Mgmt (1-12)

Full- or part-time engagement as volunteer or employee working for off-campus resource management/forestry/renewable energy organization under guidance of external supervisor. Students shall report their activities to their instructor on a weekly basis for the duration of the course and final written report is required for record. Junior or senior status, cumulative GPA of at least 2.5, and written approval of a study plan by faculty advisor and field supervisor must be submitted prior to its commencement. Fall, Spring and Summer. Prerequisite: Junior or Senior status. Must have a cumulative GPA of at least 2.5. Professor consent is required to register for this course.

FOR 501 Intro/Envrnmntl Resources Mgmt (2)

Two-week, field-based examination of forest, water, wildlife, recreation, and mineral resources and their management in New York State and surrounding states, framed by public administration, political science, economic, human dimension, and biophysical concepts. Emphasis is on experiential learning via a series of field trips. Fall (mid-August). Prerequisite(s): Enrollment in the ERM MPS degree program.

FOR 519 Green Entrepreneurship (3)

Three hours of lecture/discussion per week. Explore challenges and goals of creating a start-up venture in environmental science or technology. Recognize trends in the marketplace, and where commercial opportunities can be created. Analyze feasibility and potential to create a sustainable venture. Other topic areas include critical success factors and key start-up issues unique to environmental science and technology firms. Spring. Prerequisite(s): FOR 207 Introduction to Economics or equivalent; or permission of instructor.

FOR 521 Forest Ecology & Silviculture (3)

Two hours of classroom lecture with weekly three-hour trips and labs to forests across Central New York. Study of the conceptual underpinnings and application of forest ecology via explorations of the environmental complex and silvicultural systems. Experiential learning is emphasized through a strong field component of assessing vegetation, site and land use history variables, and treatment alternatives to create different forest conditions. Provides a study of trees as individuals and communities, and how we can manipulate them both using planned methods and techniques to affect sustained production of a wide variety of forest ecosystem benefits, services, and values. Fall. Prerequisite(s): Botany or general biology. Note: Credit will not be granted for both FOR 321 and FOR 521. Not open to students taking FOR 534.

FOR 522 Forest Mensuration (3)

Two hours of lecture and three hours of laboratory per week. Principles and methods used in the measurement of standing trees, forest stands, forest products and growth. The application of sampling designs and analysis for forest valuation and inventory planning. Graduate students will be required to complete two additional term projects in addition to those required of undergraduate students. Fall. Prerequisites: FOR 304 or equivalent. Co-requisites: APM 391 or equivalent. Note: Credit will not be granted for both FOR 322 and FOR 522.

FOR 523 Tropical Ecology (3)

Preparatory lectures(1.5 hr/wk) coupled with intensive spring break field study on a tropical island in the Caribbean. Principles of tropical ecology, resource management, and island biogeography are presented. Field trips to a variety of tropical ecosystems including rain forest, coral reefs, crater lakes, montane rain forest with comparison to north temperate ecosystems. Additional fee covers costs of travel, lodging. Spring. Prerequisite(s): General Ecology

FOR 524 Forest Biometrics (3)

Three hours of lecture per week. Statistical methods and techniques including hypothesis testing, analysis of variance, simple and multiple linear regressions used for analyzing forest resource management problems and developing forest growth and yield models. Graduate students will be required to write a research paper in addition to those required of undergraduate students. Spring. Prerequisite: APM 391 or equivalent. Note: Credit will not be granted for both FOR 323 and FOR 524.

FOR 530 Studies in Silviculture (3)

Three hours of lecture per week, with reading assignments, exams, and projects. Students gain an appreciation of silviculture and its use for influencing the character, composition, and development of forest stands, and the conceptual framework for those practices. Projects provide opportunities to explore techniques for analyzing forest stands and developing prescriptions. Fall

FOR 532 Forest Ecology (4)

Four hours of lecture/discussion and three hours of laboratory per week. Structure, function and dynamics of forest ecosystems at multiple scales, from trees to landscapes, including human interactions. Topics include ecophysiology, disturbance, succession, carbon and nutrient cycling, forest management, invasive species and climate change. Field data collection and analysis. Fall. Prerequisite(s): Undergraduate coursework in biology/ecology; or by permission of instructor

FOR 533 Natural Resrc Managerial Econ (3)

Every natural resources manager must answer the question of how to use economic information to make better business and management decisions daily. Solutions require systematically analyzing economic tools and models to identify alternative means of achieving given objective(s), then selecting the alternative that accomplishes this in the most resource efficient manner. Mandatory one-day weekend or two-day overnight weekend field trip. Required in the Master of Forestry degree program. This is a shared resource course with FOR333. Spring. Note: Credit will not be granted for both FOR333 and FOR533. Prerequisites: FOR207 Introduction to Economics (or equivalent), Precalculus or Calculus (or equivalent), and Principles of Accounting or Finance (or equivalent); or permission of the instructor

FOR 534 Silvicultural Practice (4)

Three hours of lecture and three hours of laboratory per week. The practice of silviculture in managing stands to serve various landowner interests, and explore the conceptual framework for those practices. Field trips and exercises provide opportunities to see examples of silvicultural methods under different management scenarios and to learn and practice techniques for analyzing forest stands and developing prescriptions for their treatment. Laboratory projects include reports that explore the conceptual and technical rationale for silvicultural decisions. Fall. Note: Credit will not be granted for both FOR 334 and FOR 534.

FOR 535 Advanced Forest Soils (3)

Three hours of lecture/discussion per week concerning the current state-of-the-art in forest soils. Effect of intensive forest management on soil, soil-site-species relationships, forest fertilization tree nutrition. Application of forest soils information to silviculture. Spring. Prerequisite: FOR 332 or beginning courses in soils and silviculture.

FOR 538 Meteorology (3)

Three hours of lecture/discussion per week. An introduction to the atmospheric physical processes important to understanding weather and weather forecasting at the surface of the earth and macro-, synoptic-, meso-, and micro-climates. The emphasis is on synoptic and micro-scale phenomena. Students will learn how to access weather data on the Internet and use that data to forecast weather. At the micro-scale, emphasis is on describing conditions and projecting change. Fall. Note: Credit will not be granted for both FOR 338 and FOR 538.

FOR 540 Watershed Hydrology (3)

Three hours of lecture per week. This course provides students with a detailed understanding of watershed hydrology, water quality and water management at the watershed scale, and offer the students the opportunity to gain in depth knowledge on one topic of particular interest to them through completion of a term project, and the development of a teaching/research presentation and interactive discussion with students in the class. Spring. Prerequisites: FOR345 - Introduction to Soils Note: Credit will not be granted for both FOR 340 and FOR 540.

FOR 545 Introduction to Soils (3)

Two hours of lecture and three hours of laboratory per week. Introduction to the fundamentals of soil science in the context of soil as an ecosystem component. Fall. Prerequisite or Co-requisite: one semester of Introductory Chemistry or permission of instructor. Note: Credit will not be granted for both FOR 345 and FOR 545.

FOR 546 For Soil Genesis,Class&Mapping (3)

Three hours of lecture per week during the first two-thirds of the semester. The last third of the semester is devoted to fieldwork and production of a soil map. Models of soil genesis, application of the U.S. system of soil taxonomy, and soil mapping. Spring. Prerequisite: Introductory course in soil science.

FOR 557 Fundamentals of GIS (3)

Three hours of lecture/discussion/recitation per week. Fundamental concepts of Geographic Information Systems (GIS); raster and vector data models and geodatabase design; common raster and vector data analysis tools used in the fields of forest and natural resources management, environmental science,conservation biology, ecology, and landscape architecture; cartographic model construction; and map design. Completion of an independent project is required. Fall

FOR 560 Principles of Mgmt/Envrn Prof (3)

Three hours of lecture per week. This course focuses on the basic theories, concepts, principles and functions of modem management and administration, with an emphasis on the four functions of management: leading. planning, organizing, controlling. The four functions of management are applied to the public and private sectors, as well as for profit and not-for-profit organizations. Environmental management systems, corporate ethics and social responsibility and systematic problem solving are among the principal topics emphasized. Fall.

FOR 570 Forest Mgmt Dec Mkng&Plng (3)

Two hours of lecture/discussion and three hours of laboratory per week. Introduction to the components of forest management decision making and planning. The topics include forest regulation, growth and yield, and harvest scheduling given that a landowner's goals may include more than just commercial timber production. Sensitivity analysis of parameters used in forest management planning. Spring. Prerequisites: FOR 322/522 and FOR 334/534 or permission of the instructor. Note: Credit will not be granted for both FOR 370 and FOR 570.

FOR 573 Sustainable Harvesting Pract (3)

Two hours lecture and three hours of laboratory per week. Overview of forest roads and timber harvesting; planning, construction, and maintenance of forest roads; economic and environmental characteristics of harvesting systems; safety and health; wood procurement systems; and the role of forest operations in the broader context of forest management. Emphasis on application of knowledge, requiring a written report with a problem-solving focus. Fall. Prerequisite: FOR 322 and FOR 334 or permission of instructor. Note: Credit will not be granted for both FOR 373 and FOR 573.

FOR 635 For Soils/Their Analyses (3)

One hour of lecture, one hour of recitation, four hours of field and laboratory study of forest soils, emphasizing plant-soil relationships per week. Stress on quantification of plant-soil diagnostic techniques and their interpretation. Spring (odd years). Prerequisite: FOR 446. Note: Background in physical and biological sciences recommended.

FOR 642 Watershed Ecology & Management (3)

Three hours of lecture and discussion per week. Introduction to watershed ecology and stream ecosystems. Interactions and linkages among upland, riparian and stream processes. Management and restoration associated with multiple uses of forest and rangelands. Explore influences of spatial and temporal scale, watershed and network position, disturbance regimes, and global change. Students will apply course concepts to an independent research project. Fall. Note: Credit will not be granted for both FOR 442 and FOR 642.

FOR 659 Advanced GIS (3)

Two hours of lectures and three hours of labs week. Lecture, demonstration, discussion, and lab exercises. Students learn to apply and evaluate advanced geoprocessing techniques in resource analysis and modeling. Students complete and present a capstone project. Spring. Prerequisite(s): FOR557 or equivalent

FOR 665 Natural Resources Policy (3)

Three hours of lecture per week. Analysis and application of political, policy formation, and policy administration theories to natural resources. Examination of drivers of U.S. natural resources policies. Analysis of private lands, public lands, forest, wildlife, endangered species, water, fire, and certification policies. Focus is on U.S. natural resources policies. Spring. Prerequisite: graduate standing.

FOR 670 Resource & Envrn Economics (3)

Three hours of lecture per week. An introductory course in resource and environmental economics. Apply economic theories and models to analyze decisions concerning the use of forest, marine, and water resources and to analyze policy tools for mitigating pollution created as a result of production and consumption. Fall. Prerequisite: A course in economics.

FOR 676 Ecotourism and Nature Tourism (3)

Three hours of instruction per week. Overview of ecotourism and nature tourism programs and efforts around the world. Community, business, and organizational structures necessary for managing ecotourism and nature tourism programs. Environmental, social, and economic impacts. One-day field trip. Graduate level readings, assignments, and exams. Fall. Prerequisite: FOR 372. Note: Credit will not be granted for both FOR 476 and FOR 676.

FOR 678 Wilderness & Wildlands Mgt (3)

Three hours of lecture per week and one, two-day, overnight field trip. Reviews the state and federal legislation and agency policies that frame the planning and management of public lands designated as wilderness or wildlands. Emphasizes the use of wilderness research information for adaptive management approaches to stewardship of and planning for protection of natural resources and human values. Fall. Prerequisite: FOR 372 or equivalent. Note: Credit will not be granted for both FOR 478 and FOR 678.

FOR 680 Urban Forestry (3)

Three hours of lecture per week. Evaluation and management of urban greenspace resources, with emphasis on urban trees, in the context of other values and management processes in urban areas. Class practice in evaluating urban greenspace and tree resources, development of a research paper on urban forestry. Fall. Prerequisite: Permission of instructor. Note: Credit will not be granted for both FOR 480 and FOR 680.

FOR 687 Environmental Law & Policy (3)

Three hours of lecture/discussion per week. Introduction to the approaches used in US environmental law. Analysis of common law and statutory designs and strategies used to address environmental problems. Examination of common law environmental remedies, Clean Air Act, Clean Water Act, Endangered Species Act, hazardous waste, and other environmental laws. Analysis and application of primary and secondary legal sources to business and management problems. Fall. Note: Credit will not be granted for both FOR 487 and FOR 687.

FOR 689 Natural Resources Law & Policy (3)

Three hours of lecture/discussion per week. An introduction to the law governing the management of natural resources. Examination of the history and constitutional basis of natural resources law, wildlife and biodiversity law, protected lands law, water law, marine fisheries law, rangelands law, minerals law, and forest law. Analysis and application of natural resources law research and commentary. Spring. Note: Credit will not be granted for both FOR 489 and FOR 689.

FOR 690 Integrated Resources Mgmt (3)

One hour of lecture, three hours of laboratory and three hours of supervised work per week.This capstone course emphasizes the assimilation, integration and interpretation of the biophysical and socioeconomic sciences. It provides students with the opportunity to integrate skills and knowledge accumulated from professional and supporting coursework. The final deliverable is a written management plan. Spring.

FOR 692 Capstone/Resources Management (3)

Students will integrate and apply their knowledge of resources management to practical problems of their own design in their areas of interest, in consultation with clients whom they identify to be in need of their professional services. Class sessions include opportunities to develop advanced knowledge and professional skills, such as research, analysis, management, and communication. Final project outcomes are delivered through written reports and oral presentations. Course should be taken in the student's final fall semester. Fall.

FOR 694 Writing/Scientific Pubs (3)

Three hours of lecture and discussion per week. Students will improve their skills in technical reporting by preparing a manuscript suitable for submission to a scientific journal. Topics include selection of an appropriate journal, design of effective figures and tables, sequential preparation of sections of the manuscript, writing tips, peer review and ethical issues. Spring.

FOR 696 Spec Topics/Frst & Nat Res Mgt (1-3)

Experimental and developmental courses in new areas of forestry and natural resources management not covered in regularly scheduled courses. A course syllabus will be available to students and faculty advisors prior to registration.

FOR 770 Ecological Economics & Policy (3)

Three hours of seminar per week. A transdisciplinary approach to understand the interface of human and ecological systems, includes concepts and methods of ecologists, economists, and social scientists. Focus is on historical, conceptual and epistemological foundations. Draws on contemporary economic and policy thought, evolutionary biology, ecology, systems theory, social psychology, and environmental ethics. Spring. Prerequisite: Graduate coursework in ecology or economics; doctoral student standing, or permission of instructor.

FOR 796 Spec Topics/Forst Res.Mgt (1-3)

Lectures, seminars, and discussion. Advanced topics in resource management and policy. Check schedule of classes for details of subject matter. Fall and/or Spring.

FOR 797 Seminar (1-3)

Group discussion and individual presentation of topics of current interest to forest and natural resources management. Fall and Spring.

FOR 798 Rsrch Prob/Fsty & Nat Res Mgt (1-12)

Special investigation and analysis of forest and natural resources management topics. A study plan and a final written report are required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall and Spring.

FOR 898 Prof Exp/Intern (1-6)

Professional experience/internship which applies, enriches, or complements formal coursework. All professional experiences/internships must have a signed experience/internship agreement on record with the advisor. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 899 Master's Thesis Research (1-12)

Investigation leading to the completion of a Master's thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

FOR 999 Doctoral Thesis Research (1-12)

Investigation leading to the completion of the doctoral thesis. Graded on an "S/U" basis. Fall, Spring and Summer.

FTC - FOREST TECHNOLOGY

FTC 101 Trig for Nat Res Tech (3)

Forty hours of lecture and sixteen hours of recitation conducted over a four-week period. A review of selected geometry and algebra topics, and an introduction to trigonometry and its applications. Emphasis on pythagorean theorem, quadratic equations, rectangular coordinate systems, right triangle trigonometry, oblique triangle trigonometry, the Law of Sines, the Law of Cosines and the graphing of trigonometric functions. Graphic calculator required. Summer.

FTC 105 Tree & Forest Biology (4)

A four-week summer program having 45 hours of lecture and 45 hours of lab. An introduction to the biology of trees and the diversity of animal life commonly found in forests. Field labs concentrate on biological relationships in Adirondack forests. Summer.

FTC 200 Dendrology (3)

Thirty eight hours of lecture, and forty hours of field laboratory. Characteristics, distribution, and uses of tree species in North America. Identifying plant species using common and scientific names, from leaf, twig, fruit, or bark samples. Habitats, species associates, and succession of plants, including some invasive species. Fall.

FTC 202 Intro To Surveying (3)

Twenty eight hours of lecture and 72 hours of laboratory and field exercises. The course is an introduction to the theory and practice of plane surveying. Emphasis is on developing individual skills and techniques through small crew projects where it is necessary to handle typical surveying equipment in actual field situations. Lecture topics include the theory of measurements and errors, field record keeping procedures, mathematics for plane surveying, introduction to field problems, introduction to map use and preparation, concepts of land tenure systems and basic computer aided drafting. Students tour the various offices found at the County courthouse and participate in a research exercise. Field projects include traversing using common forester's and surveyor's tools and instruments, mapping including field and office procedure, and proficiency projects in handling various surveying instruments. Fall.

FTC 204 Intro/Nat Res Measurements (4)

Forty-five hours of lecture and sixty hours of field/laboratory. A study of the tools and techniques used to measure primary forest products and inventory and/or measure natural resources, such as timber, water, biomass, carbon stocks, wildlife habitat, recreation use and impact, and plant diversity. Professional presentation of forest inventory data in the form of technical reports. Basic forest sampling methods are used and compared, and associated statistical methods are learned and applied. Fall.

FTC 205 Comp-Aided Draftng&Dsgn I (2)

Eighteen hours of lecture and 36 hours of laboratory time. An introductory course in computer aided drafting. Emphasis is on developing individual skills and techniques for making professional quality drawings and maps. Topics include the drawing, editing, layer management, dimensioning, survey computations, data reduction, contouring and Geographic Information Systems. Fall.
Prerequisite(s): FTC 202 - Introduction to Surveying

FTC 206 Forest Ecology (4)

Fifty-one hours of lecture and fifty-six hours of laboratory and field. Study of interactions between forest vegetation and the environment. Considers how sunlight, moisture, soils and climate impact species presence, composition and growth. Human dimension of forest ecology, including critical thinking and evaluation of environmental issues. Fall.

FTC 207 Communications and Safety (3)

28 Hours Lecture, 51 Hours Lab. The course provides students with professional interaction will help inform students of the various career pathways available to them. Students develop computer skills and communication skills including how to produce technical reports. A resume and cover letter will be prepared for use in the job search process. Students receive introductory training on the proper use and maintenance of forest hand tools, chainsaws and skidding equipment. First Aid and CPR/AED are covered. Fall.

FTC 208 Remote Sensing and GIS (3)

Thirty hours of lecture and forty-five hours of laboratory. This course is an introduction to the use of remote sensing and geographic information systems in the field of natural resources. Students practice interpretation of aerial photographs and digital imagery to measure horizontal distances and azimuths and calculate ground area. Acquisition, creation and basic analysis of spatial data are also emphasized. Fall.

FTC 209 Timber Harvesting (2)

Eighteen hours of lecture and thirty six hours of laboratory or field instruction. Student learns basic harvesting methods with northeastern United States emphasis and its relationship to other forest uses. Student understand the role of best management practices in timber harvesting. A technical competence in timber sale contract administration and basic timber appraisal is gained. Fall. Co-requisite(s): FTC 204, FTC 207.

FTC 210 Wildlife Techniques 1 (1)

Eight hours of lecture and eighteen hours field and laboratory time. Part 1 of an introduction to standard methods and techniques for surveying, measuring, and monitoring wildlife populations are discussed, demonstrated, and practiced. Identification of mammals and birds by sight and sound. Fall. Prerequisites: FTC 200, FTC 202, and FTC 204.

FTC 211 Silviculture (3)

40 Hours Lecture, 56 Hours Lab. The course covers the theories and practices used to establish, grow, and tend forests for various management objectives. Students are introduced to the methods used to quantify and predict forest growth. Applied silvicultural techniques for various northeast forest types are covered. Students develop stand treatments, replicate them using forest growth simulators, and then apply the treatments through timber marking. Students also gain practical experience in planting site evaluation and tree planting. Spring. Prerequisites: FTC 200, FTC 204, and FTC 206.

FTC 212 Adirondack Cultural Ecology (1)

Twelve hours of lecture and sixteen hours of field laboratory. Development of the Adirondack Park as influenced by the exploitation and eventual conservation of the region's natural resources. An historical and contemporary overview of the ecological, political, economic, and sociologic issues that define and influence Adirondack culture. Guest speakers and field trips within the Park reinforce cultural history and natural resource status while emphasizing the role of individuals, organizations, and agencies in managing the unique blend of public and private lands that comprise the Park. Fall.

FTC 213 For Inventory Practicum (2)

Six hours of lecture and sixty four hours of field/laboratory. A practical field problem requiring students to use professional methods of collecting, analyzing, and presenting forest inventory data. Inventory of the timber/biomass resource and the development of a forest type map are emphasized. Spring. Prerequisites: FTC 200, FTC 202, FTC 204, and FTC 208.

FTC 214 Leadership & Orgnztnl Perfrmnc (2)

Twenty-two hours of lecture and twenty-four hours of laboratory time. Provides students with technical competence and decision-making abilities. Students learn about company and agency organization; the selection, placement, training, and evaluation of workers; managing crews and the techniques of foremanship; and human relations in the workplace, with emphasis on the special personnel problems of the forest and surveying industries. Spring. Prerequisite(s): FTC 207 Communications and Safety

FTC 217 Wildland Firefighting & Ecol (2)

Twenty-five hours of lecture and sixteen hours of laboratory and field. An introduction to fire science. Learn basic principles of fire ecology, behavior, danger rating and control. Practical experience conducting a prescribed burn. Spring. Prerequisite(s): FTC 200, FTC 204, FTC 206, FTC 210.

FTC 219 Intro to Forest Recreation (1)

Fourteen hours of lecture and twenty hours field and laboratory time. A study of forest-recreation resources, their importance to humans, and of the basic history, laws and principles underlying forest-recreation management in the United States. The technical aspects of recreation management are emphasized, as is the study of public-land management, including wilderness. Spring. Pre-requisites: FTC 207.

FTC 221 Natural Resources Management (3)

36 Hours Lecture, 38 Hours Lab . Course offers an introduction to basic principles of natural resource management and administration including such topics as multiple use management, finance, state and federal policies, ethics, and forestland certification. A final project, which serves as the capstone project for students in the Forest Technology and Environmental and Natural Resource Conservation programs, involves the application of knowledge accumulated at the ESF Ranger School into a natural resource management plan for an assigned forest property. Spring. Prerequisites: FTC 200, FTC 204 and FTC 206.

FTC 225 Timber Transportn&Utilization (2)

Twenty-two lecture hours and thirty laboratory hours. Students gain knowledge of forest road maintenance. Differences in wood structure of various tree species are studied in the laboratory, students learn how to identify tree species by wood characteristics. Spring. Prerequisite(s): FTC 200, FTC 206, FTC 207

FTC 234 Wildlife Conservation (3)

Thirty-eight hours of lecture and twenty hours field and laboratory time. An introduction to the history and evolution of wildlife-related policies and laws, and to the biological, ecological, economical and sociological principles underlying wildlife management and conservation efforts in the United States. Terrestrial vertebrate animals serve as the basis of discussions and case studies. Students improve their communication skills by presenting papers and speeches on wildlife-related topics. Spring. Prerequisite: FTC 206.

FTC 236 Env Interp Principles&Technque (3)

Thirty three hours of lecture and thirty six hours field and laboratory time. Introduction to the history, theory and basic personal and non-personal methods of environmental interpretation. Exploration of the relationship between interpretation and nature recreation and the use of interpretation programs to informally educate the public about environmental and natural resource issues. Principles of interpretation are emphasized and applied to course projects. Students deepen understanding of course material and improve their communication skills by preparing and presenting both personal and non-personal interpretive programs. Spring. Pre-requisites: FTC 200, FTC 202, FTC 204, and FTC 206

FTC 237 Intro/Water & Soil Resources (4)

Forty-eight hours of lecture and forty hours of laboratory and field exercises. Introduction to watershed ecology and soil science. Interactions among upland, riparian, lacustrine and wetland systems, including the hydrologic cycle, water balance equation and water quality assessments. Study and measurement of soil physical, chemical and biological characteristics and processes. Recognize soil and water resource management and protection issues associated with multiple uses of forest lands. Spring. Prerequisites: FTC 202, FTC 206, and FTC 208.

FTC 238 Forest Insects and Disease (3)

Thirty-five hours of lecture and twenty-six hours of laboratory and field. An introduction to forest insects and diseases. Explore ecological roles and identify selected insects and pathogens based on morphology, signs and symptoms. Discuss integrated pest management and other control measures. Spring. Prerequisites: FTC 200, and FTC 206.

FTC 239 GIS Practicum (1)

Six hours of lecture and twenty-eight hours of laboratory. Development of an independent project utilizing Geographic Information Systems, including acquisition, manipulation, and creation of geospatial data. Plan, conduct, and present a geospatial analysis project on a topic of choice within field of study. Spring. Prerequisites: FTC 202, and FTC 208.

FTC 240 Wildlife Techniques 2 (1)

Ten hours of lecture and eighteen hours field and laboratory time. Part 2 of an introduction to standard methods and techniques for surveying, measuring, and monitoring wildlife populations are discussed, demonstrated, and practiced. Identification of birds, amphibians, and reptiles by sight and sound. Spring. Prerequisite(s): FTC 200 (Dendrology), FTC 202 (Introduction to Surveying), FTC 204 (Introduction to Natural Resources Measurements), and FTC 210 (Wildlife Techniques 1)

FTC 251 Adv Survey Measure&Comp (4)

Thirty hours of lecture and eighty-five hours of field and laboratory time. Advanced survey measurements and computational techniques including traverse calculations, rectangular coordinates, statistical analysis of surveying data, state plane coordinates, meridian determination, partition of land, trigonometric leveling and horizontal control are explored. Students will make the necessary surveying measurements in the field and be expected to complete various surveying measurements using a calculator and computer. Spring. Prerequisite: FTC 202. Co-requisite: FTC 257.

FTC 253 Survey Law (3)

Thirty five hours of lecture and 30 hours of laboratory time. The course is a study of courthouse real property research, property boundary determination by various methods, case and statute law as it relates to real property and land surveying, legal research and the liability and professionalism of the practicing land surveyor. Spring. Prerequisite: FTC 202.

FTC 255 Boundary Surveying (3)

Thirty hours of lecture and forty-five hours of field and laboratory time. A study of the procedures necessary to conduct a retracement survey including preliminary office procedures, field practices, and preparation of final survey documents. Students will complete a retracement survey and use the compiled data in a mock trial. Spring. Prerequisite: FTC 202. Co-requisite: FTC 253.

FTC 256 Subdivision Surveys (2)

Twenty hours of lecture and 30 hours of laboratory time. An introduction to the preparation of a multi-lot subdivision of a parcel of real estate. Development of a subdivision in relation to topography, zoning requirements, utility services, existing and proposed roads or streets and client requests. Students learn to design minor storm drain facilities in relation to the subdivisions. The student will incorporate all of the above while using survey software. Spring. Prerequisite: FTC 202. Co-requisite: FTC 259.

FTC 257 Construction&Topo Surveys (3)

Twenty-five hours lecture and sixty hours field and laboratory. A study of the various methods and techniques used to perform construction and topographic surveys and develop topographic maps. Theory, mathematics, and layout of circular, spiral and vertical curves. Layout of various construction projects including buildings, roads, pipelines and bridges will be discussed. Earthwork, staking and cross-section calculations will also be covered. Students complete a topographic mapping project and develop maps using appropriate surveying and mapping software. Spring. Co-requisites: FTC 251 and FTC 259.

FTC 259 Cmptr-Aided Draftng & Dsgn II (2)

Eighteen hours of lecture and seventy hours of laboratory time. An additional course in computer aided drafting and design. Emphasis is on developing individual skills and techniques for making professional quality drawings, maps and plats. Topics include the drawing, editing, layer management, dimensioning, survey computations, data reduction, surface modelling and GIS. Spring. Prerequisite(s): FTC 202 - Introduction to Surveying, FTC 205 Computer aided Drafting and Design I.

FTC 298 Independent Study (1-6)

Independent study in forest technology to apply, enhance or supplement forest technology or related natural resource education. Objectives and scope of the project are negotiated in a learning contract between the student and instructor(s), with course admission based on permission of the instructor(s). Limited to those who have attended the complete regular SFT program, or those who have graduated from another forest technology program or a related natural resource program, or to students enrolled in any ESF program other than SFT. A maximum of six credit hours may be taken by any student in total. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Semesters as arranged. Fall, Spring or Summer.

GNE - GENERAL ENGINEERING

GNE 160 Comp Methods/Engrs&Scientists (3)

Two hours lecture and three hours laboratory per week. Introduction to algorithm design, programming structures, and data structures. Engineering calculation software including programming languages, spreadsheets, and simulation software. Application of computing methods to engineering problems and data analysis. Spring.

GNE 171 Engr Mechs - Dynamics (2)

Two hours of lecture per week. Kinematics and kinetics of particles and rigid bodies; rectangular, normal and tangential, radial and transverse components; translation and rotation; force and acceleration; impulse; momentum; work and energy; impact. Spring. Prerequisites: Statics and Calculus II.

GNE 172 Statics and Dynamics (4)

Four hours of lecture per week. This course provides fundamental principles, methods and applications of engineering mechanics. Development and discussion of analytic models for rigid-body mechanics are used to apply theories. Rigid bodies of a practical nature and at rest or in motion are covered. Fall. Prerequisites: Algebra, derivative and integral calculus.

GNE 271 Statics (3)

Three hours of lecture per week. Covers fundamentals of analysis of static systems including equilibrium of rigid bodies, distributed loads, and trusses. A portion of the class is spent on open-ended problem solving and engineering design. Fall. Prerequisite: Physics I (Mechanics) and Calculus II

GNE 273 Mechanics of Materials (3)

Three hours of lecture per week. Theories of stress, deformation and stability of common structural materials subjected to various force systems. Spring. Prerequisites: Integral calculus and statics.

GNE 330 Prof Engineering Skills Sem (0.5)

Two hour seminar approximately every other week. Professional skills needed by engineers to be successful in their profession including teamwork, ethics, communications, impact of engineering solutions, life-long learning, and contemporary issues. Seminar topics include industry outlook, professional organizations, networking, finance, management, personnel issues, among other topics. Topics will typically be covered on a three-year cycle. Fall and Spring.

GNE 410 Structures (4)

Three hours of lecture, three hours of computation laboratory and discussion per week. Engineering principles in the analysis, planning design and construction of components and framed structures under various types of loadings. The proportioning of wood, steel and composite members and the design of statically determinate structural systems. Emphasis is placed on the relationship between theoretical stress analysis and codes and specifications for appropriate materials and structural design practices. Fall. Prerequisite(s): GNE 273 and scientific computing.

GNE 461 Air Pollution Engr (3)

Three hours of lecture and discussion per week. Study of physical, chemical, legislative, and meteorological aspects of air pollution and its control. Air quality and emission standards. Local and global effects of air pollution and atmospheric dispersion modeling. Design principles of air pollution control devices. Fall. Prerequisites: 1 year of college-level physics, chemistry and calculus. Note: Credit will not be granted for both GNE 461 and GNE 661.

GNE 530 Prof Engineering Skills Sem (0.5)

Two hour seminar approximately every other week. Professional skills needed by engineers to be successful in their profession including teamwork, ethics, communications, impact of engineering solutions, life-long learning, and contemporary issues. Seminar topics include industry outlook, professional organizations, networking, finance, management, personnel issues, among other topics. Topics will typically be covered on a three-year cycle. A project is required. Fall and Spring.

GNE 661 Air Pollution Engr (3)

Three hours of lecture and discussion per week. Study of physical, chemical, legislative, and meteorological aspects of air pollution and its control. Air quality and emission standards. Local and global effects of air pollution and atmospheric dispersion modeling. Design principles of air pollution control devices. Fall. Prerequisites: 1 year of college-level physics, chemistry and calculus. Note: Credit will not be granted for both GNE 461 and GNE 661.

LSA - LANDSCAPE ARCHITECTURE

LSA 132 Orientation Seminar:LSA (1)

One hour of lecture, discussion and/or exercises per week. Occasional field trips. Orientation to campus resources available to ensure academic success. Introduction to the professional culture and some topics of interest to landscape architects. Fall.

LSA 182 Drawing Studio (3)

Six hours of studio and one hour of lecture per week. This drawing course introduces the students to materials, techniques and components of drawing, architectural elements and figure drawing. Fall and Spring. Prerequisite: Landscape architecture students or permission of instructor.

LSA 201 Landscape Representation I (3)

Three hours of lecture per week. Introduction to graphic communication for landscape architecture. Course engages students in a range of graphic investigations in analog and digital media, modeling, and graphic imaging software. Emphasis is on the development of graphic representation skills for the communication of design ideas. Spring.

LSA 205 Art,Culture&Landscape I (3)

Three hours of lecture per week. The course will examine the evolution of cultural expression in the arts and allied design professions. Lectures will emphasize the interrelationships between the arts and their cultural contexts from prehistory to the Renaissance. Spring.

LSA 206 Art,Culture&Landscape II (3)

Three hours of lecture per week. The course will examine the evolution of cultural expression in the arts and allied design professions. Lectures will emphasize the interrelationships between the arts and their relation to cultural contexts from the Renaissance to the present day. Fall.

LSA 212 Place/Culture/Design (3)

Three hours of lecture/discussion per week. The course uses an interdisciplinary approach and social justice lens to critically analyze the cultural processes, practices, and systems that (unequally) shape places. These understandings are applied in the context of environmental and landscape planning and design professions. Field trips may be scheduled. Fall and Spring.

LSA 220 Intro/Landscape Architect (3)

Three hours of lecture per week. LSA 220 presents an overview and introduction to the profession of landscape architecture. It presents a survey of the development of the profession in the United States and how the profession responds to societal needs in providing services to various public and private clients. Emphasis is placed on understanding the significance of environmental, socio/cultural, physical/visual, and aesthetic factors in developing intervention strategies and designs. Contemporary landscape architectural issues, practitioners and work are presented. Fall.

LSA 222 Photogrphy, Envirnmnt, & You (3)

Three hours of lecture. Photography is used across all of the environmental science and design fields to communicate about our work, research, and findings. Yet photography is seldom formally taught as skill that must be learned in order to use it effectively. This course fills this gap by teaching working methods from photography within the contexts of daily applications for environmental science and design. This course combines fundamental photography lessons in composition with critical discussions about the application of photography within the contexts of studying landscape, environment, nature and wilderness. Lecture, reading, discussion and field work convey content. Open to all experience levels. Fall.

LSA 226 Foundation Design Studio I (4)

Seven hours of studio and one hour of lecture per week. This course introduces students to skills, techniques, and ways of thinking that are fundamental to landscape architectural design, preparing students for future studio courses by emphasizing making, precision, experimentation, iteration, and judgment. Students develop an awareness of the built environment and learn to communicate design ideas. Instructional methods involve individual and small group desk critiques, plus substantial out-of-class work by each student. Spring. Prerequisite: LSA 182 or permission of instructor.

LSA 227 Foundation Design Studio II (4)

Seven hours of studio and one hour of lecture per week. This course aims to help students refine their design sensibilities, including fieldwork observation and recording, critical design and spatial thinking, and graphic representation skills in the elaboration of small scale landscape architecture projects. Project assignments will identify key issues of conceptual and practical concern to landscape designers and build comprehensively toward a final, synthetic body of work. Instructional methods involve individual and small group desk critiques, plus substantial out-of-class work by each student. Fall Prerequisite: LSA 226

LSA 233 Plants in the Landscape (3)

Two hours of lecture and three hours of field identification lab per week. Course provides an introduction to the identification, site requirements, natural and cultural history, community ecology, and landscape value of native and exotic woody and herbaceous plant materials typical of landscape architectural practice. Field identification labs include on-campus site walks and trips to local gardens, arboreta and natural areas to demonstrate the use of plants in designed and ecological settings. Fall.

LSA 300 Digital Methods & Graphics I (3)

Three hours of lecture per week. Through active participation, students learn to produce 2D digital graphics and documents (posters, reports, presentations and e-docs). Content includes image processing and vector drawing; document assembly for print, viewing and electronic distribution; and general concepts of digital workflow management. Credit will not be given for both LSA 300 and LSA 500. Fall. Prerequisite: Undergraduate standing in Landscape Architecture, Natural History and Interpretation or permission.

LSA 301 Landscape Representation II (3)

Three hours of lecture per week. This course introduces modeling strategies to address landscape specific-phenomena, provoked by an examination of the unique temporal, spatial, and speculative representative methods which are instigated by digital media. Coursework will focus on the fundamental relationship between landform and the dynamic landscape processes embodied within terrain, inviting students to invent and implement experimental computation workflows. 2D and 3D visualization technologies used in this course include: GIS-based mapping, typological diagramming, and rendered perspective. Digital fabrication technologies used in this course include: laser cutting, CNC routing, and 3D printing. Fall Credit will not be given for both LSA 301 and LSA 501. Prerequisite: LSA 201

LSA 305 History/Landscape Arch I (3)

Three hours of lecture per week. This course offers a survey of landscape architecture and urban design in the context of the cultural history of the western world. Prior to taking this class, students should have passed at least one semester of college-level art (LSA 206) or architectural history.

LSA 311 Natural Proc-Design&Plan (3)

Three hours of lecture per week. An overview of basic principles and processes of physical and biological landscape systems with respect to their roles in landscape design and planning. Emphasizes landform, soil, slope, hydrology, climate, energy and general ecological issues as common elements influencing landscape design and the land use decision-making process. Sources and uses of environmental data are discussed. Fall. Note: Credit will not be granted for both EST 311 and LSA 311.

LSA 321 Ecol Appl/Plng & Design (3)

Three hours of lecture per week. Overview of basic principles and processes of biophysical landscape systems as well as concepts from ecology and landscape ecology with respect to their roles in sustainable landscape design and planning. Emphasis on applying theory to guide socio-ecological resilient planning and design decision making. Spring Prerequisite(s): Junior standing in the Bachelor of Landscape Architecture program or permission of the instructor.

LSA 322 Landscape Systems I (3)

Three hours of lecture/discussion per week. Overview of basic principles and processes of biophysical landscape systems as well as concepts from ecology and landscape ecology with respect to their roles in sustainable landscape design and planning. Emphasis on applying theory to guide socio-ecological resilient planning and design decision making. Spring.

LSA 323 Landscape Systems II (3)

Two hours of lecture and three hours of lab. Advanced methods for regional-scale landscape planning using geographic information system (GIS) technology to apply ecological principles, land use analysis and landscape planning frameworks. Fall.

LSA 326 Land Arch Dsgn Studio I (5)

Seven hours of studio and one hour of lecture per week. This course will instruct those enrolled in the processes of measuring various physical qualities of a site or landscape, and then how to apply knowledge of ecology, natural processes, and human behavior and culture to assess the viability of potential design uses and forms. The material addressed will include land measurement and measurement systems, physiography and landform, soils, hydrology, climate, and plant, animal and human ecology. A variety of manual and computer techniques for data collection, analysis and synthesis of natural and cultural systems information will be explored. The course will concentrate on the comparison of synthesis techniques and their use in land use and site design decision-making. Occasional local field trips will be utilized. Fall. Prerequisites: LSA 182, LSA 226, LSA 227 and LSA 311 (or their equivalent) with grades of "C" or better, or permission of instructor.

LSA 327 Land Arch Dsgn Studio II (5)

Seven hours of studio and one hour of lecture per week. This course addresses intermediate to advanced level site design, including skill development, theory and strategies as they relate to design issues and process. Emphasis is placed on in-depth investigation of concept and form expression in small-scale site design. Focus is on the form implications of applying specific materials, plantings and structural systems through design development and detailing. Occasional field trips to illustrate various design solutions. (Student field trip and materials expenses $300-$400). Prerequisite: LSA 326 with a minimum grade of "C" or better, or permission of instructor. Co-requisite: LSA 342.

LSA 333 Plant Materials (2)

One hour of lecture followed by three hours of field identification lab per week. Course provides an introduction to the identification, site requirements, natural and cultural history, community ecology, and landscape value of native and exotic woody and herbaceous plant materials typical of landscape architectural practice. Field identification labs include on-campus site walks and trips to local gardens, arboreta and natural areas to demonstrate the use of plants in designed and ecological settings. Fall.

LSA 342 Land Arch Construct Tech (4)

Three hours of lecture and three hours of studio/laboratory per week. Lectures, project, and assigned readings. This course provides an introduction to important site construction basics, including landscape grading and landform manipulation. Topics addressed will include appropriate slopes for various site uses, surface and subsurface drainage, principles of cut/fill analysis, pedestrian and vehicular circulation design, horizontal and vertical road alignment, storm water management, and soil erosion control. Appropriate methods and technologies will be demonstrated through studio projects and exercises. Spring. Prerequisite: College math (with algebra and trigonometry), LSA 326, or permission of instructor.

LSA 343 Landscape Materials&Structures (3)

Three hours of lecture and discussion per week. This course introduces the properties of various "hardscape" design materials used in landscape architectural construction, as well as the appropriate structural systems and design detailing typical for design elements. Occasional local field trips. Spring.

LSA 422 Land Arch Dsgn Studio III (5)

Seven hours of studio and one hour of lecture per week. This course introduces and applies concepts urban and regional planning, environmental planning, and landscape ecology, in the context of large-scale landscape architectural, community, and urban design. Emphasis will be placed upon the application of appropriate technologies and strategies to foster environmentally and economically sustainable community forms, as well as greater environmental and social equity. Occasional field trips to illustrate various design solutions. (Student field trip and materials expenses $300-$400). Fall. Prerequisites: LSA 327 with a minimum grade of "C" or better, or permission of instructor.

LSA 423 Land Arch Dsgn Studio IV (5)

Seven hours of studio and one hour of lecture per week. LSA 423 addresses the final refining stages of small-scale site design, design detailing, precise layout and grading, selection of individual plant specimens and other materials, and the production of "working drawings" or contract documentation. Projects will include development of a complete set of working "contract documents," including layout plans, grading plans, planting plans and design details and specification. Occasional field trips to illustrate various design solutions. (Student field trip and materials expenses $300-$400). Spring. Prerequisite: LSA 422 with a minimum grade of "C" or better, or permission of instructor.

LSA 424 Prep:Off-Camp Des Studio (1)

One hour of lecture and discussion per week. The initial orientation and exploration of suitable landscape architecture or environmental studies topics for study during LSA 460. Students will tentatively select topics, form off-campus groups and be assigned a faculty advisor. Fall. Prerequisite: Senior BLA standing, or permission of instructor.

LSA 425 Orient:Off-Camp Dsgn Studio (3)

Three hours of lecture and/or discussion per week. The initial orientation and exploration of suitable landscape architecture or environmental studies topics for study during LSA 460. Students undertake a detailed literature review, identify and refine research/study methods and prepare a detailed study proposal, including logistical details for LSA 460 (Off-Campus Design Thesis Studio). Spring. Prerequisite: LSA 424 and senior BLA standing, or permission of Off-Campus Program Director.

LSA 433 Planting Design&Practice (3)

Two hours of lecture and three hours of lab/studio exercises per week. This course provides foundations for the selection, specification, and arrangement of plants in landscape architectural design. Plants are addressed as a critical medium and as central characters to explore contemporary landscape representation, design, and construction. Students study botanical, horticultural, and ecological aspects of plants and plant communities, including form, expression, environmental responses, and time-based cycles of phenology, ephemerality, and maintenance. Projects help fortify links between design intent and spatial expression to reinforce conceptual approaches to planting design that account for plants' aesthetic, experiential, and infrastructural roles. Fall. Prerequisite: LSA 333 or permission of instructor. Note: Credit will not be granted for both LSA 433 and LSA 633.

LSA 451 Comprehensive Land Plan (3)

Three hours of lecture per week. Introduction to the planning process including survey and analysis techniques, the comprehensive plan, political context, and land use controls. Selected functional planning areas such as land use, environmental, growth management, regional planning, and economic development planning. Legal and historical basis. Spring. Prerequisite: LSA 311 or permission of instructor. Note: Credit will not be granted for both LSA 451 and LSA 651.

LSA 455 Prof Prac/Lndscpe Arch (3)

Three hours of lecture per week. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations, and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing, and continuing education. Spring. Prerequisites: Upper division standing in landscape architecture or permission of the instructor. Note: Credit will not be granted for both LSA 455 and LSA 655.

LSA 458 Off-Camp:Adv Visit,Wkly Rpts (4)

Twelve hours of individual field study per week conducted in an international or domestic location. Short field studies executed through on-site observation, sketching and analysis exercises. Study progress is communicated through weekly reports to an advisor and presented during the advisor's visit, the fifth week of the Off-Campus semester. Summer or Fall. Prerequisites: LSA 423 and LSA 425 with a minimum grade of “C”. Co-requisites: LSA 459, LSA 460.

LSA 459 Off-Camp:Dsgn Journal/Proj Ntb (4)

Twelve hours of individual field study per week conducted in an international or domestic location. Field observations and travel experiences documented through daily graphic and narrative entries in a design journal/sketchbook. Thesis project studies and research documented through daily entries in a project notebook. Summer or Fall. Prerequisites: LSA 423 and LSA 425 with a minimum grade of “C”. Co-requisites: LSA 458, LSA 460.

LSA 460 Off-Camp:Thesis Project (7)

Twenty-one hours of individual field research and studio per week conducted in an international or domestic location. The completion of a thesis project as delineated in a proposal prepared by the student and approved by the Off-Campus faculty advisor in LSA 425. Summer or Fall. Prerequisites: LSA 423 and LSA 425 with a minimum grade of "C". Co-requisites: LSA 458 and LSA 459.

LSA 461 Off-Camp Final Present Sem (1)

One hour of seminar per week. Seminar time devoted to individual presentations and critique. Content focuses on individual projects undertaken as a component of LSA 460. Spring. Prerequisite: LSA 460.

LSA 470 Thematic Land Dsgn Studio (6)

Eight and one-half hours of studio and one hour of lecture per week. Studio time devoted to demonstrations, exercises and projects. Content focuses on different themes, topics, and scales each year, traditionally addressing sub-disciplines in landscape architecture such as urban design, community design and planning, ecological design and restoration and cultural landscape preservation. Spring. Prerequisite: LSA 423 or permission of the instructor. Note: Credit will not be granted for both LSA 470 and LSA 670.

LSA 480 Seminar:Urban Design (3)

Three hours of seminar per week. This course is an exploration of literature and case studies that address the history, theories, principles and practice of 19th and 20th century North American and European urban design. The format includes readings, discussion and presentations, papers, and a three-day field trip. Fall. Prerequisite: Permission of instructor. Note: Credit will not be granted for both LSA 480 and LSA 680.

LSA 495 Undergrad Exp/College Teaching (1-3)

Undergraduate Experience in College Teaching. An opportunity for 4th year senior or 5th year students to gain experience in fully supervised, college-level teaching similar to what they can expect to perform as a graduate teaching assistant. Students assist the course instructor in the preparation and presentation of studio or lecture material in an undergraduate course. A maximum of 6 credit hours of LSA 495 and 3 credit hours relating to any single assisted course. Fall, Spring, Summer. Prerequisite(s): 4th year senior or 5th year standing, a grade of B or higher in course being assisted, consent of instructor and minimum cumulative GPA of 3.0.

LSA 496 Spec Topics/Lndscpe Arch (1-6)

One to three hours of class meetings per week. Special topics of current interest to undergraduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Fall and Spring. Prerequisite: Permission of instructor. Note: Credit will not be granted for the same topic in LSA 496 and LSA 696.

LSA 498 Intro Research Problems (1-3)

Guided study of a selection of problems relating to landscape architecture and environmental design. Emphasis on study procedure and methods employed. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Permission of instructor.

LSA 499 Undergrad Land Arch Internship (1-12)

Supervised office or field experience in a professional working environment. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisites: BLA students only with an approved internship proposal.

LSA 500 Digital Methods & Graphics I (3)

Three hours of lecture per week. Through active participation, students learn to produce 2D digital graphics and documents (posters, reports, presentations and e-docs). Content includes image processing and vector drawing; document assembly for print, viewing and electronic distribution; and coordination of workflow in team-based production settings. Prerequisite: Graduate standing in Landscape Architecture, Environmental Interpretation or permission. Note: Credit will not be given for both LSA 300 and LSA 500. Fall.

LSA 501 Landscape Representation II (3)

Three hours of lecture per week. This course introduces modeling strategies to address landscape specific-phenomena, provoked by an examination of the unique temporal, spatial, and speculative representative methods which are instigated by digital media. Coursework will focus on the fundamental relationship between landform and the dynamic landscape processes embodied within terrain, inviting students to invent and implement experimental computation workflows. 2D and 3D visualization technologies used in this course include: GIS-based mapping, typological diagramming, and rendered perspective. Digital fabrication technologies used in this course include: laser cutting, CNC routing, and 3D printing. Credit will not be given for both LSA 301 and LSA 501. Prerequisite: LSA 500

LSA 552 Graphic Communication (3)

Two three-hour studios and one one-hour lecture per week. Studio time devoted to demonstrations, exercises, and projects focusing on sketching, drafting, drawing construction and rendering techniques used in the landscape architecture field. Introduction to drawing reproduction and technologies. Emphasis on skill development, use of graphics in the design process. Drawings, examinations and a final project constitute basis for grades. Fall. Prerequisite: Graduate status in landscape architecture or permission of instructor.

LSA 577 Cultural&Hist Perspctvs in VRM (3)

Online synchronous. Three hours of lecture and discussion per week. Survey of historical context and cultural influences in visual resource management. Course discussions will explore the role of environmental and cultural ethics, and community engagement in assessment, protection and management of visual resources. Through case studies, students will examine past and present priorities in visual resource management. Fall semester; Spring and Summer as needed.

LSA 578 The Reg&Ethical Context of VRM (3)

Online synchronous. Three hours of lecture and discussion per week. This class covers the legal and regulatory framework that governs visual resource management methods and the application of these methods to the assessment of proposed projects. Students will gain an overview of current regulations and learn how to satisfy legal and ethical requirements in a variety of situations. Case studies that present visual impact projects across an array of scales and contexts will serve as a framework for studying the application of methods, assessments, and outcomes. Fall semester; Spring and Summer as needed.

LSA 579 Visual Resrce Mgt Sys&Methods (3)

Online synchronous. Three hours of lecture and discussion per week. This class covers the methods and systems used in the compilation of visual impact assessments. Students will learn to identify landscape features that contribute to the prediction of changes to scenic beauty that may result from management and/or development activities. Case studies will explore the application of visualization methods that illustrate proposed project alternatives, evaluate the expected visual change caused by a project, assess public reaction to the expected change, identify visual impacts, and recommend measures to avoid, minimize or mitigate adverse visual impacts. Students will gain experience in each of these methods through class assignments. Spring semester; Fall and Summer as needed.

LSA 581 Intro/Hist Presrv&Cultrl Lndsc (3)

An introduction to historic preservation planning (heritage conservation), a multi-disciplinary practice that seeks to sustain physical resources in the environment that convey history and define a sense of place. The course focuses on the application of historic preservation to natural and cultural resources as embodied in landscapes. Five main topics are covered: 1. Introduction to cultural landscapes and history of historic preservation as part of the American conservation movement; 2. Historic preservation laws, regulations, policies, and incentive programs; 3. Overview of advocacy organizations; 4. Inventory and evaluation of historic resources using the National Register of Historic Places and National Park Service cultural landscape program methods; and 5. Design guidelines for the treatment of historic resources using the Secretary of the Interior's Standards. Weekly readings and a semester project are required. Fall.

LSA 596 Spec Topics/Lndscpe Arch (1-3)

Experimental or special coursework in landscape architecture for graduate and undergraduate students. Subject matter and method of presentation vary from semester to semester. Fall and Spring. Prerequisite: Permission of instructor.

LSA 600 Design Studio I (4)

Nine hours of studio and one hour of lecture/discussion per week. The first in a sequence of studios focusing on the concepts, skills and methods of design. This course introduces students to the basic vocabulary of theoretical design principles, to the application and operation of these in the physical environment, and to the development of three-dimensional spatial concepts in community scale patterns. The requirements for the course include readings, examinations, field trips, design exercises and projects. Fall. Prerequisite: Graduate status in landscape architecture or permission of instructor.

LSA 601 Design Studio II (4)

Five hours of studio and one hour of lecture per week. The second in a sequence of studios applying the concepts, skills and methods of design in a critical analysis of various natural and human systems in community scale environments. Concentration is on the evaluation of options concerning a variety of land use activities, with special emphasis on landscape analysis and the functional and spatial quality of built environments. The requirements for this course include readings, examinations, field trips, design exercises and projects. Spring. Prerequisites: Graduate status in landscape architecture and LSA 600, LSA 552, or permission of instructor.

LSA 605 History of Landscape Arch (3)

Three hours of lecture per week. Historical study and style analysis of Western culture on environmental design, and changing attitudes and relationships to the environment. Non-Western influences on Western culture. Study of historical personalities as well as periods that are of environmental concern up to the modern period. Additional readings and a supplementary research/writing component. Spring. Note: Credit will not be granted for both LSA 405 and LSA 605.

LSA 611 Natural Factors Analysis (3)

Two hours and 40 minutes of lecture and one hour of discussion per week. This course addresses basic principles and processes of physical landscape systems with respect to their roles in landscape design and planning. Sources and uses of environmental data are discussed and illustrated. An emphasis is placed on landform, soil, slope, hydrology, climate and general ecological issues as common elements influencing landscape design and the land use decision making process. Fall. Prerequisite: Graduate status in landscape architecture or permission of instructor.

LSA 615 Site Construction (3)

One hour of lecture and six hours of studio per week. This course provides an introduction to important site construction basics, including landscape grading and landform manipulation to achieve appropriate slopes for use and positive surface drainage, principles of cut/fill analysis and subsurface drainage, horizontal and vertical alignment for road design, storm water management, and soil erosion control. Appropriate analysis methods and technologies will be employed through studio projects and exercises. Spring. Prerequisite: Graduate status in landscape architecture, concurrent enrollment in LSA 601 or permission of instructor.

LSA 620 Design Studio III (4)

One hour of lecture and nine hours of studio per week. This course is the third in a sequence of landscape architectural design studios. It focuses on advanced issues in site design and on the integration of project programming and design development into the design process. Concentrations include detailed designing for site layout, grading, storm water management, interior and exterior planting, site furnishing, and site lighting. Design exploration and project communication techniques are pursued such as CAD, reprographics, and computer-based visual simulation. Course requirements include readings, field trips, exercises, and design projects. Fall. Prerequisites: Graduate status in landscape architecture, LSA 601, LSA 611, LSA 615, or permission of instructor.

LSA 625 Orient/Experientl Studio (2)

This course includes two hours of lecture and discussion per week. It is an exploration of cultural, logistical and academic issues relevant to a research, internship or self-directed study experience abroad. The format also includes research and readings. Open to MLA and MS candidates. Spring.

LSA 632 Plants and Landscapes (2)

Five hours of instruction per week for eight weeks. This course provides an introduction to the identification and use of native and exotic plants typical of landscape architectural practice. It also introduces students to a range of landscape contexts ranging from natural areas to urban settings and establishes a foundation for the discussion of the social, historical and ecological themes and issues of each. Field trips required. Fall. Prerequisite: Entering MLA status or permission of the instructor.

LSA 633 Planting Design&Practice (3)

Two hours of lecture and three hours of lab/studio exercises per week. This course provides foundations for the selection, specification, and arrangement of plants in landscape architectural design. Plants are addressed as a critical medium and as central characters to explore contemporary landscape representation, design, and construction. Students study botanical, horticultural, and ecological aspects of plants and plant communities, including form, expression, environmental responses, and time-based cycles of phenology, ephemerality, and maintenance. Projects help fortify links between design intent and spatial expression to reinforce conceptual approaches to planting design that account for plants' aesthetic, experiential, and infrastructural roles. Fall. Prerequisite: LSA 632 or permission of instructor. Note: Credit will not be granted for both LSA 433 and LSA 633.

LSA 640 Research Methods (3)

Three hours of seminar per week. Students learn skills for: (1) performing scholarly activities associated with learning what is known about topics, (2) using accepted methods for producing new knowledge which possesses qualities of validity and reliability, and (3) preparing documents which meet expectations for academic rigor. Parallels between scholarship, research and design are emphasized. Spring. Prerequisite(s): Graduate standing in DLA graduate programs in Landscape Architecture or permission of the instructor.

LSA 645 Construct Document Studio (3)

Six hours of studio and one hour of lecture per week. This course covers the production of traditional contract documents for bidding and construction of landscape architectural projects. Taught as a shared resource with LSA 445, students enrolled in LSA 645 participate in a separate studio section. Spring. Note: Credit will not be granted for both LSA 445 and LSA 645.

LSA 650 Behavr Factor/Comm Desgn (3)

Three hours of lecture and discussion per week. An introduction to the contribution of the behavioral sciences to community design and planning is provided. Readings and discussions concern both theoretical and methodological aspects. Case studies are used to illustrate a variety of current behavioral science applications. Course assignments familiarize the student with basic behavioral science methods including questionnaires, observations and interviews. A final project provides an opportunity to synthesize course materials. Fall or Spring. Prerequisite: Graduate status in landscape architecture or permission of instructor.

LSA 651 Comprehensive Land Plan (3)

Three hours of lecture per week. Survey of urban planning and design and environmental management in terms of contemporary challenges; legal, technological, administrative and political processes; human and ecological processes; the role of design; case studies, and current and projected best practices. Lectures, readings, discussions and presentations. Required field trip. Spring. Note: Credit will not be granted for both LSA 451 and LSA 651.

LSA 655 Prof Prac/Lndscpe Arch (3)

Three hours of lecture per week. This course examines the historic and contemporary modes of landscape architectural practice including practice types, ethics, operations and client systems. Particular emphasis is given to the projected trends of professional practice and with impact on future roles for the landscape architect. Professional development is reviewed as it relates to internship, licensing and continuing education. Students enrolled in LSA 655 will also produce a graduate project portfolio. Spring. Prerequisite: Graduate status in landscape architecture or permission of instructor. Note: Credit will not be granted for both LSA 455 and LSA 655.

LSA 670 Thematic Land Dsgn Studio (6)

Eight and one-half hours of studio and one hour of lecture per week. Studio time devoted to demonstrations, exercises and projects. Content focuses on different themes, topics, and scales each year, traditionally addressing sub-disciplines in landscape architecture such as urban design, community design and planning, ecological design and restoration and cultural landscape preservation. Additional readings and a supplementary research/writing component. Spring. Prerequisite: LSA 423 or permission of instructor. Note: Credit will not be granted for both LSA 470 and LSA 670.

LSA 680 Seminar:Urban Design (3)

Three hours of seminar per week. This course is an exploration of literature and case studies that address the history, theories, principles and practice of 19th and 20th century North American and European urban design. The format includes readings, discussion, oral presentations, papers and a three-day field trip. This course fulfills the seminar requirement for students in the Community Design and Planning area of study. Fall. Prerequisite: Permission of instructor. Note: Credit will not be granted for both LSA 480 and LSA 680.

LSA 696 Spec Topics/Lndscp Arch (1-6)

One to three hours of class meetings per week. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Additional readings, supplementary research and writing assignments. Fall and Spring. Prerequisite: Permission of instructor. Note: Credit will not be granted for the same topic in LSA 496 and LSA 696.

LSA 697 Topics+Issues/Land Arch (1)

Two hours of lecture and discussion every other week. Topics for discussion are selected to acquaint the entering graduate student with a generalized view and current issues facing landscape architects. Fall. Pre- or co-requisite: Audit LSA 220 and graduate status in landscape architecture or permission of instructor.

LSA 699 Land Arch Internship (1-12)

Internships provide students with a supervised field experience to apply and extend their academic abilities in a professional working environment. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisites: Fast Track BLA/MS status and written approval of an internship contract by major professor, curriculum director and field supervisor.

LSA 700 Design Studio V (4)

One hour of lecture and nine hours of studio per week. This studio requires the integration of design/planning processes, research methods and information, and technical skills through focus on large-scale, community-based or multicommunity-based projects. Studio work will require individual and teamwork, as well as consideration of multidisciplinary contributions and interdisciplinary work. This studio is the final studio for all MLA students. Fall. Prerequisite: LSA 621 or permission of instructor.

LSA 760 Off-Camp Experient Studio (12)

This course involves research, internship or self-directed study abroad with faculty guidance. Activities include field analysis, research, documentation, or directed fieldwork based on faculty-approved student proposals. Immersion in the host culture is a required aspect of this course. A final report is required. The course is open to MLA and MS candidates. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Summer and Fall. Prerequisites: LSA 625 and LSA 799 with a grade of B or better. Note: Credit will not be granted for both LSA 460 and LSA 760.

LSA 796 Topics In Landscape Arch (1-3)

One to three hours of lecture per week. Special topics of current interest to graduate students in landscape architecture and related fields. A detailed course subject description will be presented as a topic area is identified and developed. Prerequisite: Permission of instructor.

LSA 798 Research Problem (1-12)

Special study of assigned problems relating to landscape architecture or planning, with emphasis on critical thinking. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Permission of instructor.

LSA 799 Capstone/Thesis Prop Dev (3)

One hour of lecture/seminar and two hours of tutorial per week. Students develop and defend a proposal for their MLA capstone projects or MS thesis. Fall or Spring. Prerequisite: LSA 640 or permission of instructor.

LSA 800 Capstone Studio (6)

One hour of lecture/seminar and 15 hours of studio per week. Students complete an academic landscape architecture investigation or professional-level project. Public presentations and comprehensive project documentation are required. Grades on an "S/U" basis. This is the final MLA studio prior to graduation. Fall or Spring. Prerequisite: LSA 799.

LSA 898 Professional Experience (1-12)

A supervised external professional work experience that satisfies Option 2 of the master's study integration requirement. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Graded on an "S/U" basis. Fall, Spring and Summer. Prerequisites: Formation of committee, approval of proposed experience by committee, and the sponsor of the professional experience.

LSA 899 Masters Thesis Research (1-12)

Research and independent study for the master's degree and thesis. Graded on an "S/U" basis. Fall, Spring and Summer.

MCR - MICROSCOPY

MCR 480 Fundamentals of Microscopy (3)

Three hours of lecture/demonstration per week. Introduction to light microscopy, electron microscopy, atomic force, confocal, Raman, Near Field Optical, Correlative and other microscopic methods and their newest applications. Light microscopic techniques include brightfield, phase contrast, polarized light, Nomarski, Kohler illumination. Imaging and recording methods. Fall. Note: Credit will not be granted for both CME 480 and CME 680

MCR 484 Scanning Electron Microscopy (3)

Two hours of lecture/three hours of laboratory/ demonstration per week. Theory and operation of the scanning electron microscope, awareness of specimen preparation techniques, digital imaging, and interpretation of micrographs. Fall.

MCR 485 Trans Electron Microscopy (3)

Two hours of lecture/ three hours of laboratory/ demonstration per week. Theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Spring.

MCR 570 Med&Industrl Apps/Electron Mic (3)

Three hours of lecture/demonstration per week. Scanning and transmission electron microscopy applications in the medical, petroleum, polymer, solar, forensic, glass, pulp and paper and other industries. Sample preparation; image collection, interpretation and analysis. Safety, calibration, and quality control techniques. Spring.

MCR 580 Microtechnique of Wood (3)

Three hours of laboratory per week. Instruction on the use of the sliding mcirotome to slice thin sections of wood for light microscopy and for sample surface preparation of wood for scanning electron microscopy. Care of the microtome blade, staining of wood sections and preparation of micrsocope slides. Fall or Spring

MCR 585 Light Microscopy/Rsrch Appl (3)

Two hours of lecture/three hours of laboratory per week. Principles of light microscopy and photomicrographic digital imagery using Spot camera and Image Pro 7.0 software. Extensive laboratory component. Spring. Prerequisite: Permission of instructor

MCR 590 IT100 for Exp. Users (1)

Operation and theory of the IT100LA scanning electron microscope restricted to users with prior experience on a scanning electron microscope, and tailored to specific research needs of the user. Spring/Fall. Prerequisites: MCR 484, MCR 783 or equivalent prior SEM experience. Professor consent is required to register for this course.

MCR 680 Fundamentals of Microscopy (3)

Three hours of lecture/demonstration per week. Introduction to light microscopy, electron microscopy,atomic force, confocal, Raman, Near Field Optical, Correlative and other microscopic methods and their newest applications. Light microscopic techniques include brightfield, phase contrast, polarized light, Nomarski, Kohler illumination. Imaging and recording methods. Fall.

MCR 682 TEM for Nanoparticle Rsrch (2)

Two hours of lecture/laboratory/demonstration plus two hours of individual laboratory per week. Theory and operation of the transmission electron microscope, specimen preparation for nanaopartical imaging, photographic technique and interpretation of micrographs. Fall or Spring.

MCR 683 Operation/Trans Electron Micro (3)

Two hours of lecture/ 3 hours of demonstration/laboratory per week. Theory and operation of the transmission electron microscope, including specimen preparation, digital imaging, and interpretation of micrographs.

MCR 685 Trans Electron Microscopy (5)

Two hours of lecture/two hours of laboratory/ demonstration/four to six hours of individual laboratory per week. The theory and operation of the transmission electron microscope including specimen preparation, photographic technique and interpretation of micrographs. Preparation of a portfolio of biological and non-biological specimens demonstrating a variety of techniques. Spring.

MCR 783 Operation/Scan Electron Micro (3)

Two hours of lecture/three hours of demonstration/ laboratory per week. Theory and operation of the scanning electron microscope, including specimen preparation, digital imaging, and interpretation of micrographs. Fall.

PSE - PAPER SCIENCE AND ENGINEERING

PSE 200 Intro to Papermaking (3)

Three hours of lecture per week. Historical and commercial consideration of the paper industry. Topics include wood handling, pulping, stock furnish, stock preparation and paper machine operation. Introductory discussions of papermaking technology, materials and paper making processes including environmental aspects. Fall.

PSE 201 Art &Early History/Papermaking (3)

Two hours lecture per week and three hours of studio. This papermaking course provides a historical (Asia - far east) and artistic perspective in both lecture and studio formats. History lectures will include the influence of paper in non-western cultures as a practical medium for human communication and as a versatile medium for expression of various paper art forms. Studio sessions will vary but generally will focus on historical papermaking by hand using non-western techniques and those paper art forms of far eastern origin. More modern techniques in the creation of paper art forms will also be explored in studio sessions. Spring

PSE 202 Pulp&Paper Lab Skills (1)

Three hours of laboratory per week provide a working knowledge of fundamental papermaking concepts. "Survival" skills learned enable students to perform well in subsequent PSE courses as well as summer employment. Operations and skills include: pulp preparation and analysis, papermaking, paper testing, report writing and team work. Spring. Pre- or co-requisite: PSE 200 (concurrent registration).

PSE 223 Intro to Lignocellulosics (4)

Three hours of lecture and three hours of laboratory per week. Topics included: structure and chemistry of lignocellulosic materials such as wood, including bark, agriculture residues, and grasses; major (cellulose, hemicelluloses, lignin) and minor constituents (extractives, proteins, ash); biosynthesis, distribution, structure, properties, conversion into energy, chemicals, and other products. Spring. Pre-requisite: One semester of organic chemistry.

PSE 296 Special Topics in Engineering (1-3)

Provides experimental, interdisciplinary, or special coursework at the freshman and sophomore levels within the field of environmental resources engineering. Subject matter and course format vary from semester to semester and section to section. Fall and Spring.

PSE 304 Professional Internship (1)

Twelve weeks full time employment approved by the department with an industrial or research partner acquired through on-campus interviews or other means. The student and the supervisor set goals and expectations for the internship. The students and supervisors also provide feedback on the performance of the student. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Summer.

PSE 305 Professional Co-op (1)

A semester of full-time employment approved by the department with an industrial or research partner acquired through on-campus interviews or other means. The student and the supervisor set goals and expectations for the co-op. The students and supervisors also provide feedback on the performance of the student. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall and Spring.

PSE 306 Professional Synthesis (1)

Students will develop a synthesis of their work experience from either PSE 304 or PSE 305 and present their results both orally and in a written report. Fall or Spring.

PSE 350 Fiber Processing (3)

Two hours of lecture, three hours of laboratory per week. Discussion of the principles of operation and the basic chemistry used in pulping, bleaching, and deinking processes. Transport and physical operations involved in fiber procurement, preparation, pulping, dispersion, washing, screening and refining are presented. Principles of operation of pulp mill equipment are reviewed and demonstrated in the laboratory. Spring. Prerequisites: PSE 200, PSE 223 or FCH 223. Note: Credit will not be granted for both PSE 350 and PSE 550.

PSE 436 Pulp & Paper Unit Operations (3)

Two hours of lecture and three hours of laboratory per week. Applications of momentum, heat, and mass transfer to operations in the pulp and paper industry. Topics include pulp flow, heater and heat exchanger design, black liquor evaporation, humidification, steam systems, paper and pulp drying, gas absorption, pulp washing, leaching, and extraction. Laboratory exercises include paper drying, pulp washing and cleaning, heat exchanger operations, and gas absorption for liquor preparation. Spring. Prerequisites: PSE 361, PSE 370, PSE 371, BPE 335.

PSE 437 Equip Troubleshooting&Maintenc (3)

Two hours of lecture and three hours of laboratory and/or recitation discussions per week, plus literature study of assigned topics. Provides students with fundamental knowledge in troubleshooting and maintenance of industrial machines, processes and systems used in pulp and paper, bioprocess, and chemical engineering field. Spring and/or Fall. Note: Credit will not be granted for both PSE 437 and PSE 637.

PSE 438 Biorenew Fibrous&Nonfibrs Prod (3)

Three hours of lecture per week. Three credit-hour advanced science course through the topics in the production and properties of lignocellulosic products. Topics cover fibrous products including different paper grades, nanocellulose and cellulose derivatives, and nonfibrous products including products of enzymatic and/or chemical conversion of biomass constituents. Spring and/or Fall. Prerequisite(s): PSE 465 Fiber and Paper Properties and/or PSE 223 Introduction to Lignocellulosics or consent of instructor. Note: Credit will not be granted for both PSE 438 and PSE 638.

PSE 450 Pulping & Bleaching Processes (3)

Two hours of lecture, three hours of laboratory per week plus a critical review of recent literature on assigned topics including a technical write-up and presentation. Discussion of principle and fundamental chemistry in pulping and bleaching processes. Conducted experiments in pulping, bleaching and pulp evaluation. Spring. Prerequisites: PSE 350. Note: Credit will not be granted for both PSE 450 and PSE 650.

PSE 456 Management in Industry (3)

Three hours of lecture per week. Discussion of published approaches to managerial excellence are supplemented with current reports from periodicals, newspapers, and business and human resource oriented websites to prompt discussion of underlying principles of good management. Examples of good and bad results from published examples are used to prompt discussion of current issues in management around the world. Current and retired business managers are invited to guest lecture and share their experience with the students. The correlation between excellent business results and excellence in management of people is included and discussed. Spring. Note: Credit will not be granted for both PSE 456 and PSE 656.

PSE 462 Papermaking Processing I (3)

One hour of lecture, six hours of laboratory per week. Laboratory and pilot-scale study of the papermaking process and paper grade development from customer specifications. Emphasis is on raw material selection, stock preparation, paper machine operations, evaluation of the finished product, and engineering analysis of the stock and paper machine systems. Results are presented in written reports and student seminars. Fall. Prerequisites: PSE 200, ECH 202, PSE 465.

PSE 465 Fiber & Paper Properties (4)

Three hours of lecture and three hours of laboratory per week. Evaluation, study, and discussion of the physical, optical, and chemical properties of fibers, non-fibrous paper additives, and paper. The interrelationships between papermaking fibers, nonfibrous additives, and manufacturing methods, and their effects on the final quality of paper are discussed in correlation with different test methods. Fall. Prerequisite: PSE200 Introduction to Papermaking

PSE 466 Paper Pigment & Barrier Coatng (3)

Three hours of lecture per week. Discussion and study of surface sizing, various pigment coating formulations, and introduction to polymers used in barrier coating. Study of equipment used in coating operations, fundamental principles, and parameters which control their use and the effects on final paper properties. Spring or Fall. Prerequisite: PSE465 Fiber and Paper Properties

PSE 467 Papermaking Wetend Chem (3)

Three hours of lecture per week. Provides the student with the fundamental principles of colloid and surface chemistry as they relate to the interaction of papermaking materials and chemical additives in the wet end of a paper machine system. The topics of retention of fine solids and dewatering are addressed in detail. Application of the various topics presented during the course are made during a pilot paper machine trial. Spring. Note: Credit will not be granted for both: PSE 467 and BPE 310.

PSE 468 Papermaking Processes (6)

One hour of lecture, fifteen hours of laboratory per week. Laboratory study of the papermaking process, with emphasis on operation of the semi-commercial Fourdrinier paper machine. Emphasis is on the fundamentals of pulping, stock preparation, paper machine operation, evaluation of the finished product, and the collection and analysis of data to develop material and energy balances. Results of each paper machine run are evaluated in seminar-type discussions. Spring. Prerequisites: PSE 300, PSE 370, PSE 465. Note: Credit will not be granted for both PSE 468 and PSE 668.

PSE 469 Functional and Nano Additives (3)

Two hours of lecture and three hours of laboratory and/or recitation discussions per week, plus literature study of assigned topics. Provides the student with fundamental knowledge of structure, occurrence and preparation of mineral materials, the concepts of mineralogy -with an emphasis on carbonates, silicates (clay, talcum), titanium dioxide, sulphates, aluminum compounds, as well as pigments. The use of mineral materials in paper making applications. Consideration of ecological and economic aspects in relation to the mineral applications. Spring and/or Fall. Pre- or co-requisites: PSE 465. Note: Credit will not be granted for both PSE 469 and PSE 669.

PSE 478 Papermaking Processing II (2)

Six hours of laboratory/discussions/seminars per week. Semi-commercial study of papermaking processes, continuing the work of PSE 462. Emphasis on the scale-up of paper machine operations based on previous laboratory and pilot scale results, and engineering analysis of the stock and paper machine systems through detailed mass and energy balances. Results are presented in written reports and student seminars. Spring. Prerequisites: PSE 200, ECH 202 Co-requisite PSE 465

PSE 481 Engineering Design (3)

Three hours of lecture per week. Design-project procedure; data sources and development. Application of simulation and computer-aided design to process synthesis and plant layout. Formulation and solution of original design problems. Fall. Prerequisites: ECH 355, PSE 200

PSE 492 Research Practice (3)

One hour of lecture per week and six hours of laboratory and/or recitation discussions, plus literature study of assigned topics, with emphasis on managing and executing a research project in the pulp and paper, bioprocess, chemical and environmental sector. Provides the student with in-depth knowledge of literature and patent search, correct research techniques, research planning, data gathering techniques and reporting. Fall. Note: Credit will not be granted for both PSE 492 and PSE 792. Student needs to register for PSE 498 in Spring for research project execution.

PSE 496 Special Topics (1-3)

Lectures, conferences and discussions. Specialized topics in chemistry, chemical engineering and physics as well as topics pertaining to management as related to the pulp, paper, paperboard and allied industries. Fall and Spring.

PSE 498 Research Problem (1-4)

The student is assigned a research problem in pulping, bleaching, refining, additives, quality control of paper or paper products, or chemical engineering. The student must make a systematic survey of available literature on the assigned problem. Emphasis is on application of correct research technique rather than on the results of commercial importance. The information obtained from the literature survey, along with the data developed as a result of the investigation, is to be presented as a technical report. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer.

PSE 550 Fiber Processing (3)

Two hours of lecture, three hours of laboratory per week. Discussion of the principles of operation and the basic chemistry used in pulping, bleaching, and deinking processes. Transport and physical operations involved in fiber procurement, preparation, pulping, dispersion, washing, screening and refining are presented. Principles of operation of pulp mill equipment are reviewed and demonstrated in the laboratory. Each student will conduct independent study of at least one facet modern pulping processes and equipment and present results during a lecture or laboratory session. Spring. Prerequisites: PSE 200, PSE 223 or FCH 223. Note: Credit will not be granted for both PSE 350 and PSE 550.

PSE 552 Fiber Matrls Recylng&Processes (3)

Two hours of lecture and three hours of laboratory and/or recitation discussions per week, plus literature study of assigned topics. Topics include advanced process operation and calculations for deinking, dispersion, washing, cleaning and bleaching of recycled fiber raw materials including related chemistry used in the paper processing industry. Spring and or Fall.

PSE 561 Engr Thermodynamics (3)

Three hours of lecture per week. Principles of classical thermodynamics applied to engineering practice. First and second laws; heat effects; property functions and their correlation; physical and chemical equilibrium; solutions and mixtures; equations of state. Compressible flow. Electrolyte solutions. Thermodynamic analysis of processes and systems via case studies and computer simulation. Compressible flow and /or thermodynamics of electrolyte solutions. Fall. Credit will not be granted for both PSE 361 and PSE 561 Prerequisites: Physics and Calculus

PSE 570 Prin Mass/Energy Balance (3)

Three hours of lecture per week. Conservation of mass and energy applied to steady-state and dynamic process units and systems. Problem analysis and solution; computational techniques. Thermodynamic data and their use; real vs. perfect gases; steam properties; psychrometry. Computer simulation of steady and non-steady state process systems. Fall. Prerequisites: Physics, Calculus, and General Chemistry. Note: Credit will not be granted for both PSE 370 and PSE 570.

PSE 571 Fluid Mechanics (3)

Three hours of lecture per week. Fluid statics. Principles of mass, energy and momentum balance. Bernoulli's equation. Application to pipe flows, flow measurement and porous media. Movement of particles in fluid media. Rheology of fluids and suspensions typical in the pulp and paper industry (pulps, black liquor, etc.) Filtration and sedimentation of fibrous and particulate suspensions. Characteristics of pumps. Flow systems with economic considerations. Analysis of some papermaking operations such as drainage, dewatering, vacuum dewatering and wet pressing. Fall. Prerequisites: Physics, Chemistry, Calculus. Note: Credit will not be granted for both PSE 371 and PSE 571.

PSE 596 Special Topics (1-3)

Lectures, conferences, discussions and laboratory. Topics in environmental and resource engineering not covered in established courses. Designed for the beginning graduate student or selected upper-division undergraduate. Fall and/or Spring.

PSE 637 Equip Troubleshooting&Maintenc (3)

Two hours of lecture and three hours of laboratory and/or recitation discussions per week, plus literature study of assigned topics. Provides students with fundamental knowledge in troubleshooting and maintenance of industrial machines, processes and systems used in pulp and paper, bioprocess, and chemical engineering field. Spring and/or Fall. Note: Credit will not be granted for both PSE 437 and PSE 637.

PSE 638 Biorenew Fibrous&Nonfibrs Prod (3)

Three hours of lecture per week. Three credit-hour advanced science course through the topics in the production and properties of biorenewable products for graduate students. Topics include fibrous products such as different paper grades; printing and writing paper, paper board, tissue, and specialty papers, and nanocellulose and cellulose derivatives and nonfibrous products such as hemicelluloses, lignin, pectins, extractives and products of enzymatic and chemical conversion of carbohydrates. Independent academic research component required. Spring and/or Fall. Prerequisite(s): PSE 465 Fiber and paper Properties and/or, PSE 223 Introduction to Lignocellulosics or consent of instructor. Note: Credit will not be granted for both PSE 438 and PSE 638.

PSE 650 Pulping & Bleaching Processes (3)

Two hours of lecture, three hours of laboratory per week plus a critical review of recent literature on assigned topics including a technical write-up and presentation. Discussion of principle and fundamental chemistry in pulping and bleaching processes. Conducted experiments in pulping, bleaching and pulp evaluation. Spring. Prerequisite(s): Organic, physical and analytic chemistry. Note: Credit will not be granted for both PSE 450 and PSE 650.

PSE 656 Management in Industry (3)

Three hours of lecture per week. Discussion of published approaches to managerial excellence are supplemented with current reports from periodicals, newspapers, and business and human resource oriented websites to prompt discussion of underlying principles of good management. Examples of good and bad results from published examples are used to prompt discussion of current issues in management around the world. Current and retired business managers are invited to guest lecture and share their experience with the students. The correlation between excellent business results and excellence in management of people is included and discussed. Students will critically review selected literature and present their findings. Spring. Note: Credit will not be granted for both PSE 456 and PSE 656.

PSE 662 Papermaking Processes I (3)

One hour of lecture, six hours of laboratory per week. Laboratory and pilot-scale study of the papermaking process and paper grade development from customer specifications. Emphasis is on raw material selection, stock preparation, paper machine operations, evaluation of the finished product, and engineering analysis of the stock and paper machine systems. Results are presented in written reports and student seminars. Students will engage in independent research projects related to the papermaking process. Fall. Prerequisites: PSE 570, PSE 665.

PSE 665 Fiber & Paper Properties (4)

Three hours of lecture and three hours of laboratory per week. Advanced science course in evaluation, study, and discussion of the physical, optical, and chemical properties of fibers, nonfibrous paper additives, and paper. The interrelationships between fibers and nonfibrous paper additives, and manufacturing methods, and their effects on the final paper quality of paper are discussed. Independent academic research required. Fall. Prerequisite: PSE202 Introduction to Papermaking Note: Credit will not be granted for both PSE 465 and PSE 665.

PSE 666 Paper Pigment & Barrier Coatng (3)

Three hours of lecture per week. Advanced course in materials and processes used in surface sizing, pigment coating, and barrier coating for graduate students. Study of equipment used in coating operations, fundamentals and parameters, which control their use and effects on final paper properties. Independent literature research with report and presentation on a selected topic. Spring and/or Fall. Prerequisite: PSE 465 Fiber and Paper Properties. Note: Credit will not be granted for both PSE 466 and PSE 666.

PSE 667 Colloid&Interface Sci App (3)

Three hours of lecture per week. Provides the student with the fundamental principles of Colloidal and Interface Science as it relates to the interaction of papermaking materials and chemical additives in the wet end of a paper machine system. The topics of retention of fine solids and dewatering are addressed in detail. Spring. Pre- or co-requisite: Physical chemistry.

PSE 668 Papermaking Processes (6)

One hour of lecture and fifteen hours of laboratory per week. Study of the papermaking process from theoretical and practical standpoints featuring the operation of the pilot paper machines. Emphasis is on the fundamentals of stock preparation and paper machine operations, papermaking process and product design, evaluation of the finished product, and the collection and analysis of process data. An independent project is required in conjunction with the undergraduate paper machine runs. Spring. Pre- or co-requisite(s): PSE 300, PSE 370, PSE 665. Note: Credit will not be granted for both PSE 468 and PSE 668.

PSE 669 Functional and Nano Additives (3)

Two hours of lecture and three hours of laboratory and/or recitation discussions per week, plus literature study of assigned topics. Provides the student with fundamental knowledge of structure, occurrence and preparation of mineral materials, the concepts of mineralogy -with an emphasis on carbonates, silicates (clay, talcum), titanium dioxide, sulphates, aluminum compounds, as well as pigments. The use of mineral materials in paper making applications. Consideration of ecological and economic aspects in relation to the mineral applications. Spring and/or Fall. Pre- or co-requisites: PSE465 Note: Credit will not be granted for both PSE 469 and PSE 669.

PSE 677 Process Control (3)

Three hours of lecture per week. Presents an introduction to the principles of process control. Linear analysis, LaPlace transforms, and nonlinear simulation are presented and applied to feedback, and feedforward control. Examples of process simulation, accuracy and stability of control are drawn from paper industry processes. Process identification using numerical techniques and MATLAB. Fall. Prerequisite: Differential Equations. Note: Credit will not be granted for both PSE 477 and PSE 677.

PSE 678 Papermaking Processes II (2)

Six hours of laboratory/discussions/seminars per week. Semi-commercial study of papermaking processes, continuing the work of PSE 662. Emphasis on the scale-up of paper machine operations based on previous laboratory and pilot scale results, and engineering analysis of the stock and paper machine systems through detailed mass and energy balances. Results are presented in written reports and student seminars. Spring. Prerequisites: PSE 570, PSE 665, PSE 662 (or permission of the instructor)

PSE 792 Research Practice (3)

One hour of lecture per week and six hours of laboratory and/or recitation discussions, plus literature study of assigned topics. with emphasis on managing and executing a research project in the pulp and paper, bioprocess, chemical and environmental sector. Provides the student with in depth knowledge of literature and patent search, correct research techniques, research planning, data gathering techniques and reporting. Fall. Note: Credit will not be granted for both PSE 492 and PSE 792. Student needs to register for PSE 798 in Spring for research project execution.

PSE 797 Seminar (1-3)

Discussion of assigned topics in the fields related to Paper Science Engineering. Spring and Fall.

PSE 798 Resrch/Paper Science Engr (1-12)

Independent research topics in Paper Science Engineering. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. Credit hours to be arranged.

PSE 898 Prof Experience/Synthesis (1-6)

A supervised, documented professional work experience in the Master of Professional Studies degree program. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, or Summer. Pre- or co-requisite(s): Approval of proposed study plan by advisor, Faculty, and any sponsoring organization.

PSE 899 Masters Thesis Research (1-12)

Research and independent study for the master's thesis. Fall, Spring or Summer. Credit hours to be arranged.

PSE 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral dissertation. Fall, Spring or Summer. Credit hours to be arranged.

RMS - RENEWABLE MATERIALS SCIENCE

RMS 132 Intro/Renewable Mat Science I (1)

One hour lecture or three-hour lab/field trip per week. Introduction to renewable materials and their utilization as fields of enquiry and as career paths. Introduction to campus resources available to ensure campus success. Credit will not be granted for more than one of BPE 132, PSE 132, or RMS 132.

RMS 133 Intro/Renewable Mat Science II (1)

One hour of lecture or three-hour workshop per week. Introduction to the tools needed for successful learning about renewable materials science, such as the scientific method, calculations, basic statistics, problem solving, ethics, professional responsibility, and internship and co-op requirements. Credit will not be granted for more than one of BPE 133, PSE 133 or RMS 133. Fall.

RMS 200 Renewable Mat&Comp/Lignocell (3)

Two hours of lecture and three hours of laboratory per week; this is an introductory modular course in renewable materials; structure and composition of lignocellulosics/wood; production, properties and use of wood products and wood composites; pulp, paper, packaging, and lignin products; polymers: natural and synthetic. Fall. Prerequisites: Two semesters of General Chemistry Lecture and Lab, Calculus I and II, Two semesters of General Physics and Lab Co-requisite: Organic Chemistry I Lecture and Lab

RMS 322 Wood Machining (3)

Two hours of lecture and three hours of laboratory/discussion per week. Evaluate principles involved in machining wood for production and use as products. Study reasons for and methods of various machining operations. Evaluate relations between the substrate, the surface created, chip formation and the cutting tool. Fall.

RMS 335 Trsprt Properties of Materials (3)

Two lectures/one laboratory per week. Transport phenomena applied to wood and paper. Discussions and demonstrations of the movement of gases and liquids through wood (seasoning and preservation) and paper (drying) and transport of fibers in suspension (pulp slurries). Topics include conduction, convective heat and mass transfer, diffusion in both steady-state and transient situations. Discussion of specific industrial examples. Spring. RMS 387, RMS 388, PSE 370

RMS 376 Decay of Wood Products (3)

Three hours of lecture/laboratory/demonstration per week. Degradation of wood by fungi and other biological agents. Emphasis on the effects of decay on wood properties, methods of decay detection in wood products and decay prevention. Spring. Prerequisite: RMS 387

RMS 387 Renewable Mat/Sustainable Cons (3)

Three hours of discussion, lecture and demonstration per week. Properties and uses of wood and other renewable materials as a major construction materials. Identification and knowledge of the major wood species and their applications in construction. Fall.

RMS 388 Wood and Fiber Ident Lab (2)

Six hours of laboratory per week. Wood and papermaking fiber identification using both gross and microscopic features. Fall.

RMS 422 Composite Mat/Sustainable Cons (3)

Two hours of lecture, three hours of laboratory per week. Properties, manufacture, and design of multiphase materials. Applications and testing for service in sustainable construction systems and life-cycle analysis. Spring. Prerequisite(s): GNE 271, Statics and CME 387, Renewable Materials for Sustainable Construction

RMS 465 Renewable Materials & Surfaces (3)

Study bulk and surface properties of porous materials, including structure, morphology, mechanical, optical, thermal and moisture equilibrium and dynamics. Applications to wood products and wood composites, pulp/paper/packaging products; natural and synthetic polymers. Fall. Pre-requisites: RMS 200 or by instructor's permission

RMS 468 Product Design:Timber or Paper (3)

Independent study. The student demonstrates mastery of RMS principles by producing a new application of those principles to the design and construction of a prototype model. Fall. Senior standing in Renewable Materials Science or permission of instructor

RMS 481 Capstone Project/Senior Thesis (3)

Independent study. Demonstrate mastery of RMS program content by undertaking a project following consultation with the instructor. Required elements are: creative and critical thinking and an ability to analyze data collected/generated by the student, leading to a conclusion that is presented in a written and oral technical report. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Senior standing or permission of instructor. Spring. Senior standing in Renewable Materials Science or permission of instructor

RMS 496 Special Topics (1-3)

Lectures, readings, problems and discussions. Topics in renewable materials science as agreed upon with adviser. Fall, spring or summer. (1-3)

RMS 498 Rsrch Probs/Renew Mats Science (1-4)

Independent work on a research project in renewable materials science as agreed upon with adviser. A literature review, suitable research plan, execution of the research plan, collection of data and presentation in a written report is required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. (1-4).

RMS 587 Renewable Mat/Sustainable Cons (3)

Three hours of discussion, lecture and demonstration per week. Properties and uses of wood and other renewable materials as major construction materials. Identification and knowledge of the major wood species and their applications in construction. Evaluation of current practices and materials. Fall.

RMS 596 Special Topics in RMS (1-3)

Lectures, conferences, discussions and laboratory. Topics in Renewable Materials Science not covered in established courses. Designed for the beginning graduate student or selected upper-division undergraduate. Fall and/or Spring.

RMS 622 Composite Mat/Sustainable Cons (3)

Two hours of lecture, three hours of laboratory per week. Properties, manufacture, and design of multiphase materials. Applications and testing for service in sustainable construction systems and life-cycle analysis. Evaluation of current practices and materials. Spring. Prerequisite(s): GNE 271, Statics, and RMS 387 or RMS 587, Renewable Materials for Sustainable Construction

RMS 796 Advanced Topics in RMS (1-3)

Lectures, conferences, discussions and/or laboratory. Advanced topics in renewable materials science. Fall and/or Spring. Prerequisite: Permission of instructor

RMS 798 Rsrch/Renewable Mat Sci (1-12)

Independent research topics in renewable materials science. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring or Summer. Credit hours to be arranged

RMS 898 Professional Experience (1-6)

A supervised, documented professional work experience in the Master of Professional Studies degree program. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, or Summer. Pre- or co-requisite(s): Approval of proposed study plan by advisor, Faculty, and any sponsoring organization.

RMS 899 Master's Thesis Research (1-12)

Research and independent study for the master's thesis. Fall, Spring or Summer. Credit hours to be arranged.

RMS 999 Doctoral Thesis Research (1-12)

Research and independent study for the doctoral dissertation. Fall, Spring or Summer. Credit hours to be arranged.

SRE - SUSTAINABLE RENEWABLE ENERGY

SRE 150 Intro to Sust Energy Managemnt (1)

1 hour lecture per week. An introduction to the Sustainable Energy Management major and employment opportunities, sustainable energy information resources, and the ESF Syracuse campus's sustainable energy resources and conservation efforts.

SRE 225 Physics of Energy (3)

Three hours of lecture per week. Introduction to the principles of physics and their application in conventional and sustainable energy systems. This course covers the fundamentals of mechanical, chemical, electrical, thermal, and nuclear energy, including efficiency of energy conversions. Fall. Prerequisite: APM 103 or equivalent and enrollment in the Sustainable Energy Management major, or permission of instructor

SRE 298 Rsrch Apprntceshp/Sus Enrg Mgt (1-3)

Students will participate in research projects consistent with their educational and professional goals. A faculty member in the Department of Sustainable Resources Management will serve as the student's faculty sponsor. The student, in consultation with the faculty sponsor, will prepare a study plan outlining the apprenticeship's educational goals. The faculty sponsor will generate a performance assessment and record of activities at the end of the apprenticeship. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Grading Satisfactory/Unsatisfactory. Fall, Spring, Summer. Instructor permission required

SRE 325 Energy Systems (3)

Three hours of lecture per week. The Energy Systems course provides an interdisciplinary overview of human-dominated energy systems. A variety of topics will be covered to introduce students to fossil fuel-based, renewable, and other energy systems, including: energy supply and consumption, extractive approaches, resource demands, environmental impacts and energy security, and quantitative methods related to energy metrics. Students will use systems thinking to evaluate existing and emerging energy systems. The course involves occasional field trips. Fall. Prerequisites: SRE 225 or equivalent introductory physics course, and FCH 110 and FCH 111 or equivalent one semester of introductory chemistry with lab. Note: Credit will not be granted for SRE 325 and SRE 525.

SRE 335 Renewable Energy (3)

Three hours of lecture/discussion per week providing an overview of the role of renewable energy in the context of energy generation and supply. Sustainable sources of heat, power and fuels will be covered and compared in terms of technological, economic and environmental impacts. Spring. Prerequisites: PHY 211, EFB 200, SRE 225 or equivalent one semester of introductory physics. FCH 110 and FCH 111, or equivalent one semester of introductory chemistry with lab. SRE 325 or instructor permission. Note: Credits will not be granted for SRE 335 and 535

SRE 337 Energy Resource Assessment (3)

Three hours of lecture or two hours of lecture and three hours of field visits per week. Evaluation of energy pathways employed in the Northeast U.S. Primary emphasis on the following topics: the economic, environmental, and technical tradeoffs of utility-scale energy pathway; assessments of the economic viability of utility-scale energy pathways.

SRE 416 Sustainable Energy Policy (3)

Three hours of lecture per week. Evaluation of the sustainable energy field as it relates to policy. Primary emphasis on the following topics: policy concerns that motivated the development and expansion of sustainable energy, a history of the policy interactions between sustainable energy pathways, and controversies that have arisen from these interactions and their effects. Prerequisite: SRE 325, SRE 335. Corequisite: SRE 422

SRE 419 Energy Pol Assessmnt Methodlgs (3)

Three hours of lecture per week. This course covers the primary methodologies employed to conduct assessments of energy policies and policy proposals, including techno-economic assessment, deterministic analysis, and stochastic analysis. Students will learn how to select the methodology that is most appropriate for an analytical scenario, conduct assessments using the available methodologies, and select the policies or policy proposals that are most effective at achieving a desired energy policy outcome. Spring. Prerequisites: SRE 335, SRE 416, or FOR333

SRE 422 Energy Markets and Regulation (3)

Three hours of lecture/discussion concerning markets and regulation of energy. Topics include: the economics of energy markets, industry restructuring, and the development of markets for energy efficiency and renewable power. The role and impacts of energy regulation on markets will also be examined. Fall. Prerequisites: SRE 325 Energy Systems Note: Credits will not be granted for SRE 422 and SRE 622.

SRE 441 Biomass Energy (3)

Three hours of lecture per week. Production and use of biomass as a source of renewable energy for the production of bioenergy, biofuels and bioproducts. Characteristics of biomass sources, their conversion to different forms of energy and end products, and an assessments of sustainability. Field trips to regional biomass facilities. Spring. Prerequisites: SRE 325, SRE 335 or consent of instructor

SRE 450 Sustainbl Energy Capstone Plng (1)

One hour group meeting every two weeks, with supervised individual activity per week. This course will afford the student an opportunity to select a topic, in conjunction with the instructor, for detail investigation in Capstone II. Each student will work individually with the instructor to arrive at a feasible project. Prerequisites: SRE 325, SRE 335 Corequisite: SRE 422

SRE 454 Sustainble Energy Fin&Analysis (3)

Three hours of lecture/discussion per week. Focus on issues concerning renewable energy finance and analysis. Topics include: the adoption and financing of renewable energy project within the context of overall economics of energy markets, financial analysis of renewable energy projects, the role of tax and subsidies in promoting the adoption of renewable sources of energy. Prerequisite(s): FOR205 Principles of Accounting (or equivalent) and FOR333 Natural Resources Managerial Economics (or equivalent) or permission of the instructor

SRE 479 Life Cycle Assessment (3)

Three hours of lecture per week. Life cycle assessment (LCA) is a tool used across fields to determine the cradle-to-grave environmental impacts of products and systems. The course will cover how to perform an LCA and how to evaluate LCA results. Students will conduct in groups a full life cycle assessment with a literature review, sensitivity analysis, and uncertainty analysis using available data and impact assessment methods. Fall. Prerequisites: A college-level statistics course, junior or senior standing, or instructor permission.

SRE 481 Advanced Life Cycle Assessment (3)

Three hours of lecture per week. This course covers advanced topics in LCA, focusing on modeling approaches and methods. Topics include advanced life cycle impact assessment methods, consequential and attributional modeling approaches, modeling end-of-life, dynamic LCA, organizational and territorial LCA, and Life cycle management. Spring Credit will not be given for both SRE 481 and SRE 681 Prerequisites: SRE 479 or Instructor's Permission

SRE 491 Sustainable Energy Mgt Capstne (3)

Three hours of lecture/discussion per week. This capstone course emphasizes the assimilation, integration, and interpretation of the physical and socioeconomic sciences. It provides students with the opportunity to integrate skills and knowledge accumulated from professional and supporting coursework. A written comprehensive energy resource plan, also presented orally, provides the central vehicle by which students demonstrate their abilities as future energy resource managers. Spring. Prerequisites: SRE 325, SRE 335, SRE 422, and FOR 333, or Permission of Instructor

SRE 495 Undergrad Exp/College Teaching (1-3)

Undergraduate students gain experience as teaching assistants. They assist the instructor with the teaching and learning experience, assist students with learning course concepts, and mentor students on how to succeed in an undergraduate course. Responsibilities vary by section and instructor. A maximum of 6 credit hours of SRE 495, and 3 credit hours relating to any single assisted course, may apply toward graduation requirements. Fall and Spring. Prerequisite: Prior completion of course to be assisted with grade of B or better. Professor consent is required to register for this course.

SRE 496 Special Topics/Sust Energy Mgt (1-3)

Experimental and developmental courses in new areas of sustainable energy management or areas not covered in regularly scheduled courses. Topics may include but are not limited to the biological, physical, and social dimensions and the many and varied renewable energy resources. Specific detailed course descriptions for each course taught under the SRE 496 designation are available for student perusal. Fall, Spring and Summer.

SRE 498 Ind Study/Sustainable Energy (1-6)

Independent research or study in sustainable energy management/forestry for selected undergraduate students. Selection of subject area, nature of the research or study, and number of credit hours determined by student in conference with appropriate faculty member; initiative in taking SRE 498 rests with the student. Final written report is required for record. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Cumulative GPA of at least 2.50 and approval of the adviser and instructor. Professor consent is required to register for this course.

SRE 499 Internship/Sustainable Energy (1-12)

Full- or part-time engagement as volunteer or employee working for off-campus resource management/forestry/renewable energy organization under guidance of external supervisor. Record of activities and final written report is required for record. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring and Summer. Prerequisite: Junior or Senior status. Must have a cumulative GPA of at least 2.5. Professor consent is required to register for this course.

SRE 525 Energy Systems (3)

Three hours of lecture per week. The Energy Systems course provides an interdisciplinary overview of human-dominated energy systems. A variety of topics will be covered to introduce students to fossil fuel-based, renewable, and other energy systems, including: energy supply and consumption, extractive approaches, resource demands, environmental impacts and energy security, and quantitative methods related to energy metrics. Students will use systems thinking to evaluate existing and emerging energy systems. The course involves occasional field trips. Students taking SRE 525 will be required to complete additional work and held to higher expectations than those taking SRE 325. Fall. Prerequisites: Undergraduate courses in introductory physics and introductory chemistry. Note: Credits will not be granted for SRE 325 and SRE 525.

SRE 535 Renewable Energy (3)

Three hours of lecture/discussion per week providing an overview of the role of renewable energy in the context of energy generation and supply. Sustainable sources of heat, power and fuels will be covered and compared in terms of technological, economic and environmental impacts. Students taking SRE 535 will be required to complete additional work and held to higher standards than those taking SRE 335. Spring. Prerequisites: Graduate standing or instructor permission. Note: Credits will not be granted for SRE 335 and 535.

SRE 537 Energy Resource Assessment (4)

Three hours of lecture per week. One week of field visits to utility-scale energy facilities during the week following the end of finals. Evaluation of energy pathways employed in the Northeast U.S. Primary emphasis on quantification and comparison of the economic, environmental, and technical tradeoffs of utility-scale energy pathways. Critical analysis and assessment of the economic viability of utility-scale energy pathways. Spring semester. Prerequisite: Graduate standing of instructor permission. Note: Credit will not be granted for both SRE 337 and SRE 537.

SRE 619 Energy Pol Assessmnt Methodlgs (3)

Three hours of lecture per week. This course covers the primary methodologies employed to conduct assessments of energy policies and policy proposals, including techno-economic assessment, deterministic analysis, and stochastic analysis. Students will learn how to select the methodology that is most appropriate for an analytical scenario, conduct assessments using the available methodologies, and select the policies or policy proposals that are most effective at achieving a desired energy policy outcome. Graduate students will be expected to further compare and contrast the different methodologies available, identify the appropriate methodology for a policy question and justify its use, and quantify the effectiveness of the solution to the policy question in a separate term paper. Spring. Prerequisite: Graduate standing

SRE 622 Energy Markets and Regulation (3)

Three hours of lecture/discussion concerning markets and regulation of energy. Topics include: the economics of energy markets, industry restructuring, and the development of markets for energy efficiency and renewable power. The role and impacts of energy regulation on markets will also be examined. Fall. Prerequisites: SRE 325 Energy Systems or equivalent or permission of instructor Note: Credits will not be granted for SRE 422 and SRE 622.

SRE 641 Biomass Energy (3)

Three hours of lecture per week. Production and use of biomass as a source of renewable energy for the production of bioenergy, biofuels and bioproducts. Characteristics of biomass sources, their conversion to different forms of energy and end products, and an assessment of source sustainability. Field trips to regional biomass facilities. Spring. Note: Credit will not be granted for SRE 441 and SRE 641

SRE 650 Climate&Sust Science&Practce I (3)

Full days - Four days at start of the semester, third Friday each month during. This course develops a strong foundation for emerging leaders working in climate change mitigation and adaptation fields with a focus on four key areas: (1) Climate Science and Policy, (2) Equity and Environmental Justice, (3) Project Planning, Management, and Analysis, and (4) Professional & Strategic Communications. Through hands-on problem-based learning, guest speakers, in-house experts, and breakout sessions, students will gain the tools, knowledge, and critical thinking skills to tackle the climate crisis as young climate protection professionals. Co-requisites: SRE 898

SRE 660 Climate&Sust Science&Prctce II (3)

One full day a month, 9:00AM – 5:00 PM, two full days mid semester. Through a variety of lectures, readings, speakers and hands-on workshops, students will develop a deeper working knowledge in four key areas: (1) Clean Technologies and Applications, (2) Corporate Sustainability Reporting, (3) Project Finance and Green Economy, and (4) Career Planning and Job Search. Students will learn to use climate-relevant tools and methods, applying them to real-world projects, including energy assessments, carbon inventories, climate action plans, and quantitative analysis. Spring. Prerequisite: SRE 650; Co-requisites: SRE 898

SRE 679 Life Cycle Assessment (3)

Three hours of lecture per week. Life cycle assessment (LCA) is a tool used across fields to determine the cradle-to-grave environmental impacts of products and systems. The course will cover how to mathematically define the life cycles of products and systems, perform an LCA, and interpret LCA results and evaluate them within the context of the scientific literature. Students will individually conduct a full life cycle assessment with a literature review, sensitivity analysis, and uncertainty analysis using available data and impact assessment methods. Fall. Prerequisites: A college-based statistics course or instructor permission.

SRE 681 Advanced Life Cycle Assessment (3)

Three hours of lecture per week. This course covers advanced topics in LCA, focusing on modeling approaches and methods. Topics include advanced life cycle impact assessment methods, consequential and attributional modeling approaches, modeling end-of-life, dynamic LCA, organizational/territorial LCA, and Life cycle management. Spring. Credit will not be given for both SRE 481 and SRE 681 Prerequisite: SRE 479/679 or Instructor's Permission

SRE 796 Special Topics in Sust Energy (1-3)

Lectures, seminars, and discussion. Advanced topics in sustainable energy and its management. Fall and/or Spring.

SRE 797 Seminar (1-3)

Group discussion and individual presentation of topics of current interest to sustainable energy. Fall and Spring

SRE 798 Research Probs in Sust Energy (1-12)

Special investigation and analysis of sustainable energy topics. A study plan and a final written report are required. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, and Summer

SRE 898 Prof Experience/Internship (1-12)

Professional experience/internship which applies, enriches, or complements formal course work. All professional experiences/internships must have a signed experience/internship agreement on record with the advisor. Graded on an "S/U" basis. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, and Summer

SRE 899 Master's Thesis Research (1-12)

Investigation leading to the completion of a Master's thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

SRE 999 Doctoral Thesis Research (1-12)

Investigation leading to the completion of a doctoral thesis. Graded on an "S/U" basis. Fall, Spring, and Summer.

SUS - SUSTAINABILITY MANAGEMENT

SUS 296 Special Topics in Sust Mngmnt (1-3)

Online asynchronous. Experimental and developmental courses in new areas of sustainability management not covered in regularly scheduled courses. A detailed course description will be presented as the topic areas is identified and developed. Fall, Spring and Summer.

SUS 300 Sus Systems: Eco, Econ, & Soc (3)

Online This course defines sustainability and sustainable development, introduces the United Nations Sustainable Development Goals and helps the student begin to understand the complex interactions between the environment, the economy, and society, and their implications for sustainable development. Fall, with Spring and Summer as needed Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 310 Human & Soc Dim Sustainability (3)

Online SUS 310: Human and Social Dimensions of Sustainability; Online; This course explores how social systems and systems of governance, individual and collective human behaviors, attitudes, values, and ethics influence sustainability. It considers examples of the forces and factors which may or may not foster sustainable human and natural communities and ecosystems. In essence, this course seeks to define "what is a sustainable society?" Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 320 Eco. Dim. Of Sustainability (3)

Online This course will expand on the interconnected nature of biophysical systems and cycles, and human dependence upon the sustainable use of resources in these systems. Our atmosphere, water, mineral, energy, and biological resources are all limited in ways which demand understanding and stewardship to sustain human and natural communities. Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 330 Intro Sustain. Data Analysis (3)

Online This course will introduce students to various types of metrics and analyses to assess sustainability outcomes/results. The course provides students with an overview of analytical methods and tools including spreadsheets and statistics. Specific examples of how these methods and tools are applied to sustainability solutions are included. Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 335 Applied Stats for Sustainablty (3)

Online asynchronous. This course introduces students to many commonly used statistical tests that allow them to answer questions about the population with which they are working. Students will be able to estimate population values, determine if there have been significant changes to the variables you are studying, compare these population values between groups, and create models that will help you to track and predict changes within your population. Fall, with Spring and Summer as needed

SUS 340 Principles Sustainable Dvlpmnt (3)

Online Concepts of sustainable development, specifically focusing on the drivers of change and the roles and limitations of the private and governmental sectors in supporting sustainable alternatives. Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 350 Intro. Spatial Analysis & GIS (3)

Online SUS 350: Introduction to Spatial Analysis & Geographic Information Systems; Online; This course will introduce students to various types of spatial analyses, and provide students with an overview of GIS technology and applications, including the uses and limitations of geospatial data, remote sensing, and GIS software & associated tools. Specific examples of how GIS may be applied to sustainability solutions are included. Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 355 Con Bio & Landscape Ecology (3)

Online. This course introduces essential concepts in conservation biology, focusing on a system that has created a global crisis for people, wildlife, and ecosystems. We will study the principles underlying older and newer approaches to conservation biology, as well as explore evidence that may illuminate when, and under what conditions, approaches to each may be successful. The paradigm is shifting towards the integration of human communities in the management and conservation of protected areas, and the valuation of ecosystem services. Innovative ways are needed to integrate human communities with conservation efforts, while adding value to ecosystem services. Through this lens we will assess the relationship of people and protected areas, investigate the role economics and politics plays in decision making, and debate the costs and benefits of a new paradigm shift away from traditional conservation. Fall, with Spring and Summer as needed

SUS 360 Climate Change&Sustainability (3)

Online This course will introduce the basic science of climate change and the social, economic, and environmental implications of climate change. Students will compare climate model projections, and evaluate various climate adaptation and mitigation strategies in global, regional and local environments. Pre-requisites: SUS 330: Introduction to Sustainability Data Analysis or equivalent, or permission of program advisor Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 375 Environmental Economics (3)

Online. This course provides an introduction to the basic principles of environmental economics. It seeks the application of economic theory and models to examine how environmental resources are managed, the way people make decisions that lead to environmental destruction and/or environmental improvements. Topics covered include the current state of the environment, economic incentives, market failures, economic valuation, environmental policy analysis in the United States and global environmental issues. Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor is required.

SUS 400 Analysis Sustainable Systems (3)

Online This course will introduce students to analysis methods and tools used by private and public sector organizations to determine the effectiveness and sustainability potential of products and systems. (e.g., Life Cycle Assessment ecological models, economic models, energy and sustainability audit). Pre-requisites: SUS 330: Introduction to Sustainability Data Analysis or equivalent. Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 410 Sustainable Urbanism (3)

Online This course will discuss the unique ecological, economic and social considerations of the human nature dimension in urban and regional environments, and explore best practices for fostering sustainability in these settings. Specific topics include transportation, food systems, urban wildlife and green infrastructure. Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 415 Sustainable Agriculture (3)

Online asynchronous. This course examines the social, economic, and environmental dimensions of sustainable agriculture and the emerging global challenges and constraints on modern (conventional) farming. Students examine farming systems and approaches worldwide to improve sustainability, including integrated crop management, conservation agriculture, organic farming, regenerative, and permaculture among others. The course emphasizes the principles and practices of sustainable agriculture and drivers and constraints affecting the adoption of ecologically based farming practices. Students assess agricultural operations concerning crops, animals, soil, and pest management. Spring, with Fall and Summer as needed

SUS 420 Sust Enrgy: Tech,Systms&Policy (3)

Online This course explores concepts and various technologies in sustainable energy production, consumption, storage, environmental and social impact, and explores the ways in which these relate to sustainability. Topics cover a wide range of energy systems, including nuclear, fossil fuels, wind, solar, biofuels, and biomass. Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 430 Managerial Ecnmcs for Sustblty (3)

Online Every manager of a for-profit or not-for-profit organization must answer the question: "How do we use economic information to make better business and resource management decisions given a sustainability objective?" These decisions require identifying alternative means of achieving given sustainability and other objective(s) and then selecting the alternative that accomplishes the stated objective(s) in the most resource efficient manner given the goals of the organization. Pre-requisites: SUS 330: Introduction to Sustainability Data Analysis and an Introduction to Economics class, or permission of program advisor. Fall, with Spring and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 440 Env Justice:Pol, Law & Society (3)

Online This course examines political, economic and social conditions that promote environmental inequality and explores the modern history of environmental exploitation of marginalized populations in the U.S. This course introduces students to the principles of environmental justice. Students will evaluate relevant environmental law and policy, examine prominent case studies related to the environmental justice literature and movement and apply appropriate tools to assess environmental inequality. Pre-requisites: SUS 350: Introduction to Spatial Analysis & Geographic Information Systems or equivalent, or permission of Sustainability Management program advisor. Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 450 Civic Engagement&Particip Plng (3)

Online This course entails an analysis of civic engagement and participatory planning processes. Students will identify the purposes and best practices for empowering communities and organizations to participate in the informed design and management of sustainability projects and processes. Students will examine social theories and evaluate the dynamics, strategies and motivations of various stakeholders such as government institutions, public and private organizations, and individual participants. Students will apply skills and knowledge to create a planning process around a sustainability topic of their choice. Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management major, or permission of Sustainability Management program advisor, is required.

SUS 480 Sustainability Mngmnt Capstone (3)

Online This course will focus on the application of learned knowledge to sustainability management problems and workplace skills. Spring, with Fall and Summer as needed. Note: Enrollment in the Sustainability Management Program, or permission of Sustainability Management program advisor, is required. This course should be taken during a student's final semester of enrollment in the Sustainability Management program.

SUS 499 Internship/Sustainability Mgmt (1-12)

Online. Supervised office or field experience in a professional working environment. Students shall report their activities to their instructor on a weekly basis for the duration of the course. Fall, Spring, and Summer. Note: Enrollment in the sustainability management major and permission of Sustainability Management program coordinator are required.

ESF FACULTY AND PROFESSIONAL STAFF

Nasri Abdel-Aziz (2001) Director, Math Program and Instructor, Environmental Studies, MS, Syracuse University, 2001

Neal M Abrams (2007) Associate Professor, Associate Chair Chemistry, Chemistry, PHD, Pennsylvania State University-Main Campus, 2005

Aidan C Ackerman (2018) Assistant Professor, Landscape Architecture, MLA, Harvard University, 2011

Kim B Adams (1993) Director, Tree Pest Information Service, Environmental Biology, PHD, SUNY College Of Environmental Science And Forestry, 2017

Ebby M Adukkalil (2021) Coordinator of International Recruitment, Instruction and Graduate Studies, BA, Canisius College, 2001

Erica S Allen (2023) Director of Counseling, Student Affairs, MS, SUNY College At Oswego, 2012

Michael Amadori (2009) Campus Energy Manager, Sustainability Division, MS, SUNY College Of Environmental Science And Forestry, 2012

Mark J Appleby (2008) Forest Property Manager I, Forest Properties - Tully, BA, SUNY College Of Environmental Science And Forestry, 1997

Raymond J Appleby (1982) Director, Pilot Operations,Chemical Engineering,AS,Columbia-Greene Community College,1980

Emily R Arsenault (2023) Assistant Professor & Director Cranberry Lake Biological Station, Environmental Biology, PHD, University Of Kansas Main Campus, 2021

Kyle A Artelle (2023) Assistant Professor, Environmental Biology, PHD, Simon Fraser University, 2017

Ryan M Ash (2010) Forest Property Manager II, Forest Properties - Tully, MA, SUNY College Of Environmental Science And Forestry, 2013

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CHARLES A. MAYNARD (1980 - 2016) Professor and Director, American Chestnut Research & Restoration Center, Forest and Natural Resources Management; BS, Iowa State University, 1974; MS, Iowa State University, 1977; PHD, Iowa State University, 1980

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