ESF Curriculum Proposal Form
Committee on Instruction - ESF Faculty Governance
Office of Instruction & Graduate Studies

Date: March 26, 2012
Department: Sustainable Construction Management and Engineering
Curriculum Title: Construction Management

☐ New curriculum and/or degree program OR X Changes in existing curriculum (check all that apply):
☐ new program title ☐ new courses added ☐ new accreditation
☐ revised courses ☐ change in total cr. hrs. ☐ new assessment plan
X new course sequence ☐ new program objectives ☐ other significant change

Justification Narrative: please provide an explanatory narrative outlining the need or rationale for the new curriculum or program, or justifying the need to significantly change an existing curriculum (i.e. addressing emerging or changing societal demand, addressing changing technology, focusing on a new interdisciplinary body of knowledge, etc.)

A major revision to the Construction Management curriculum was made for the 2010-2011 school year. At the time the curriculum proposal was developed teaching assignments were unresolved. Certain course offerings (by semester) have never matched the catalog sequence. In working to resolve those discrepancies, the following results were obtained:
1) Improved balance (by semester) of upper division electives.
2) Improved first-semester experience for Freshman
3) Improved linkage between CME 255 and CME 343

Institutional Impact:

Anticipated Enrollment: 100 per semester Change from existing condition: 0

New Faculty or Staffing Requirements: None

New Technology and Classroom Resource Demands: None

New Computing Resources Requirements: None (since the present catalog sequence was not implemented)

New Accreditation Requirements: None (the program is currently not accredited)

New Assessment Requirements (explain & describe): None (since the present catalog sequence was not implemented)
New Library Resources Requirements: None (since the present catalog sequence was not implemented)

New Transportation Requirements: None (since the present catalog sequence was not implemented)

New Forest Properties or Field Practicum Facilities Required: None

Impacts on other Departments at ESF (please obtain and attach response from affected departments): No direct impact on other departments, students from other departments in the Construction Management and Sustainable Construction minors have been informed of the sequence changes.

Impacts on Admissions (particularly transfer requirements and articulation agreements; please obtain and attach response from Admissions if an impact is anticipated): Communication with admissions has been ongoing to try to assist our transfers with sequence requirements.

List courses taught outside the Department at ESF: No change (GENEDU (2), CLL 190, FCH 150/151, APM 105, FOR 207, CLL 290, PHY 211/221, FOR 360, APM 106, ERE 371, APM 391, CIE 337)

List courses taught outside the Department at SU:
- Accessory Instruction credit hours at SU required per student in this curriculum: No change (8)
- Accessory Instruction credit hours required per semester by this curriculum No change (1)
- Change in Accessory Instruction needs over current programs and curricula None

Catalog Curriculum Narrative:
Please provide a narrative description of the program, the broad program objectives and learning outcomes, and a curriculum course outline using the precise format proposed for/ or currently used in the ESF catalog (if revising an existing program or curriculum proposal, please attach a copy of the original MS Word file with revisions shown in "track changes"):

Curriculum Transition Plan:
Please provide a narrative description of your plan for transitioning from your existing curriculum to the proposed new curriculum. Please provide specific dates for implementing curriculum changes, overlap periods where old and new curricula may exist simultaneously, and final phase out of old curricula. Please also include impacts and mitigating considerations for students in mid-program during implementation, impacts of changes in semester delivery of existing courses, addition of new courses within a particular semester, etc.
There will be no change in the semester that any courses are offered. Advising sheets have already been created to assist advisors working with students on the 2010-2011 and 2011-2012 curricula.
<table>
<thead>
<tr>
<th>Year</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRESHMAN YEAR</strong></td>
<td>CME 202 Intro.to Professional Communications 3</td>
<td>GENEDU General Education Course From Fresh Sp 3</td>
</tr>
<tr>
<td></td>
<td>CLL 190 Writing and the Environment 3</td>
<td>CME 202 Intro.to Professional Communications From Fresh Fa 3</td>
</tr>
<tr>
<td></td>
<td>FCH 150 General Chemistry I 3</td>
<td>CME 132 Orientation Seminar 1</td>
</tr>
<tr>
<td></td>
<td>FCH 151 General Chemistry Lab I 1</td>
<td>APM 104 PreCalc OR Elective 3</td>
</tr>
<tr>
<td></td>
<td>CME 132 Orientation Seminar 1</td>
<td>GENEDU General Education Course From Soph Fa 3</td>
</tr>
<tr>
<td></td>
<td>APM 104 PreCalc OR Elective 3</td>
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<td></td>
<td>Elective 3</td>
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<tr>
<td></td>
<td>Total Credits 17</td>
<td></td>
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<tr>
<td><strong>SOPHOMORE YEAR</strong></td>
<td>GENEDU General Education Course 3</td>
<td>APM 105 Calculus I 4</td>
</tr>
<tr>
<td></td>
<td>PHY 211 General Physics I 3</td>
<td>CME 215 Sustainable Construction 3</td>
</tr>
<tr>
<td></td>
<td>PHY 221 General Physics Lab I 1</td>
<td>FOR 207 Introduction to Economics/Economics 3</td>
</tr>
<tr>
<td></td>
<td>GENEDU General Education Course 3</td>
<td>CME 202 Intro.to Professional Communications 3</td>
</tr>
<tr>
<td></td>
<td>PHY 211 General Physics I 3</td>
<td>CME 215 Sustainable Construction 3</td>
</tr>
<tr>
<td></td>
<td>PHY 221 General Physics Lab I 1</td>
<td>FOR 207 Introduction to Economics/Economics 3</td>
</tr>
<tr>
<td></td>
<td>GENEDU General Education Course 3</td>
<td>CME 202 Intro.to Professional Communications 3</td>
</tr>
<tr>
<td></td>
<td>APM 106 Calculus 2</td>
<td>CME 215 Sustainable Construction 3</td>
</tr>
<tr>
<td></td>
<td>CME 342 Light Construction</td>
<td>FOR 207 Introduction to Economics/Economics 3</td>
</tr>
<tr>
<td></td>
<td>Total Credits 17</td>
<td>CME 202 Intro.to Professional Communications 3</td>
</tr>
<tr>
<td><strong>Spring Semester</strong></td>
<td>CME 226 Statics/Mechanics</td>
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<tr>
<td>Course</td>
<td>Credits</td>
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<tr>
<td>Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CME 306 Engineering Materials for Sustainable Construction</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GENEDU General Education Course</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CME 255 Plan Interpretation and Quantity Takeoff</td>
<td>3</td>
<td></td>
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<tr>
<td>Total Credits:</td>
<td>16</td>
<td></td>
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</tbody>
</table>

**JUNIOR YEAR**

**Fall Semester**
- CME 331 Construction Safety | 3
- CME 387 Renewable Materials for Sustainable Const. | 3
- ERE 371 Surveying for Engineers | 4
- FOR 360 Principles of Management | 3
- CME 305 Sustainable Energy Systems for Buildings | 3

**Spring Semester**
- CME 343 Construction Estimating | 3
- CME 404 Applied Structures | 3
- APM 391 Intro to Probability and Statistics | 3
- CME 304 Environmental Performance Measures for Buildings | 3
- elective | 3

**SENIOR YEAR**

**Fall Semester**
- CIE 337 Geotechnical Engineering | 4
- CME 335 Cost Engineering | 3
- CME 497 Senior Seminar | 3
- CME 453 Construction Planning and Scheduling | 3
- CME 422 Composite Materials for Sustainable Const. | 3
- Elective | 3

**Fall Semester**
- CIE 337 Geotechnical Engineering | 4
- CME 335 Cost Engineering | 3
- CME 497 Senior Seminar | 3
- CME 453 Construction Planning and Scheduling | 3
- Elective | 3

**Total Credits**
- 16
- 15
- 16
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CME 454 Construction Project Management</td>
<td>3</td>
</tr>
<tr>
<td>CME 455 Construction Contracts &amp; Specs</td>
<td>3</td>
</tr>
<tr>
<td>CME 405 Building Information Modeling for Const. Mgmt. (new)</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>3</td>
</tr>
<tr>
<td>CME 304 Environmental Performance Measures for Buildings</td>
<td>3</td>
</tr>
<tr>
<td>Total Credits</td>
<td>15</td>
</tr>
<tr>
<td>Total Program Credits</td>
<td>128</td>
</tr>
</tbody>
</table>
Department of Sustainable Construction Management and Engineering

SUSAN E. ANAGNOST, Chair
204 Baker Laboratory, 315-470-6880; FAX 315-470-6879
www.esf.edu/scme/

Participating Faculty

ANAGNOST, Chair, (Wood Anatomy, Microscopy, Biodegradation of Wood, Micro-technique); CROVELLA (Residential Construction, Sustainable Construction Management); KYANKA (Construction, Applied Mechanics, Engineering Design); MEYER (Wood Properties, Wood Utilization, Anatomy); MORSI-HUSSEIN (Construction Engineering, Applied Mechanics, Structures); SMITH, J. (Cost Engineering, Construction Management, Sustainable Construction); SMITH, W. (Wood Preservation and Protection, Wood Moisture Relations and Drying, Composite Products, Manufacturing and Processing, Marketing); TISS (Construction Safety, Estimating, Planning and Scheduling, Construction Management)

The Department of Sustainable Construction Management and Engineering offers a bachelor of science in construction management and graduate education in Sustainable Construction Management and Wood Science leading to the master of science, master of professional studies, and doctor of philosophy degrees.

The degree programs emphasize principles and practices of sustainable construction. By learning sustainable construction and construction management, the use of renewable resources in construction, and methods to ensure energy efficiency, ESF graduates can literally build a sustainable future. They can also learn how to produce products from wood, be it furniture, construction material, or utility poles — in the most energy efficient way possible. Students take classes, labs and lectures in the newly renovated Baker Laboratory that features high-tech lecture halls, pilot-scale manufacturing equipment for building materials and wood products, an accredited engineering test facility, and computer labs equipped with the latest commercial software for planning, scheduling, project management and estimating. Instruction is tailored to the interests of individual students through the selection of electives.
At the undergraduate level, two concentration areas are available: wood products engineering and sustainable construction and renewable materials. Minors that enhance business skills in general management studies, marketing, and entrepreneurship are available for qualified students. Students interested in these or other minors should meet with their advisors as soon as possible.

Professional growth of students is stimulated by active membership in student chapters of professional construction and wood science organizations. Students are encouraged to join at least one organization that is of particular interest to them. Student organizations associated with our department include the Green Construction Group (formerly the Student Construction Association) affiliated with National Association of Home Builders, The Associated General Contractors of America and General Building Contractors of New York State, and the Forest Products Society student chapter.

Many students who enter the undergraduate program in construction management are transfer students. Graduates of A.S. programs in liberal arts, math/science, and engineering/science as well as A.A.S. programs in architectural, civil, construction, mechanical, and wood technologies are encouraged to apply. Students with or without two-year degrees who meet all lower-division requirements and have 62 credits in acceptable coursework transfer as juniors for a four-semester program. Transfer students who have completed pre-calculus, but have not completed calculus, chemistry and/or physics or have not met most of their general education requirements generally finish in five or six semesters.

**Bachelor of Science in Construction Management**

The construction industry represents about ten percent of the world’s gross domestic product, while the entire construction industry represents 20 percent of the nation’s GDP. The U.S. Bureau of Labor Statistics projects employment in the construction industry will increase by 17 percent between 2008 and 2018. With more construction companies bidding on jobs, organizations with the best-prepared professionals using the latest technology are the most successful. This competition applies not only to contractors, but also many others involved in construction operations such as engineers, human resource managers, and material and equipment suppliers. People engaged in this industry must have state-of-the-art skills and knowledge to thrive.

The construction management degree prepares students for management careers in the construction industry. The objectives of the program are to provide the management skills to effectively deliver construction projects in a timely manner, within budget, safely and in accordance with the clients’ objectives; to study the various methods used to take a design into the field and construct a quality structure in the most efficient and effective manner with minimal environmental impacts; and to provide an understanding of basic engineering and environmental considerations in construction.

The curriculum offers several opportunities for professional certification or for obtaining professional credentials. Through successful completion of course requirements, students obtain the OSHA 30-hour card in Construction Safety. During their last semester, students take the Associate Constructor Examination, part 1 of the two-step examination process to
become a Certified Professional Constructor. Students learn the fundamentals of the various rating systems for buildings (LEED, Green Globes, and others), which can prepare them to take the LEED AP exam. Students interested in pursuing a career in engineering have coursework that partially fulfills the preparation required for the fundamentals in engineering examination.

The core of the curriculum includes topics in construction management: light construction, construction safety, construction equipment, construction methods, building codes and zoning, contracts and specifications, planning and scheduling, estimating, construction project management, applied structural analysis, soil mechanics, composite materials, and computer applications including building information modeling (BIM). Aspects of green construction and sustainability are incorporated into these courses. Students learn the properties and behavior of construction materials: steel, concrete, wood and engineered wood products, as well as non-traditional materials, and the analysis of various structural components and systems. The curriculum also includes courses that address the expanding field of sustainable construction and the "greening" of the industry. Students are introduced to sustainable construction in a sophomore-level overview course. More advanced courses include renewable materials for sustainable construction, energy systems in buildings, and environmental performance of buildings as related to certification programs.

Environmental and safety aspects of construction are addressed in the program with course topics on workplace safety, environmental impact evaluation, and building codes that cover structural, fire, and hazardous material requirements. Emphasis on environmental and personal safety includes asbestos mitigation, noise pollution, air monitoring and sampling techniques.

A concentration in wood products engineering provides additional courses in the manufacturing, properties, and marketing of wood products. Wood is a premier sustainable material for manufacturing, building and construction. It is renewable and produced from a sustainable natural resource. Wood is strong, lightweight, economical, long lasting and attractive and is made into countless products desired by society. In combination with required coursework (renewable materials for sustainable construction, composite products, applied structures) students are prepared for employment in wood products industries, as well as construction management firms and building materials companies.

Graduates of the construction management program are well prepared for careers in a very challenging and dynamic field. Positions held by alumni include construction project manager, safety director, OSHA compliance officer, construction engineer, estimator, company executive, and planner/scheduler. Students who choose the concentration elective coursework in wood products engineering are also prepared for employment in wood products manufacturing and marketing.

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 62 credits of college coursework, in courses comparable to the lower-division course requirements.
## Undergraduate Program Requirements

### Lower Division Required Courses (45 or 48 credits)

*Students who take pre-calculus receive 48 credits; students who do not take pre-calculus receive 45 credits of required lower division courses.*

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td><strong>CME 132</strong> Orientation Seminar: Wood Products Engineering</td>
<td>1</td>
</tr>
<tr>
<td><strong>APM 105</strong> Calculus I</td>
<td>G 4</td>
</tr>
<tr>
<td><em>Meets the requirements for general education skills and knowledge area. A complete listing of courses that meet general education standards established by SUNY is listed in Undergraduate Education.</em></td>
<td></td>
</tr>
<tr>
<td><strong>APM 106</strong> Calculus II</td>
<td>4</td>
</tr>
<tr>
<td><strong>CME 202</strong> Introduction to Professional Communications</td>
<td>3</td>
</tr>
<tr>
<td><strong>EWP 190</strong> Writing and the Environment</td>
<td>G 3</td>
</tr>
<tr>
<td><strong>EWP 290</strong> Writing, Humanities and the Environment</td>
<td>G 3</td>
</tr>
<tr>
<td><strong>FCH 150/151</strong> General Chemistry I and Laboratory</td>
<td>G 4</td>
</tr>
<tr>
<td><strong>FOR 207</strong> Introduction to Economics</td>
<td>G 3</td>
</tr>
<tr>
<td><strong>CME 255</strong> Plan Interpretation and Quantity Takeoff</td>
<td>3</td>
</tr>
<tr>
<td><strong>CME 215</strong> Sustainable Construction</td>
<td>3</td>
</tr>
<tr>
<td><strong>CME 226</strong> Statics and Mechanics</td>
<td>4</td>
</tr>
<tr>
<td><strong>CME 342</strong> Light Construction</td>
<td>3</td>
</tr>
<tr>
<td><strong>CME 306</strong> Engineering Materials for Sustainable Construction</td>
<td>3</td>
</tr>
<tr>
<td><strong>FOR 360</strong> Principles of Management</td>
<td>3</td>
</tr>
</tbody>
</table>
Lower Division Electives (12 or 15 credits; 12 credits if a student is required to take APM 104 Precalculus)

Students may use elective credits to pursue a concentration in Wood Products Engineering or Sustainable Construction and Renewable Materials.

<table>
<thead>
<tr>
<th>Electives</th>
<th>12 or 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required for students who enter as transfer students.</td>
<td></td>
</tr>
</tbody>
</table>

General Education courses (6 credits). Students must select two additional general education courses from two of the following categories: American History, Other World Civilizations, Western Civilization, and the Arts:

<table>
<thead>
<tr>
<th>General Education Course: American History, Other World Civilizations, Western Civilization, or the Arts</th>
<th>G 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluding the category chosen above.</td>
<td></td>
</tr>
</tbody>
</table>

Upper Division Required Courses (53 credits):

<table>
<thead>
<tr>
<th>CME 255</th>
<th>Plan Interpretation and Quantity Takeoff</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>APM 391</td>
<td>Introduction to Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>CIE 337</td>
<td>Soil Mechanics and Foundations I</td>
<td>4</td>
</tr>
<tr>
<td>ERE 371</td>
<td>Surveying for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>FOR 360</td>
<td>Principles of Management</td>
<td>3</td>
</tr>
<tr>
<td>CME 304</td>
<td>Environmental Performance Measures for Buildings</td>
<td>3</td>
</tr>
<tr>
<td>CME 305</td>
<td>Sustainable Energy Systems for Buildings</td>
<td>3</td>
</tr>
<tr>
<td>CME 331</td>
<td>Construction Safety</td>
<td>3</td>
</tr>
<tr>
<td>CME 335</td>
<td>Cost Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CME 343</td>
<td>Construction Estimating</td>
<td>3</td>
</tr>
<tr>
<td>Course</td>
<td>Title</td>
<td>Credits</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>CME 387</td>
<td>Renewable Materials for Sustainable Construction</td>
<td>3</td>
</tr>
<tr>
<td>CME 404</td>
<td>Applied Structures</td>
<td>3</td>
</tr>
<tr>
<td>CME 405</td>
<td>Building Information Modeling for Construction Management</td>
<td>3</td>
</tr>
<tr>
<td>CME 422</td>
<td>Composite Materials for Sustainable Construction</td>
<td>3</td>
</tr>
<tr>
<td>CME 453</td>
<td>Construction Planning and Scheduling</td>
<td>3</td>
</tr>
<tr>
<td>CME 454</td>
<td>Construction Project Management</td>
<td>3</td>
</tr>
<tr>
<td>CME 455</td>
<td>Construction Contracts and Specifications</td>
<td>3</td>
</tr>
<tr>
<td>CME 497</td>
<td>Senior Seminar</td>
<td>3</td>
</tr>
</tbody>
</table>

**Upper Division Electives (9 credits)**

Total minimum credits for the degree 128 credits

**Concentration in Wood Products Engineering (14 credits)**

- CME 322 Mechanical Processing
- CME 326 Fluid Treatments
- CME 376 Decay of Wood Products
- CME 388 Wood Identification
- CME 444 Materials Marketing

**Concentration in Sustainable Construction and Renewable Materials (12 credits from the following for students who entered the program prior to 2010-11)**

- CIE 326 Engineering Materials
- CIE 478 Rehab of Civil Structures
- ERE 519 Green Entrepreneurship
- EST 426 Community Planning and Sustainability
- EST 550 Environmental Impact Analysis
- CME 330 Building Codes
- CME 376 Decay of Wood Products
Graduate Program in Sustainable Construction Management and Wood Science

Graduate areas of study related to sustainable construction management and wood science allow students with technical degrees to engage specific topics of current interest. There is an overall objective of having students look at the broad environmental implications of the construction process and the use of wood as a material, to be efficient and environmentally correct in their use of materials, and to integrate current technology to a practicum, thesis or dissertation, as appropriate to the graduate degree. The department offers three degrees: the Master of Professional Studies (M.P.S.), the Master of Science (M.S.), and the Doctor of Philosophy (Ph.D.).

General entry requirements to the Sustainable Construction Management and Wood Science program follow those described in the catalog for the Graduate School at SUNY-ESF. The Option in Sustainable Construction Management and Wood Science (SCMWS) offers three areas of study:

- Construction Management
- Sustainable Construction
- Wood Science

Entry requirements to the Option in Sustainable Construction Management and Wood Science are specific to each area of study. Students are accepted into our programs from a variety of backgrounds. When the Department of Sustainable Construction Management and Engineering (SCME) reviews an applicant’s academic and professional experience, it may determine that preparatory coursework is required before entry into the program. Either undergraduate or graduate courses may be recommended to remedy deficiencies depending on circumstances. In some cases, remedial coursework should be completed prior to matriculation.

**Entry requirements for Construction Management**: applicants for the Master of Science or Ph.D. degrees in the construction management area of study are required to have a bachelor’s degree in one of the following: science, construction management, business, management, architecture, or engineering.

Applicants for the M.P.S. degree in the construction management area of study are required to have a minimum of five years’ experience in the construction management industry plus a bachelor’s degree in one of the following: science, construction management, business, management, architecture, or engineering.

**Entry requirements for Sustainable Construction**: Applicants for the Master of Science or Ph.D. degrees in sustainable construction are required to have a bachelor’s degree in one of the following: science, construction management, architecture, or engineering. Students must have completed courses in physics, chemistry, and calculus.
Applicants for the M.P.S. degree in sustainable construction are required to have a minimum of two years’ experience in the construction management industry plus a bachelor’s degree in one of the following: science, construction management, architecture, or engineering. Students must have completed courses in physics, chemistry, and calculus.

**Entry requirements for Wood Science:** Applicants for the Master of Science or Ph.D. degrees in the wood science area of study are required to have a bachelor’s degree in science or engineering. Applicants must have the appropriate undergraduate degree for the area of study they pursue. Applicants must have completed at least one semester of coursework in chemistry, biology, physics, and calculus.

Applicants for the M.P.S. degree in wood science are required to have a minimum of two years’ experience in the wood products engineering or related industry plus a bachelor’s degree in science or engineering. Applicants to the M.P.S. in wood science and technology must have completed at least one semester of coursework in chemistry, biology, physics, and calculus.

**Degree requirements**

The Ph.D. degree requires a minimum total of 60 graduate credits. These credits must include a minimum of 30 credits of coursework, and include not more than 30 credits for dissertation. As tool requirements, students must demonstrate competence in one of the three following areas: computer science, statistics or advanced mathematics, or a language other than English commonly used in science or engineering practice. A study plan that formally identifies an individual’s program requirements is developed for each student as soon as possible, but at least during the first year of graduate study. This plan includes all required and elective courses as well as a tentative schedule for completion.

The M.S. degree requires a minimum of 30 credit hours. A minimum of 18 credits of coursework and a minimum of 6 thesis credits are required to complete the M.S. degree. Undergraduate courses do not meet the requirements for minimum number of graduate credit hours. Students select a study area at the time of application for admission to the program. Specific areas of study may require specific coursework requirements. If so, they are listed under that area of study. The student’s study plan (Form 3B) must be approved by the steering committee and graduate coordinator or department chair by the end of the first semester in residence.

The purpose of the M.P.S. degree is to update current professional skills and/or to prepare graduate students for higher levels of management in their general area of expertise. The M.P.S. degree is intended to be a terminal degree, therefore acceptance to the M.P.S. degree does not guarantee admission to the M.S. or Ph.D. programs and vice versa. A minimum of 30 credit hours are required for the M.P.S. degree. The degree requires 24-27 credits of graduate-level course work, a 3-6 credit practicum or synthesis based on professional experience, and a capstone seminar. Specific coursework requirements are listed under each area of study.

**Construction Management (M.S., M.P.S., Ph.D.)**

Participating Faculty: CROVELLA; KYANKA; MORSI-HUSSEIN; SMITH, J.; TISS
**Ph.D./M.S. in Construction Management.** Topics for the M.S. or Ph.D. research may include the following:

- Construction project management
- Estimating, cost engineering, building codes and zoning
- Green construction
- Production management
- Computer graphics and computer applications in engineering
- Structural design

For the M.S. or Ph.D. degree in Construction Management the following courses are required (or their equivalent with committee approval):

- CME 543 Construction Estimating (3)
- CME 653 Construction Planning and Scheduling (3)
- CME 654 Construction Project Management (3)

**M.P.S. in Construction Management**: Requirements include 24-27 credit hours of required and elective coursework in three categories plus 3-6 credit hours of a practicum or professional experience/synthesis. Two coursework options are available, the M.P.S. coursework and practicum option, or the M.P.S. coursework and synthesis option.

**M.P.S. coursework and practicum option** (total minimum of 30 credits): Engineering/construction management courses (12-21 credits), resource management courses (3-6 credits), environmental studies courses (3-6 credits), practicum (3-6 credits).

Engineering/construction management courses (12-21 credits). These courses (group A or group B) are required: (Students who plan to complete their degree in one calendar year should select group B)

**A:**

- CME 543 Construction Estimating (3)
- CME 653 Construction Planning and Scheduling (3)
- CME 654 Construction Project Management (3)

**OR**

**B:**

- CME 643 Estimating for Construction in a Green Global Economy (3)
- CME 663 Managing a Construction Project through Construction Planning and Scheduling (3)
- CME 664 Urban Project Management (3)
Select additional courses from the following or similar courses with committee approval:

CME 525 Construction Methods and Equipment (3)
CME 531 Construction Safety (3)
CME 535 Cost Engineering (3)
CME 658 Construction Contracts and Specifications (3)

Resource management courses (3-6 credits) from the following or similar courses with committee approval:

FOR 665 Natural Resources Policy (3)
FOR 670 Resource and Environmental Economics (3)
FOR 680 Urban Forestry (3)
FOR 685 Business and Managerial Law (3)
FOR 687 Environmental Law and Policy (3)
FOR 689 Natural Resources Law and Policy (3)
FOR 770 Ecological Economics and Policy (3)

Environmental studies courses (3-6 credits) from the following or similar courses with committee approval:

EST 550 Environmental Impact Analysis (3)
EST 603 Research Methods and Design (3)
EST 604 Social Survey Research Methods for Environmental Issues (3)
EST 605 Qualitative Methods (3)
EST 626 Concepts and Principles of Sustainable Development (3)
EST 627 Environmental and Energy Auditing (3)
EST 635 Public Participation and Decision Making: Theory and Application (3)
EST 640 Environmental Thought and Ethics (3)
EST 660 Land Use Law (3)

Practicum (3-6 credits):

CME 898 Professional Experience/Synthesis (3-6)

**M.P.S. coursework and synthesis option**: Core courses (10 credits), engineering/construction management courses (9 credits), application electives (5-8 credits), professional experience/synthesis (3-6 credits). Total minimum of 30 credits.

Core courses (minimum 10 credits): These courses are required (group A or group B): Students who plan to complete the degree in one calendar year should select group B.

A:
CME 543 Construction Estimating (3)  
CME 653 Construction Planning and Scheduling (3)  
CME 654 Construction Project Management (3)  
CME 658 Construction Contracts and Specifications (3)  

OR  

B:  

CME 643 Estimating for Construction in a Green Global Economy (3)  
CME 663 Managing a Construction Project through Construction Planning and Scheduling (3)  
CME 664 Urban Project Management (3)  
CME 658 Construction Contracts and Specifications (3)  

Engineering/construction management courses (9 credits) from the following or similar with committee approval:  

CME 525 Construction Methods and Equipment (3)  
CME 531 Construction Safety (3)  
CME 535 Cost Engineering (3)  
CME 605 Building Information Modeling/ Construction Management (3)  

Application electives (5-8 credits):  
As approved by the steering committee  
Professional experience/synthesis (3-6 credits):  
CME 898 Professional Experience/Synthesis (3 - 6)  

**Sustainable Construction (M.S., M.P.S., Ph.D.)**  

Participating Faculty: CROVELLA; KYANKA; MORSI-HUSSEIN; MEYER; SMITH, J.; SMITH, W.; TISS. This area of study 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.  

**Ph.D./M.S. in Sustainable Construction:** 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
- Structural design

Required coursework: 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. For the M.S. degree and Ph.D. degree, the student’s study plan is developed with the steering committee according to the general college guidelines described earlier.

**M.P.S. in Sustainable Construction**: 24-27 credit hours of coursework plus 3-6 credit hours of a practicum or professional experience/synthesis. Two coursework options are available, the M.P.S. coursework and practicum option, or the M.P.S. coursework and synthesis option. Total minimum of 30 credits

**M.P.S. coursework and practicum option**: Engineering/construction management courses (12-21 credits), resource management courses (3-6 credits), environmental studies courses (3-6 credits), practicum (3-6 credits). Total minimum of 30 credits.

Engineering/construction management courses (12-21 credits) from the following or similar courses with committee approval:

- CME 605 Building Information Modeling /Construction Management (3)
- CME 543 Construction Estimating (3)
- CME 653 Construction Planning and Scheduling (3)
- CME 654 Construction Project Management (3)
- CIE 678 Rehab of Civil Structures (3)

Resource management courses (3-6 credits) from the following or similar courses with committee approval:

- FOR 665 Natural Resources Policy (3)
- FOR 670 Resource and Environmental Economics (3)
- FOR 680 Urban Forestry (3)
- FOR 685 Business and Managerial Law (3)
- FOR 687 Environmental Law and Policy (3)
- FOR 689 Natural Resources Law and Policy (3)
- FOR 770 Ecological Economics and Policy (3)

Environmental studies courses (3-6 credits) from the following or similar courses with committee approval:
EST 550 Environmental Impact Analysis (3)
EST 603 Research Methods and Design (3)
EST 604 Social Survey Research Methods for Environmental Issues (3)
EST 605 Qualitative Methods (3)
EST 626 Concepts and Principles of Sustainable Development (3)
EST 627 Environmental and Energy Auditing (3)
EST 635 Public Participation and Decision Making: Theory and Application (3)
EST 640 Environmental Thought and Ethics (3)
EST 660 Land Use Law (3)

Practicum (3-6 credits):

CME 898 Professional Experience/Synthesis (3 - 6)

**M.P.S. coursework and synthesis option:** Core courses (10 credits), engineering/construction management courses (9 credits), application electives (5-8 credits), professional experience/synthesis (3-6 credits). Total minimum of 30 credits.

Core courses (10 credits) from the following or similar with committee approval:

- CME 532 Mechanical/Electrical Equipment (3)
- CME 565 Sustainable Innovations for Residential Construction (3)
- CME 596 Sustainable Energy Systems for Buildings (3)
- CME 596 Environmental Performance Measures for Buildings (3)
- ERE 519 Green Entrepreneurship (3)

Engineering/construction management courses (9 credits) from the following or similar with committee approval:

- CME 605 Building Information Modeling /Construction Management (3)
- CME 543 Construction Estimating (3)
- CME 653 Construction Planning and Scheduling (3)
- CME 654 Construction Project Management (3)
- CIE 678 Rehab of Civil Structures (3)

Application electives (5-8 credits):

- As approved by the committee

Synthesis (3-6 credits):

- CME 898 Professional Experience/Synthesis (3-6)

**Wood Science (M.S., M.P.S., Ph.D.)**
Participating Faculty: ANAGNOST; CROVELLA; KYANKA; MEYER; MORSI-HUSSEIN; SMITH, J.; SMITH, W. Students entering this area of study should have an undergraduate degree in wood science or a related area of science or engineering.

**M.P.S. in Wood Science and Technology:** 24-27 credit hours of coursework plus 3-6 credit hours of a practicum or professional experience/synthesis. Two coursework options are available, the MPS coursework and practicum option and the MPS coursework and synthesis option.

1. **M.P.S. coursework and practicum option:** Engineering/construction management courses (12-21 credits), resource management courses (3-6 credits), environmental studies courses (3-6 credits), practicum (3-6 credits). Total minimum of 30 credits. Courses are selected in consultation with the steering committee.

2. **M.P.S. coursework and synthesis option:** Core courses (10 credits), engineering/construction management courses (9 credits), application electives (5-8 credits), professional experience/synthesis (3-6 credits). Total minimum of 30 credits. Courses are selected in consultation with the steering committee.

**Ph.D./M.S. in Wood Science**

Topics for the M.S. or Ph.D. research may include the following:

- **Wood Science and Technology** (adhesives and finishing, processing and machining, mechanical and physical properties, wood anatomy and wood properties, wood biodegradation, wood composites). Because wood is renewable, it will meet the needs of modern society for a perpetually available, carbon dioxide-neutral material perfectly suited for a vast array of products. The study area Wood Science and Technology includes detailed research on physical, mechanical, or anatomical aspects of wood and its utilization and leads to the M.S., M.P.S., or Ph.D. degree. Wood science stresses research on the material science of wood, dealing with properties important to its use, or to solve problems in wood utilization by practical applications of such knowledge.

- **Engineered Wood Products and Structures** (M.S., Ph.D.) (materials science, engineering mechanics and elasticity, engineering properties of wood composites, computer-aided design, static and dynamic properties of wood) Students with interest in Engineered Wood Products and Structures should have a strong background in integral calculus, statics, mechanics, and mechanical and physical properties of wood. The behavior of wood and wood-based components under loads and the effects of duration of the loads are critical elements when developing engineering codes. Wooden components as small as dowels or as large as bridge beams are considered, using elements of materials science, engineering mechanics and structural engineering. Basic property knowledge, employing theories of elasticity, visco-elasticity and fracture mechanics, is coupled with computer-aided design data to analyze the performance of wood and to solve...
application problems, such as those encountered in wood-frame construction and timber utility structures. How such factors as chemical fire retardant treatments, adhesive performance and mechanical fastener design interact with use requirements is considered. National and international design codes and their development play an important role in specifying research areas of current interest and need. Fabrication and testing of actual components such as trusses, composite beams, and furniture connections are completed in the department’s Wood Engineering Laboratory.

- **Wood Anatomy and Ultrastructure** (wood formation and cell wall organization, cytoskeleton of plant cells, properties related to anatomy and ultrastructure, electron, light and video microscopy). Students with interest in Wood Anatomy and Ultrastructure should have an undergraduate degree in wood anatomy or the biological sciences. Students are required to develop an extensive background in all aspects of microscopy: light, scanning electron, transmission electron, video microscopy and image analysis, including micro-techniques for effective preparation of specimens for the appropriate instrument. Wood anatomy studies are basic to wood identification, wood utilization, and physical/mechanical properties. These studies may include woods from other continents. The field of ultrastructure is very broad with applications in many biological, chemical and materials sciences. Applied to wood, it emphasizes the sub-light microscopic structures (smaller than 0.2 micrometers) found in this natural material, either in the mature form or in its formative stages where various organelles of the living cell may be studied for their roles in producing the mature wood cell. The behavior of wood in its many applications can be observed and explained via microscopy and related instrumentation such as EDXA (energy-dispersive x-ray analysis). State-of-the-art resources and facilities are concentrated in the Center for Ultrastructure Studies, which provides instruction and research support staff.

- **Wood Treatments** (wood-water relationships and wood drying, preservative treatments, polymer treatments, sealants and coatings). Students with an interest in wood treatments and preservation should have an undergraduate degree in wood science or a closely related field. Graduate study in the area of wood treatments allows the student to investigate the scientific basis for the improvement of wood and wood products with various treatments, which include drying, preservative treatments and coatings. Preparation for research includes graduate coursework in wood-water relationships and transport processes and additional study in areas such as wood anatomy and ultrastructure, mechanical properties, wood chemistry, wood microbiology, thermodynamics, and engineering economics. Current research interests include use of innovative techniques to dry and preserve wood, effects of drying method on the subsequent treatability of wood, evaluation of energy usage in lumber drying technologies, improving wood properties with polymer treatments, and moisture migration studies.
Tropical Timbers (identification keys and systematics, wood properties and end use suitability, life zone analyses, expert systems). Studies of tropical timbers take many forms, depending on individual student interests. Often students from other countries bring specific problems and materials with them so their thesis will find immediate application when they return home. The holdings of the C. deZeeuw Memorial Library and reference wood specimens of the H.P. Brown Memorial Wood Collection of the Tropical Timber Information Center (TTIC), housed in Baker Laboratory facilities, are vital to this work. Research topics may be formulated to answer questions dealing with anatomy, identification, properties or uses of various woods from around the world, using the TTIC reference materials. These studies may be quite narrow, such as anatomy and physical properties of woods from a particular region, or much broader, such as regional distribution of species and species groups based on life zone research throughout a country or larger geographic area.

Facilities

A major renovation to the teaching and research laboratories in Baker Laboratory has been completed with a computer facility for estimating, scheduling, project management, wood engineering design, computer-aided design and drafting, finite element analysis and other specialized software. The Wood Products Engineering Laboratory TL-317 (WPEL), is an IAS accredited laboratory (ANS/ISO/IEC 17025:2005) for mechanical testing and includes a wide range of equipment for mechanical testing and wood processing, including electronic data acquisition capabilities, a dry kiln, wood preservation equipment, a wood machining lab, and sawmill.

Construction Management facilities for research and teaching include laboratories for construction safety, building materials and green construction. A dedicated computer laboratory, the Construction Management Laboratory, provides specialized software for construction estimating, scheduling, project management, wood engineering design, computer-aided design and drafting, finite element analysis and other specialized software.

The C.J.K. Wang Wood Biodegradation Laboratory includes mycology culturing facilities and a modern molecular analysis laboratory; research microscopes, image analysis system and wood micro-technique equipment.

One of the largest wood collections in the world, the H. P. Brown Memorial Wood Collection is used to support the graduate research program of the Tropical Timber Information Center. The center also maintains the Carl deZeeuw Memorial Library.

A complete microscopy and image analysis laboratory is provided by the N.C. Brown Center for Ultrastructure Studies. This equipment includes a JEOL JSM-2000EX transmission electron microscope, JEOL JSM-5800LV scanning electron microscope with energy dispersive x-ray analysis and particulate analysis accessories, and a wide variety of light microscopes equipped with image enhancement and various video image analysis capabilities. Graduate students in wood science using this equipment have the best available systems to relate the macroscopic behavior of wood to its...
anatomical characteristics. The facility is available for students and faculty at all departments at SUNY-ESF and neighboring colleges and universities.

The Renewable Materials Institute conducts research in the broad area of sustainable development of wood resources and the uses of wood products.