Department of Environmental Engineering and Earth Sciences

Graduate Student Handbook for the Academic Year 2018 - 2019
Version 1.1

MS Degrees:  Biosystems Engineering
  Environmental Engineering & Science
  Hydrogeology

PhD Degrees:  Biosystems Engineering
  Environmental Engineering & Earth Sciences
<table>
<thead>
<tr>
<th>Policy Additions/Changes</th>
<th>Explanation/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Student Proposal</td>
<td>New on-line form created to submit MS Proposal</td>
</tr>
<tr>
<td></td>
<td>approval by default.</td>
</tr>
</tbody>
</table>
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1.0 INTRODUCTION

We, the faculty and staff in the Department of Environmental Engineering and Earth Sciences (EEES), are glad that you have chosen to pursue your graduate studies here, and we look forward to getting to know you better during your time at Clemson. **It is extremely important that you read this Handbook because it is your responsibility as a graduate student to keep track of your progress in the degree program.**

The first four sections of this Handbook inform graduate students in the EEES Department about academic affairs and regulations pertaining to the granting of advanced degrees. Students should become familiar with this information, as well as with the general Graduate School requirements available from: [http://www.clemson.edu/graduate/](http://www.clemson.edu/graduate/).

The final chapters discuss graduate assistantships and miscellaneous departmental, university, and laboratory policies.

While we have attempted to make sure that all material in this Handbook is consistent with policies set forth by the Graduate School, there may be instances in which there are differences. In that event, the Graduate School policies take precedence.
2.0 REGISTRATION

2.1 Graduate Program Coordinators
Professor Mark Schlautman serves as the Graduate Program Coordinator for the MS in Environmental Engineering and Science (EES) and PhD in Environmental Engineering and Earth Sciences (EEES). Professor Larry Murdoch serves as the Graduate Program Coordinator for the MS Hydrogeology degree program. Professor Terry Walker serves as the Graduate Program Coordinator for the MS and PhD degrees in Biosystems Engineering. The Graduate Program Coordinators should be contacted whenever questions or problems occur relative to regulations and procedures pertinent to the graduate programs. Barbara Smith serves as the Graduate Student Services Coordinator for all graduate students in the EEES Department.

2.2 Registration for New Graduate Students
Prior to registration for their first semester of study, beginning graduate students must communicate with their advisor and/or respective Graduate Program Coordinator who will help them plan their initial program of study. As needed, the Graduate Program Coordinator will help identify suitable major advisors. Registration may be accomplished through iROAR prior to arriving on campus.

2.3 Registration Procedures for All Graduate Students
The Office of Registration Services provides an on-line registration portal (www.registrar.clemson.edu/portal/) with links to registration procedures, schedule of classes, etc., that may be referred to for steps to be taken in the registration process. If a student’s questions are not answered by consulting the on-line resources, including this Handbook, please contact the appropriate Graduate Program Coordinator or the Graduate Student Services Coordinator. The minimum credit requirements for the department are provided in Table 2.1. Exceptions to these requirements may exist for students who are supported by funding from outside of Clemson University. Students are responsible for checking for additional requirements for full-time status, visa status, insurance, fellowships, or other considerations.

Note: There are different requirements for students supported by an assistantship.
### Table 2.1. Minimum Credit Requirements

<table>
<thead>
<tr>
<th>Student Status*</th>
<th>Fall</th>
<th>Spring</th>
<th>Long Summer</th>
<th>SS-I‡</th>
<th>SS-II‡</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supported-full or partial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time, class and/or research</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Full time, thesis writing only</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Part-time, class and/or research</td>
<td>not allowed: supported students must be full-time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time, thesis writing</td>
<td>not allowed: supported students must be full-time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Off-campus</td>
<td>not allowed: supported students must be full-time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Not Supported</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time, class and/or research</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Full-time, thesis writing only</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Part-time, classes only</td>
<td>credits of classes taken</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time, class &amp; research or just research</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Part-time, thesis writing, on-campus</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Off-campus, thesis writing</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*INTERNATIONAL STUDENTS SHOULD CHECK WITH THE OFFICE OF GLOBAL ENGAGEMENT'S INTERNATIONAL SERVICES TO CLARIFY THE NUMBER OF CREDITS REQUIRED FOR THEIR SPECIFIC VISA.*

‡SS-I and -II = first and second Summer terms, respectively.

### 2.4 Section Assignments

Table 2.2 lists section numbers that should be used when signing up for courses such as research (8910 and 9910) and special topics:
Table 2.2. Section Numbers for Individual Faculty Members

<table>
<thead>
<tr>
<th>COURSE</th>
<th>SECTION</th>
<th>USERID</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>8910/9910 001</td>
<td>CDRAPCH</td>
<td>Drapcho, Caye</td>
</tr>
<tr>
<td>BE</td>
<td>8910/9910 002</td>
<td>WALKER4</td>
<td>Walker, Terry</td>
</tr>
<tr>
<td>BE</td>
<td>8910/9910 003</td>
<td>TOWINO</td>
<td>Owino Tom</td>
</tr>
<tr>
<td>BE</td>
<td>8910/9910 005</td>
<td>CDARNAU</td>
<td>Darnault, Christophe</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 001</td>
<td>NMARTI3</td>
<td>Martinez, Nicole</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 002</td>
<td>DEVOL</td>
<td>DeVol, Timothy A.</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 003</td>
<td>TKARANF</td>
<td>Karanfil, Tanju</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 004</td>
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<td>Darnault, Christophe</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 005</td>
<td>KTF</td>
<td>Finneran, Kevin</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 006</td>
<td>LC</td>
<td>Lee, Cindy M.</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 007</td>
<td>FREDI</td>
<td>Molz, Fred J. III</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 008</td>
<td>AMETCAL</td>
<td>Metcalf, Andrew</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 009</td>
<td>FALTAR</td>
<td>Falta, Jr. Ronald W.</td>
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<tr>
<td>EES</td>
<td>8910/9910 010</td>
<td>DFREEDM</td>
<td>Freedman, David L.</td>
</tr>
<tr>
<td>EES</td>
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<td>LADNER</td>
<td>Ladner, David</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 012</td>
<td>LSHULLE</td>
<td>Shuller-Nickles, Lindsay</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 013</td>
<td>LMURDOC</td>
<td>Murdoch, Lawrence C.</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 014</td>
<td>BPowell</td>
<td>Powell, Brian</td>
</tr>
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<td>EES</td>
<td>8910/9910 015</td>
<td>ECARRAW</td>
<td>Carraway, Elizabeth R.</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 016</td>
<td>MSCHLAU</td>
<td>Schlautman, Mark A.</td>
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<td>EES</td>
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<td>Owino, Tom</td>
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<td>EES</td>
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<td>Drapcho, Caye</td>
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<td>WALKER4</td>
<td>Walker, Terry</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 021</td>
<td>ECATES</td>
<td>Cates, Ezra</td>
</tr>
<tr>
<td>EES</td>
<td>8910/9910 022</td>
<td>MADALE</td>
<td>Dales, Michael</td>
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<tr>
<td>EES</td>
<td>8910/9910 023</td>
<td>SPOPAT</td>
<td>Popat, Sudeep</td>
</tr>
<tr>
<td>GEOL</td>
<td>8910 001</td>
<td>APULLEN</td>
<td>Pullen, Alexander</td>
</tr>
<tr>
<td>GEOL</td>
<td>8910 002</td>
<td>FALTAR</td>
<td>Falta, Ron</td>
</tr>
<tr>
<td>GEOL</td>
<td>8910 004</td>
<td>LMURDOC</td>
<td>Murdoch, Lawrence</td>
</tr>
<tr>
<td>GEOL</td>
<td>8910 005</td>
<td>CDARNAU</td>
<td>Christopher Darnault</td>
</tr>
<tr>
<td>GEOL</td>
<td>8910 006</td>
<td>LC</td>
<td>Lee, Cindy M.</td>
</tr>
</tbody>
</table>

2.5 Maximum Enrollment Limits

The university sets limits on the maximum number of credits graduate students may earn in a given term, as specified in the Graduate School Policies and Procedures Handbook. All requests for permission to exceed these limits must be approved by the Dean of the Graduate School and the Chair of the EEES Department.
3.0 POLICIES AND PROCEDURES FOR MASTERS OF SCIENCE (MS) DEGREES

3.1 Introduction
These policies were adopted by the faculty of EEES on 10 March 1997, and govern all students matriculating in the master's program after August 2015. These policies supersede the policies dated 10 March 1997, 17 January 1986 and 2 March 1985.


Academic policies and procedures are posted on the Graduate School website: http://www.clemson.edu/graduate/students/policiesprocedures/index.html

3.2 Research Advisors
MS thesis students supported by a teaching assistantship should select an advisor during the first semester following matriculation if one is not already selected. The advisor will guide the day-to-day research activities and the preparation of the thesis. The advisor also helps plan the student’s curriculum. The selection of the advisor is one of the most important decisions facing the graduate student.

All matriculating students not receiving financial assistance are considered non-thesis students. Non-thesis students should meet with their advisor at least once per semester. In special cases, a student not receiving financial assistance may request permission to pursue thesis research. For these special situations, the student must make a written request to the appropriate Graduate Coordinator who will either approve or deny the request based on student qualifications, department resources available, etc.

During each semester, all students receiving financial assistance should meet with their advisor to discuss their research project on a regular basis. Students funded under a teaching assistantship will be contacted by the Department Chair or an instructor regarding their TA assignment near the beginning of the semester.

3.3 Advisory Committee
The Advisory Committee should be chosen during the first semester after matriculation. An MS Advisory Committee shall consist of a minimum of three members who hold faculty appointments at Clemson University. A majority of the committee members must hold regular faculty appointments in the EEES Department.

The chair of the committee is usually the research advisor and shall hold a faculty appointment in the EEES Department. It is recommended that the GS-2 Part I (Committee Selection) be submitted as soon as the committee is selected. The
advisory committee for non-thesis students will be the examining committee for the final oral exam.

The student's Advisory Committee will perform the following functions:

- specify required co-requisite/remedial courses, if deemed necessary;
- approve course work;
- supervise the research program;
- administer the final oral examination;
- approve the MS thesis; and
- make a recommendation to the Graduate School for awarding the degree.

**Note:** Co-requisite/remedial courses are specified by the Advisory Committee to resolve deficiencies in a student’s educational background and must be completed before receipt of the MS degree.

3.4 Curriculum Requirements for MS Degrees

There are four unique degree tracks/programs at the MS level in the EEES Department: 1) Biosystems Engineering (BE); 2) Environmental Engineering and Science (EES); 3) Environmental Engineering and Science -- Environmental Health Physics (EHP); and 4) Hydrogeology (HYDRO).

3.4.1 Biosystems Engineering

For the MS degree in **Biosystems Engineering** (BE), the following requirements apply:

- A minimum of 24 hours of graduate course credits (including 1 hour of graduate seminar), with at least one-half at the 8000 level or above;
- 9 graduate credits of coursework with engineering rubric (excluding special topics courses), of which 6 credit hours should be of the BE rubric;
- 6 hours of thesis research;
- STAT 8010;
- 3 credit hours of additional coursework that emphasizes advanced mathematics, i.e., courses with the Mathematics, Engineering or Experimental Statistics (STAT prefix) rubric;
- BE 6510;
- Submission of one manuscript to a peer-reviewed journal;
- A maximum of 3 credit hours of special topics (regardless of rubric); and
- Attendance in EES 8610 during the fall semester and BE 6510 during the spring semester.

Course work for the MS degree in Biosystems Engineering is typically completed in 2 years. An oral defense is required for the thesis. A non-thesis option is not available for Biosystems Engineering students.

Remedial coursework for Biosystems Engineering students is required for those who do not have an ABET-accredited (or equivalent) undergraduate degree. The
remedial coursework consists of:

- Basic math courses through differential equations (MATH 2080)
- Freshmen chemistry and biology courses that include laboratories.
- Three of the listed engineering science courses required for undergraduates majoring in Biosystems Engineering. These include Statics, Dynamics, Fluids, Mechanics of Materials, Thermodynamics, and Circuits; consult the BE undergraduate curriculum to determine equivalent courses.

3.4.2 Overview: EES, EHP & HYDRO

For the MS degree tracks in Environmental Engineering and Science (EES), Environmental Health Physics (EHP) and Hydrogeology (HYDRO), the following requirements apply:

- A minimum of 24 semester hours of graduate credit (exclusive of EES 8610 or GEOL 8510) approved by the student’s Advisory Committee (unless the non-thesis option is chosen – see Section 3.8 below);
- At least one-half of the total graduate credit hours required by the Advisory Committee, exclusive of thesis research, must be selected from courses numbered 8000 or above;
- Attendance in EES 8610 or GEOL 8510 during the fall and spring semesters.

Prerequisite and co-requisite courses do not count toward the 24 semester hours of graduate credit required for the degree. Prerequisite and co-requisite courses are specified by the faculty to resolve deficiencies in a student’s educational background. Prerequisite courses typically must be completed before admission as a graduate student, whereas co-requisite courses must be completed before receipt of the MS degree. Note: any pre-requisite or co-requisite course taken at Clemson will be included in the overall GPA, which must be 3.0 or above to be in good academic standing.

3.5 Required Core Courses for the MS in EES

All MS students pursuing the Environmental Engineering and Science degree are required to take three core courses (unless a similar course was previously taken and accepted by the EES Graduate Program Coordinator or Chair of EEES), constituting a total of nine credit hours.

- EES 8020, Environmental Engineering Principles
- EES 8430, Environmental Chemistry
- EES 8510, Biological Principles of Environmental Engineering, or EES 8150, Radiobiology (for students seeking the EHP degree)

3.6 Focus Areas for the MS in EES

Each student pursuing an MS in Environmental Engineering and Science (EES) will
choose one of the following five focus areas and meet the requirements listed. Substitutions and changes will be allowed upon written approval of the student’s advisor and the EES Graduate Program Coordinator. Filing of the GS2-Committee Selection and Plan of Study Forms is required by the end of the student’s second semester.

In addition to the three core classes listed above, the five focus areas below specify 3 to 9 credit hours in required courses (typically 9) and typically another 3 from an approved list of electives. A program of the three core courses, three required courses in a focus area, and an elective in the focus area constitutes 21 of the minimum 24 credit hours of course work for the thesis-based MS degree.

3.6.1 Process Engineering Focus Area
The purpose of the process engineering focus area is to prepare graduates to design engineered systems for removing contaminants from air, water, and soil - an activity that is central to the field of environmental engineering. Because of the continually evolving nature of the problems faced by environmental engineers, courses in this area focus on the approach to problem solving rather than on specific solutions to today's problems. This provides the students with a strong foundation in unit operations and the ability to assemble them into process trains capable of solving any pollution control problem, regardless of its complexity or nature.

Required Courses:
- EES 8030 Physicochemical Operations I
- EES 8060 Process and Facility Design for Environmental Control Systems (at least 3 credit hours)

Approved Electives: (at least one required)
- EES 8040 Biochemical Operations in Wastewater Treatment Systems
- EES 6370 Biodegradation and Bioremediation
  Other courses on appropriate subjects may be substituted upon approval of the student’s Advisory Committee.

Suggested Electives:
- EES 6300 Air Pollution Engineering
- EES 6840 Municipal Solid Waste Management
- EES 8050 Environmental Unit Operations Laboratory
- EES 8450 Environmental Organic Chemistry
- EES 8470 Advanced Environmental Chemistry
- EES 8560 Pollution of the Aquatic Environment
- EES 8800 Environmental Risk Assessment
- CHE 6010 Transport Phenomena
- CHE 6500 Chemical Reaction Engineering
- CHE 8050 Chemical Engineering Kinetics
Example programs of study for the first three semesters within the Process Engineering focus area are outlined in Table 3.1, based on five subareas:

### Table 3.1. Example Course Sequences for the Process Engineering Focus Area

<table>
<thead>
<tr>
<th>Wastewater Treatment</th>
<th>Biological Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td><strong>Spring</strong></td>
</tr>
<tr>
<td>EES 8020</td>
<td>EES 8030</td>
</tr>
<tr>
<td>EES 8430</td>
<td>EES 8040</td>
</tr>
<tr>
<td>EES 8510</td>
<td>Elective 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physicochemical Treatment</th>
<th>Hazardous Waste Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td><strong>Spring</strong></td>
</tr>
<tr>
<td>EES 8020</td>
<td>EES 8030</td>
</tr>
<tr>
<td>EES 8430</td>
<td>Elective 1</td>
</tr>
<tr>
<td>EES 8510</td>
<td>Elective 2</td>
</tr>
</tbody>
</table>

*These electives would be taken by non-thesis students.

### 3.6.2 Environmental Chemistry Focus Area

The overall goal of the Environmental Chemistry focus area is to introduce the fundamental concepts important to environmental chemistry. In particular, the focus is on understanding sources of chemicals in the environment and the characteristics of the chemical and the environment that control fate and effects. Also of interest are the physical, chemical and biological processes that affect the behavior of inorganic and organic contaminants in natural and engineered systems and how these properties may be exploited to detect, quantitatively model and control the contaminants in environmental systems.

**Required Courses:**
- EES 8450 Environmental Organic Chemistry
- EES 8470 or 8460 Advanced Environmental Chemistry or Inorganic
Environmental Geochemistry

Approved Electives: (at least one required)
- EES 6370  Biodegradation and Bioremediation
- EES 8460  Inorganic Environmental Geochemistry
- EES 8470  Advanced Environmental Chemistry
- EES 8560  Pollution of the Aquatic Environment (even F)
- EES 8800  Environmental Risk Assessment
- ETOX 8410  Procedures and Techniques in Ecological Risk Assessment
- GEOL 8090  Subsurface Remediation Modeling

*Other courses on appropriate subjects may be substituted upon approval of the student’s Advisory Committee.*

Other Suggested Courses:

- EES 6300  Air Pollution Engineering
- EES 6840  Municipal Solid Waste Management
- EES 6850  Hazardous Waste Management
- EES 6860  Pollution Prevention and Industrial Ecology
- EES 8030  Physicochemical Operations I
- EES 8130  Environmental Radiation Protection Laboratory 3 (1,6)
- EES 8170  Applied Process Simulation
- EES 8320  Air Pollution Meteorology
- CH 8110  Analytical Chemistry
- CH 8120  Chemical Spectroscopic Methods
- CH 8160  Separation Science
- CH 8350  Chemical Kinetics
- CHE 6010  Transport Phenomena
- CHE 6500  Chemical Reaction Engineering
- CHE 8050  Chemical Engineering Kinetics
- CHE 8140  Applied Numerical Methods in Process Simulation
- ETOX 6300  Toxicology
- ETOX 8060  Advanced Environmental Toxicology
- ETOX 8520  Ecological Models
- ETOX 8540  Aquatic Toxicology
- STAT 8010  Statistical Methods I 4 (3,3)
- STAT 8040  Sampling
- GEOL 6820  Groundwater and Contaminant Transport
- GEOL 8080  Groundwater Modeling
- GEOL 8100  Analytical Methods for Hydrogeology
- GEOL 8750  Hydrogeology Summer Field Camp
- MICR 6100  Soil Microbiology

**NOTE:** The above suggested courses are a sampling of what was available at the start of the 2018-19 academic year. Students are encouraged to consult current course offerings.
3.6.3 **Subsurface and Surface Processes Focus Area**
The main objective of the Subsurface and Surface Processes Focus Area is to provide students with the knowledge and training needed to deal with transport and fate processes in engineered and natural systems. Natural systems include the atmosphere, surface waters and subsurface waters. Incorporation of the results of transport analyses into management decisions involving monitoring and remediation often requires the quantification and analysis of various real and perceived risks, so an additional objective is to provide the basic tools needed for risk and decision analysis. A fundamental, quantitative understanding of all these processes is emphasized, so that students will be able to adapt readily to ever-changing conditions in the real world.

**Required Courses (two out of three):**
- EES (GEOL) 8080 Groundwater Modeling
- EES 8800 Environmental Risk Assessment
- EES (GEOL) 8170 Applied Process Simulation

**Approved Electives Group A: (at least two required)**
- EES (GEOL) 8080 Groundwater Modeling
- EES 8800 Environmental Risk Assessment
- EES (GEOL) 8170 Applied Process Simulation
- EES (GEOL) 8090 Subsurface Remediation Modeling
- EES 6370 Biodegradation and Bioremediation
- GEOL 6590 Biogeochemistry
- EES 8420 Actinide Chemistry
- EES 8450 Environmental Organic Chemistry
- EES 8470 Advanced Environmental Chemistry

**Approved Electives Group B: (at least one required)**
- GEOL 6130 Stratigraphy
- GEOL 6210 GIS Applications in Geology
- GEOL 6820 Groundwater and Contaminant Transport
- GEOL 8010 Field Geophysical Techniques
- GEOL 8030 Geostatistics
- GEOL 8060 Aquifer Characterization
- GEOL 8140 Environmental Sedimentology
- GEOL 8160 Aquifer Systems
- GEOL 8180 Hydrogeology of Fractured Aquifers
- GEOL 8750 Hydrogeology Summer Field Camp

*Other courses on appropriate subjects may be substituted upon approval of the student’s Advisory Committee.*

3.6.4 **Sustainable Systems and Environmental Assessment Focus Area**
The Sustainable Systems and Environmental Assessment focus area is designed to challenge students to think about environmental systems in a broader context.
The objective of the curriculum is to provide a basis for the analysis of complex interactions between human and natural systems. The core courses cover fundamental principles of systems analysis and risk assessment while the electives allow students to define a path of study that bridges scientific and social inquiry.

**Required Courses: (two out of three)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES</td>
<td>6860 Environmental Sustainability</td>
</tr>
<tr>
<td>EES</td>
<td>8200 Environmental Systems Analysis</td>
</tr>
<tr>
<td>EES</td>
<td>8800 Environmental Risk Assessment</td>
</tr>
</tbody>
</table>

**Approved Electives:**

**Group A: (at least 6 credits required)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL</td>
<td>6410 Ecology</td>
</tr>
<tr>
<td>BIOL</td>
<td>6430 Freshwater Ecology</td>
</tr>
<tr>
<td>CE</td>
<td>6360 Sustainable Construction</td>
</tr>
<tr>
<td>CE</td>
<td>6370 Sustainable Energy Project Design and Analysis</td>
</tr>
<tr>
<td>CPSC</td>
<td>8300 Systems Modeling</td>
</tr>
<tr>
<td>CRP</td>
<td>8340 Spatial Modeling Using GIS (note pre-requisites)</td>
</tr>
<tr>
<td>ECON</td>
<td>6400 Game Theory</td>
</tr>
<tr>
<td>EES</td>
<td>8200 Environmental Systems Analysis</td>
</tr>
<tr>
<td>EES</td>
<td>8800 Environmental Risk Assessment</td>
</tr>
<tr>
<td>ENR</td>
<td>6130 Restoration Ecology</td>
</tr>
<tr>
<td>ETOX</td>
<td>6300 Toxicology</td>
</tr>
<tr>
<td>ETOX</td>
<td>8410 Procedures and Techniques in Ecological Risk</td>
</tr>
<tr>
<td>ETOX</td>
<td>8520 Ecological Models</td>
</tr>
<tr>
<td>ETOX</td>
<td>8540 Aquatic Toxicology</td>
</tr>
<tr>
<td>GEOL</td>
<td>6210 GIS Applications in Geology</td>
</tr>
<tr>
<td>IE</td>
<td>6870 Industrial Safety</td>
</tr>
<tr>
<td>IE</td>
<td>8030 Engineering Optimization and Application</td>
</tr>
<tr>
<td>MATH</td>
<td>6030 Introduction to Statistical Theory</td>
</tr>
<tr>
<td>MATH</td>
<td>6340 Advanced Engineering Mathematics</td>
</tr>
<tr>
<td>MATH</td>
<td>6410 Stochastic Models</td>
</tr>
<tr>
<td>STAT</td>
<td>8010 Statistical Methods I</td>
</tr>
<tr>
<td>STAT</td>
<td>8150 Environmental and Ecological Statistics</td>
</tr>
</tbody>
</table>

**Group B: (at least one of the following courses or related course approved by Advisory Committee required)**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>APEC</td>
<td>6570 Natural Resource Economic Theory and</td>
</tr>
<tr>
<td>APEC</td>
<td>8100 Natural Resources Management and Policy</td>
</tr>
<tr>
<td>APEC</td>
<td>8110 Economics of Environmental Quality</td>
</tr>
<tr>
<td>CRP</td>
<td>8000 Human Settlement</td>
</tr>
<tr>
<td>CRP</td>
<td>8030 Site Planning and Infrastructure</td>
</tr>
<tr>
<td>CRP</td>
<td>8060 Urban Systems and Growth Management</td>
</tr>
<tr>
<td>CRP</td>
<td>8140 Public Transit</td>
</tr>
<tr>
<td>CRP</td>
<td>8410 Seminar in Environmental Planning</td>
</tr>
<tr>
<td>CRP</td>
<td>8450 Water Policy and Law (POST 8450)</td>
</tr>
<tr>
<td>CRP</td>
<td>8700 Seminar in Sustainable Development</td>
</tr>
<tr>
<td>ENR</td>
<td>6290 Environmental Law and Policy</td>
</tr>
</tbody>
</table>
ENR 6500 Conservation Issues
ENSP 6720 Environmental Planning and Control
HLTH 6980 Improving Population Health
ME 6200 Energy Sources and Their Utilization
SOC 6330 Globalization and Social Change
SOC 8360 Environmental Sociology
POST 8700 Seminar in Sustainable Development
PRTM 8490 Sustainable Event Management
PRTM 8500 Sustainable Tourism: Myth or Reality?

Other courses on appropriate subjects may be substituted upon approval of the student’s Advisory Committee.

3.6.5 Nuclear Environmental Engineering & Science (NEES) Focus Area
The Nuclear Environmental Engineering and Science (NEES) program offers a combination of laboratory and lecture courses on topics such as environmental health physics, risk assessment, actinide chemistry, radiation detection and measurement, and radioactive waste management. The research efforts primarily focus on radiation detection and measurements, environmental radiochemistry, risk assessment, radionuclide fate and transport, and radioactive waste processing. Students within the NEES program may follow either the Environmental Radiochemistry program or the Accreditation Board for Engineering and Technology (ABET) Applied Science Accreditation Commission (ASAC) accredited Environmental Health Physics program. Specific coursework for each program is listed below.

NEES - Environmental Radiochemistry Program
The Environmental Radiochemistry program curriculum is designed to introduce the fundamental concepts associated with quantification of radionuclide concentrations and behavior in natural and engineered systems. Emphasis is placed on actinide environmental chemistry, radionuclide fate and transport in the environment, radionuclide speciation, analytical radiochemical methods, and chemical separations important in the nuclear fuel cycle. The objective of the curriculum is to provide students with knowledge and training in such areas as radionuclide/actinide speciation, fate and transport in subsurface environments, radioanalytical chemical separations, nuclear waste management, spent nuclear fuel processing and isotope production.

Required Courses: (two out of three)
- EES 6100 Environmental Radiation Protection
- EES 8130 Environmental Radiation Protection Laboratory*
- EES 8420 Actinide Chemistry

*Note: EES 6110 is a prerequisite for EES 8130.
At least 9 credit hours of the following are required, 3 credit hours of which must be from an approved elective:

**Approved Electives:**
- EES 6110  Ionizing Radiation Detection and Measurement
- EES 8120  Environmental Nuclear Engr. (Radioactive Waste Mgt.)
- EES 8130  Environmental Radiation Protection Laboratory
- EES 8420  Actinide Chemistry
- EES 8450  Environmental Engineering Chemistry II
- EES 8470  Advanced Environmental Chemistry
- EES 8800  Environmental Risk Assessment

**Other Suggested Courses:**
- EES 6300  Air Pollution Engineering
- EES 6370  Biodegradation and Bioremediation
- EES 6820  Groundwater and Contaminant Transport
- EES 6850  Hazardous Waste Management
- EES 8170  Applied Process Simulation
- EES 8320  Air Pollution Meteorology
- EES 8330  Air Pollution Control Systems
- EES 8370  Biodegradation and Bioremediation
- EES 8440  Environmental Engineering Chemistry Laboratory I
- EES 8550  Surface and Subsurface Transport
- EES 8560  Pollution of the Aquatic Environment
- CH 8050  Theoretical Inorganic Chemistry
- CH 8110  Analytical Chemistry
- CH 8120  Chemical Spectroscopic Methods
- CH 8130  Electrochemical Science
- CH 8310  Chemical Thermodynamics
- CH 8350  Chemical Kinetics
- STAT 8010  Statistical Methods
- STAT8040  Sampling
- GEOL6590  Biogeochemistry
- GEOL6820  Groundwater and Contaminant Transport
- GEOL 8080  Groundwater Modeling
- GEOL 8090  Subsurface Remediation Modeling
- GEOL 8100  Analytical Methods for Hydrogeology
- MATH 6340  Advanced Engineering Mathematics
- MATH 8050  Data Analysis
- MICR 6100  Soil Microbiology
- PHYS 8520  Radiation Physics
NOTE: The above-suggested courses are a sampling of what was available at press time. Students are also encouraged to consult current course offerings.

**NEES - Environmental Health Physics Program**

Environmental Health Physics (EHP) is designed to address broad environmental issues associated with anthropogenic and natural radioactivity. The objective of the curriculum is to provide students with knowledge and training needed to protect human health and the environment from ionizing radiation. Integral to this program is assessing risk associated with the radiation. Research areas include low-level radiation detection, analytical techniques to quantify stable elements utilizing radiation, environmental monitoring, radionuclide transport, radioactive waste management, and risk assessment.

**Educational Objectives**

The educational objectives of the EHP are for its alumni to demonstrate following a few years after graduation:

- EHP alumni will advance in responsibility in their careers through addressing contemporary problems in environmental health physics
- EHP alumni will make significant professional contributions in independent research, project leadership or professional leadership

**NOTE:** the Environmental Health Physics program is accredited by the Applied Science Accreditation commission of ABET, [http://www.abet.org](http://www.abet.org).

**Required Courses:**
- EES 6100 Environmental Radiation Protection
- EES 6110 Ionizing Radiation Detection and Measurement
- EES 8800 Environmental Risk Assessment

**Approved Elective Courses:**
- BIOE 6310 Medical Imaging
- EES 6140 Radioecology
- EES 6300 Air Pollution Engineering
- EES 6850 Hazardous Waste Management
- EES 8030 Physicochemical Operations I
- EES 8120 Environmental Nuclear Engr. (Radioactive Waste Mgt.)
- EES 8130 Environmental Radiation Protection Laboratory
- EES 8160 Technical Nuclear Forensics
- EES 8320 Air Pollution Meteorology
- EES 8330 Air Pollution Control Systems
- EES 8420 Actinide Chemistry
- EES 8440 Environmental Engineering Chemistry Laboratory I
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- EES 8450 Environmental Engineering Chemistry II
- EES 8550 Surface and Subsurface Transport
- GEOL 6150 Analysis of Geological Processes
- GEOL 8030 Geostatistics
- STAT 8010 Statistical Methods
- STAT 8040 Sampling
- ME 6200 Energy Sources and Their Utilization
- ME 6260 Nuclear Energy
- MATH 6340 Advanced Engineering Mathematics
- MATH 8050 Data Analysis
- PHYS 6520 Atomic and Nuclear Physics

**NOTE:** The courses above are a sampling of what was available at press time. Students are also encouraged to consult current course offerings.

### 3.7 MS in Hydrogeology

The objective of the Hydrogeology MS degree program is to train students for a career in hydrogeology.

Students are expected to demonstrate strong capabilities in the Earth Sciences including competency in Physical Geology, Structural Geology, and Sedimentology and Stratigraphy. Students who have not taken courses in these Earth Science topics at the undergraduate level must either take them as a graduate student, or have this expectation waived by their graduate committee.

Quantitative skills are important to a successful career in hydrogeology. All graduate students in the hydrogeology program are required to take GEOL 8080 to provide a foundation for groundwater modeling skills. Graduate students who have not taken a course in differential equations are required to take GEOL 6150.

The foundations of nearly all hydrogeology projects are based on data obtained in the field. Hydrogeology graduate students are required to take GEOL 8750 to acquire an introduction to field methods.

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 8080</td>
<td>Groundwater Modeling</td>
</tr>
<tr>
<td>GEOL 8750</td>
<td>Hydrogeology Field Camp</td>
</tr>
</tbody>
</table>

**Other Requirements**

Graduate students must take a minimum of two additional 8000-level courses, to be selected from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 8010</td>
<td>Field Geophysical Techniques¹</td>
</tr>
<tr>
<td>GEOL 8030</td>
<td>Geostatistics</td>
</tr>
<tr>
<td>GEOL 8050</td>
<td>Advanced Stratigraphy¹</td>
</tr>
</tbody>
</table>
GEOL 8060  Aquifer Characterization\(^1\)
GEOL 8090  Subsurface Remediation Modeling
GEOL 8100  Analytical Methods for Hydrogeology\(^1\)
GEOL 8110  Rock Physics\(^1\)
GEOL 8130  Environmental Geochemistry
GEOL 8140  Environmental Sedimentology\(^1\)
GEOL 8160  Aquifer Systems
GEOL 8170  Applied Process Simulation
GEOL 8180  Hydrogeology of Fractured Aquifers\(^1\)

\(^1\)These courses are inactive as of 2018, but they may be offered in the future.

3.8 Non-Thesis Option for the MS Degrees in EES and Hydrogeology
A non-thesis option is available for the MS degrees in EES and Hydrogeology upon approval by the EEES faculty. The non-thesis option consists of a minimum of 30 semester hours of graduate coursework approved by the student’s Advisory Committee, and students must pass a final oral exam. Coursework by students in the non-thesis option normally includes the courses required for the EES or Hydrogeology MS degree. A minimum of 21 hours must be at the 8000-level.

Students in the non-thesis option must complete a research project supervised by a faculty member, and present the project during their final oral exam. The research project can be used for up to 3 credits of a Special Problems course (either EES 8810 or GEOL 8810).

Students in the non-thesis option are not eligible for research or teaching assistantship appointments, but are eligible for graduate internships or other sources of support. A student who has received assistantship support at any time while a graduate student in the EEES department is not eligible for the non-thesis option except under rare circumstances that must be approved by the appropriate Graduate Coordinator and Department Chair.

NOTE: A non-thesis option is being developed for the MS in Biosystems Engineering.

3.9 Curriculum Development - GS2 Form
All students are expected to develop an area of study consisting of one of the areas of specialization above with the advice and consent of their Advisory Committee. Programs that do not follow one of the focus areas must be approved by the Advisory Committee.

The GS2 Form should be completed as soon as the student talks with their advisor and determines the course of study they will pursue; but no later than the end of the second semester for MS students. The GS2 is an electronic form that serves
to appoint the Graduate Advisory Committee in Part 1 and notifies the Graduate School of all the classes the student will take to fulfill their degree requirements in part 2. It is important to note that any class listed on one's GS2 must be completed before graduation. If changes are necessary, a revised GS2 must be filed.

Information about the electronic GS2 form may be found at: http://www.clemson.edu/graduate/students/gs2-hints.html

3.10 MS Thesis

3.10.1 Proposal
The MS thesis proposal is a persuasive document intended to describe the worthiness of the proposed research. It should be a concise document that is at least 5 pages in length when double-spaced, not including references. MS students must complete the final draft of their proposal by the end of their second semester. Guidelines for the proposal are described in Section 5.

The proposal is developed with the help of the advisor and committee. The approach and procedure vary somewhat from advisor to advisor, so students should discuss the process with their research advisor early. The purpose of the proposal is to create a research plan. Actual activities may vary as conditions and initial results dictate.

The research proposed should be worthwhile and tractable. At the center of the proposal, there should be a clear hypothesis to be tested and/or a set of objectives. The material before the objectives should give the necessary background and lead to why the hypotheses/objectives are worth pursuing. After the objectives are stated, a research plan should be presented aimed at attaining the objectives. Students should review the central parts of the proposal, especially the objectives, with their advisor, and then produce an initial draft.

The student’s advisor will review the first draft and offer suggestions for changes. Upon approval of the advisor, electronic or hard copies will be distributed to the other committee members for their review and approval. A signed hard copy of the title page signifying approval of the thesis proposal by the Advisory Committee must be given to the Student Services Coordinator. A sample proposal cover sheet can be found at: http://www.clemson.edu/cecas/departments/eees/about/form-files.html

3.10.2 Completion of the MS Thesis
The first draft of the thesis should be completed at least eight weeks before the date of the final oral examination. Refer to Section 5 for details for preparing the thesis.
### 3.10.3 Final Oral Examination for the MS Thesis

The final oral examination is given no later than approximately three weeks before graduation, under the authority of the student's Advisory Committee in accordance with Graduate School deadlines, found at: [http://www.clemson.edu/graduate/students/deadlines.html](http://www.clemson.edu/graduate/students/deadlines.html)

The MS thesis committee should receive a final draft at least 10 working days before the scheduled defense.

The student is responsible for scheduling the examination, in consultation with the chair of the committee and its members, and with the Student Services Coordinator who will notify Graduate School. The student is responsible for notifying the Graduate School (via the Graduate School web site) at least 10 days before the defense to place the date and location on the calendar. During the examination, MS thesis students will be expected to orally present the findings of the research, support various aspects thereof, and be questioned on integrated knowledge of related coursework. The Graduate School will be notified of the time and place of the examination at least ten days prior to the time scheduled. Procedurally, the examination consists of a 30- to 45-minute presentation made by the student followed by questions posed first by non-members of the Graduate Advisory Committee and then by the members of the student's Graduate Advisory Committee.

Satisfactory performance on the final examination will result in a favorable report to the Deans of Engineering, Computing and Applied Sciences and the Graduate School. The GS7M form will be prepared for the Advisory Committee by the Student Services Coordinator and will be signed by the committee after all revisions to the thesis have been approved by the committee.

Unsatisfactory performance on the final examination, as determined by the Advisory Committee, will result in at least one of the following actions: (a) additional work on the thesis and resubmission of the thesis to the Advisory Committee for further review; (b) additional study in the environmental engineering & science field and reexamination; or c) failure on the exam. In the case of failure, the Advisory Committee is required to submit a written report to the Deans of the College of Engineering, Computing and Applied Sciences and the Graduate School that the student failed the final examination. The Advisory Committee may specify the nature of the reexamination. A second failure on the final examination may, at the discretion of the examining committee, result in the student being declared ineligible for an MS degree in EEES at Clemson University.

### 3.11 MS Non-Thesis

The final oral examination for non-thesis MS students consists of a short (15-20 minute) technical presentation based on the special project and questions on
material from five courses that are selected by the student and the advisory committee chair. The examining committee is the same as the advisory committee listed on the student GS2. The non-thesis exam takes place in a closed session.

3.12 Application for Graduation
Early in the semester that the student intends to graduate, the student must apply to graduate through iROAR. Go to “Student Record” and select “Apply to Graduate.” Deadlines for each graduation can be found at: https://www.clemson.edu/graduate/students/deadlines.html

3.13 Checkout and Exit Interview
Before graduation, students must complete a checkout form and an Exit Interview Form. When the forms are completed, the student should contact the Student Services Coordinator and schedule an exit interview. The checkout form ensures that all research materials are provided to the advisor, labs are clean and samples are archived or disposed of properly, etc. The exit interview is part of the assessment process for the faculty to continuously improve the curriculum and graduate experience for the students.

3.14 Jurisdiction/Authority
This Handbook is subject to periodic review and revision by the EEES faculty. Each MS student is subject to the policies in effect at the time of matriculation in their degree program. If policies change, a student may petition in writing the EEES faculty for approval, or disapproval, of changing to the new policies.

3.15 Exceptions to Policy
A student may be granted an exception to this policy for the MS degree if they petition the faculty of EEES in writing and receive a favorable action.

3.16 Master's Student Checklist
Table 3.2 provides a checklist for milestones in the Master of Science degree program.
### Table 3.2: Checklist for Master’s Students

<table>
<thead>
<tr>
<th>What</th>
<th>When</th>
<th>How/Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Selection of major advisor</td>
<td>Before end of 1st semester</td>
<td>Notify Student Services Coordinator of choice</td>
</tr>
<tr>
<td>2. Appointment of Advisory Committee</td>
<td>Before end of 1st semester</td>
<td>In consultation with advisor and committee</td>
</tr>
<tr>
<td>3. Preparation of study program</td>
<td>Before end of 1st semester</td>
<td>In consultation with major advisor</td>
</tr>
<tr>
<td>4. Filing of study plan</td>
<td>Before end of 2nd semester</td>
<td>GS2 Form by student</td>
</tr>
<tr>
<td>5. Approval of thesis or project proposal</td>
<td>Before end of 2nd semester</td>
<td>Signed thesis or project proposal submitted to graduate student file</td>
</tr>
<tr>
<td>6. Graduation application</td>
<td>After completion of at least 15 hours of course work and early in the semester during which degree is expected</td>
<td>iROAR by student</td>
</tr>
<tr>
<td>7. Submittal of thesis or schedule the non-thesis exam</td>
<td>For thesis: 1st draft at least 8 weeks before date of final examination; final (advisor approved) copies at least 10 days before final examination For non-thesis: Schedule oral exam so that it can be completed well before final grades are due.</td>
<td>By student</td>
</tr>
<tr>
<td>8. Final examination (oral)</td>
<td>At least 3 weeks prior to graduation (see Graduate School schedule for date)</td>
<td>GS7 Form to be filed by advisor after examination is completed</td>
</tr>
<tr>
<td>9. Cap and gown rental</td>
<td>Early during semester in which degree is to be conferred</td>
<td>By student</td>
</tr>
<tr>
<td>10. Final Checkout</td>
<td>At least one week prior to graduation</td>
<td>Obtain all required signatures on checkout form and make appointment for exit interview</td>
</tr>
</tbody>
</table>
4.0 POLICIES AND PROCEDURES FOR THE PhD DEGREE

4.1 Introduction
These policies were adopted by the faculty of EEES on 10 March 1997, and govern all students matriculating in the Doctoral program after August 2011. These policies supersede the policies dated 10 March 1997, 17 January 1986 and 2 March 1985.


4.2 Advisory Committee
The student, in consultation with their research advisor, selects an Advisory Committee. A PhD Advisory Committee shall consist of a minimum of four members who hold professorial appointments at Clemson University. A non-Clemson employee must be appointed as an adjunct faculty member to serve on a committee. A majority of the committee shall hold regular faculty appointments in the Department of EEES. Students and advisors are encouraged to select at least one member from a department other than EEES. If a minor is declared, this area must be represented on the committee. The chairperson of the committee shall hold a regular faculty appointment in EEES.

The Advisory Committee will perform the following functions for students:

- Specify required co-requisite/remedial courses, if deemed necessary
- Approve their plan of study;
- Supervise their graduate program and dissertation research;
- Administer the qualifying, comprehensive, and final examinations; and
- Make a recommendation to the Graduate School for awarding of the PhD degree.

4.3 Curriculum Development
A plan of course work is developed by the PhD student with the assistance of the research advisor and input from the Advisory Committee. This is normally done before the end of the second semester after matriculation, but must be no later than the beginning of the fourth semester. This plan is formally submitted to the Graduate School on the electronic GS2 Form, which consists of two parts. Part 1 is the appointment of the committee and part 2 is the plan of study. Instructions for the GS2 form are located at: http://www.clemson.edu/graduate/students/gs2-hints.html
Students may opt to follow the MS degree if they enter the PhD program without an MS. This option allows the student to obtain an MS degree once certain conditions are met. Information about this option is available below.

4.3.1 PhD in Environmental Engineering and Earth Sciences
A minimum of 18 hours of doctoral research is required. The combination of coursework must represent at least 30 hours beyond the MS degree. Courses listed on the GS2 Form must be completed prior to graduation. If changes are necessary, a revised GS2 must be submitted.

Work in a minor field, if declared, normally requires 12 to 24 hours in courses carrying graduate credit.

All resident EEES PhD students must register for EES 9610 (seminar) each term that it is offered.

4.3.2 PhD in Biosystems Engineering
Requirements include:
- A minimum of 18 hours of dissertation research, of which 3 credits must be in Experimental Statistics;
- Submission of 2 manuscripts to peer-reviewed journals,
- A maximum of 3 credit hours of special topics (regardless of rubric); and
- Enrollment in BE 6510 (seminar) once during the PhD program.

Work in a minor field, if declared, normally requires a minimum of 15 hours in courses carrying graduate credit above the requirements of an MS degree with one-half at the 8000-level or above, of which 6 credit hours should have a BE rubric.

A research proposal is due to the graduate committee within the first year of study.

The combination of coursework must represent at least 33 hours beyond the MS degree. Courses listed on the GS2 Form must be completed prior to graduation. If changes are necessary, a revised GS2 must be submitted.

4.4 Qualifying Examination
The qualifying examination will serve to examine the ability of a student to apply the knowledge of Environmental Engineering and Earth Sciences or Biosystems Engineering, with an emphasis in the student’s area of specialization, to contemporary problems encountered during PhD level work. The exam is intended to be a “gateway” to the PhD program in which a student demonstrates that he/she has the necessary critical thinking skills required to complete the PhD degree and provide convincing evidence of a student's intellectual mastery of
their PhD coursework.

- The qualifying exam will be taken no more than 12 months after the student’s matriculation into the degree program.

- In order to sit for the qualifying exam, students must have at least a 3.4 GPA after completing 2 semesters and at least 12 credit hours of 6000/8000 level lecture or laboratory courses. Students who do not have greater than a 3.4 GPA are not eligible to continue in the PhD program and may consider matriculating into the MS degree program upon approval of his/her advisor. Students who enter the PhD program with an MS degree may take the qualifying exam without having taken any courses at Clemson University. The material covered on the exam will be the same as for students who have taken EES courses. If a student who enters the PhD program with an MS degree opts to take courses before taking the qualifying exam, then the minimum 3.4 GPA applies.

- The examining committee will consist of the Major Advisor and at least three other faculty members; at least one half of the members of the committee faculty must be regular faculty in EEES.

- The format of the qualifying exam shall be at the discretion of the examining committee, but will typically be a written and oral exam. The questions will be devoted to examining the student in his/her focus area. The student may discuss the expected areas and format of the exam with members of the examining committee. Within one week of completing the written exam, the committee will administer an oral exam, which will emphasize follow-up on the written exams.

- Satisfactory performance on the qualifying exam will result in the student being declared eligible to continue in the PhD program and begin working towards their comprehensive exam (a written and oral discussion of the proposed dissertation research).

Unsatisfactory performance on the qualifying examination will be determined at the sole discretion of the examining committee with the student either:

a) being allowed to be reexamined on all or part of the exam, in oral and/or written format, or

b) being declared ineligible for the PhD degree in the department. In either case, the reexamination must be completed within two months of the first try, whereupon the examining committee will determine if the student will continue working towards a PhD degree.

The Department has a form that must be used to record the results of the qualifying exam:
4.5 Comprehensive Examination

Students who have successfully passed the qualifying exam are eligible to take the comprehensive exam. The purpose of the comprehensive exam is to obtain convincing evidence of a student's preparedness for performing research at the PhD level. The exam consists of a written proposal for the dissertation and an oral defense of the proposal. The proposal and defense will be evaluated by the student's PhD Advisory Committee. The comprehensive exam should be completed within two years of completing the qualifying exam.

The written proposal will be distributed to the Advisory Committee at least one week prior to the oral defense. The proposal should:

- introduce the research topic;
- clearly state the research hypothesis and/or objectives;
- establish uniqueness and originality through literature citations;
- describe the methodology to be employed;
- provide preliminary data; and
- establish the environmental significance of the proposed work.

Additional guidance on preparation of the research proposal can be found in Section 5.

During the oral examination, the student will present and defend their dissertation research proposal. The dissertation committee members will ask questions related to the written dissertation proposal, the presentation materials, and other materials relevant to the student’s research area as deemed appropriate by the committee.

Satisfactory performance on the comprehensive exam will result in a recommendation to the Graduate School of acceptance of a student's application for admission to candidacy. This is done by submission of form GS5D: https://www.clemson.edu/graduate/files/pdfs/GS5D.pdf

The EEES Graduate Student Services Coordinator will provide the GS5D form for the Advisory Committee. Upon achieving the status of PhD candidate, an annual stipend increase of $1,500 will follow. It is the student’s responsibility to see that the paperwork is filed with the Student Services Coordinator for this increase.

Unsatisfactory performance on the comprehensive exam will be determined at the sole discretion of the Advisory Committee. In the event of unsatisfactory performance, the student will be:

a) allowed to submit a revised proposal and/or repeat all or part of the oral defense; or
b) declared ineligible for the PhD degree in the department.
A second failure of the comprehensive exam shall result in a student being declared ineligible for the PhD degree in EEES at Clemson University.

4.6 En-Route Master’s Degree

Students who are accepted to the PhD program without having first obtained a Master’s degree may be eligible to obtain an En-Route Master’s degree during the course of their PhD program. Qualified students must submit a written request to the appropriate Graduate Program Coordinator asking that they be considered a candidate for the en-route MS degree. The GS2-14 form can be found on the Graduate School web site.

Students must fulfill the following to qualify for the awarding of an en-route MS degree:

- Complete at least 24 hours of appropriate coursework and 6 hours of dissertation research. Students requesting an en-route MS degree in EES must satisfy the requirements of one of the five focus areas described in Section 3.6;
- Complete at least one seminar of BE 6510 or EES 8610;
- Maintain a >3.0 GPA; and
- Complete the PhD comprehensive exam.

Upon meeting all of the above requirements, the student’s advisor will notify the Graduate Coordinator who will sign the GS2-14 form and submit it to the Graduate School. Note: normal university deadlines apply.

4.7 Application for Graduation and Diploma Order

Early in the semester that the student plans to defend his/her dissertation and expects to graduate, the student must use iROAR to notify the Enrolled Student Services of their intent to graduate. Go to “Student Record” and select “Apply to Graduate.” Check the Graduate School website for the deadline to apply. The student must also notify the Graduate Student Services Coordinator by completing the Defense Request Form.

4.8 Final Oral Examination

An oral examination given at least three weeks before graduation will serve to examine the students on their dissertation research. (See deadlines set by the Graduate School for the specific date for each term at the URL below). The student is responsible for scheduling the defense in coordination with the Major Advisor and Advisory Committee. Once the date is set, the Student Services Coordinator must be notified by submitting the Defense Request Form.

A broad and penetrating interpretation of the research project and conclusions are required of the student. The committee members should receive a final
draft copy of the dissertation at least 10 working days before the examination. This examination will be conducted under the authority of the PhD Advisory Committee.

Successful completion of this examination will result in a recommendation (GS7D Form) by the Advisory Committee to the Graduate School that the PhD degree be awarded. The Student Services Coordinator will prepare the GS7D form for the Advisory Committee. The completed GS7D must be returned to the Student Services Coordinator (Barbara Smith); do not send the form directly to the Graduate School.

Unsatisfactory performance on the final examination will result in a requirement for complete re-examination (with or without recommendations for additional work) or dismissal. The Advisory Committee has full discretion to determine the consequences for unsatisfactory performance.

4.9 Dissertation Approval
After the dissertation has been approved by the Advisory Committee, the dissertation must be submitted on-line to the Manuscript Review Office to obtain format approval:
manuscriptreview-l@clemson.edu

Check the Graduate School website for deadlines. Information about the format may be found at:
http://www.clemson.edu/graduate/students/theses-and-dissertations/index.html.

Additional information about formatting can be found in Section 5.

After format approval, the student is responsible for submitting an electronic copy of the dissertation to the Graduate School. An electronic copy is also required by the department.

4.10 Jurisdiction/Authority and Exceptions to Policies
Each PhD student is subject to the policies in effect at the time of matriculation in the PhD program. If policies change, students may petition in writing to the EEES faculty for approval or disapproval of changing to the new policies.

A student may be granted an exception to this policy for the PhD degree if they petition the faculty of EEES in writing and receive a favorable action.

4.11 PhD Student Checklist
Table 4.1 provides a checklist of milestones for the PhD degree program. These are general guidelines and may change for students who enter the doctoral program without a Master’s Degree.
Table 4.1: Checklist for PhD Students

<table>
<thead>
<tr>
<th>What</th>
<th>When</th>
<th>How/Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Selection of major advisor</td>
<td>Occurs at the time of admission</td>
<td>By student and advisor</td>
</tr>
<tr>
<td>2. Appointment of Advisory Committee</td>
<td>Before end of 2nd semester</td>
<td>In consultation with major advisor</td>
</tr>
<tr>
<td>3. Preparation of curriculum</td>
<td>Before end of 2nd semester</td>
<td>In consultation with major advisor and Advisory Committee</td>
</tr>
<tr>
<td>4. Filing of curriculum, GS2</td>
<td>Before beginning of 3rd semester</td>
<td>GS2 Form by student</td>
</tr>
<tr>
<td>5. Qualifying Exam</td>
<td>Not later than 12 months after entering</td>
<td>Advisory Committee</td>
</tr>
<tr>
<td>6. Comprehensive Exam</td>
<td>Upon completion of course work</td>
<td>Advisory Committee</td>
</tr>
<tr>
<td>7. Admission to Doctoral Candidacy</td>
<td>After completion of Comprehensive Exam</td>
<td>Research Advisor GS5D Form to be completed by committee</td>
</tr>
<tr>
<td>8. Application for Graduation &amp; Diploma</td>
<td>Early in the semester during which degree is to be expected</td>
<td>By student through iROAR</td>
</tr>
<tr>
<td>9. Cap &amp; Gown</td>
<td>Early during semester during which degree is to be expected</td>
<td>By student</td>
</tr>
<tr>
<td>10. Completion of draft of dissertation</td>
<td>1st draft at least 8 weeks before date of final examination; final (advisor approved) copies at least 2 weeks before final</td>
<td>By student with review by research advisor</td>
</tr>
<tr>
<td>11. Final oral exam</td>
<td>At least 3 weeks prior to date on which degree is expected (see Graduate School schedule for last possible date)</td>
<td>GS7D Form to be filed by major advisor after document revisions are completed</td>
</tr>
<tr>
<td>12. Approval of dissertation by Graduate School</td>
<td>About 2 weeks before graduation (consult Graduate School Schedule for exact deadline)</td>
<td>By student</td>
</tr>
<tr>
<td>13. Final Check Out</td>
<td>At least one week prior to graduation</td>
<td>Student obtains all required signatures; makes appointment for exit interview</td>
</tr>
</tbody>
</table>
5.0 PREPARATION OF PROPOSAL, THESIS, OR DISSERTATION

5.1 General Guidelines
All theses, and dissertations shall be prepared in accordance with Graduate School guidelines:
http://www.grad.clemson.edu/Manuscript/format.php

This EEES Graduate Handbook provides advice on preparing acceptable and effective theses and dissertations. EEES students should consult this guide before beginning the writing phase of their graduate research. Pay particular attention to formatting requirements. The EEES style guide is the ACS Style Guide: A Manual for Authors and Editors edited by Janet S. Dodd, which is available at the Cooper Library or on-line at:
http://pubs.acs.org/isbn/9780841239999.

For further guidance on writing reports, papers, or theses, the following books are recommended:
- How to Publish a Scientific Paper by Robert A. Day; and

5.2 Planning
Task planning is a very important part of any research program. The deadlines for the tasks depend on the date of anticipated graduation and are presented in the Graduate School Announcements. A list of the deadlines is also available from the Graduate School web site:
http://www.clemson.edu/graduate/index.htm.

Failure to meet any of these deadlines will result in postponement of graduation.

Sufficient time must be allotted for writing the research proposal, thesis or dissertation. It is highly recommended that the student fully complete their thesis or dissertation before leaving the university. Several former students who left without completing their thesis ended up not completing their degree requirements. Experience shows it is very difficult to complete a thesis or dissertation after leaving the university.

5.3 Research Proposal
The MS thesis proposal is a persuasive document intended to document the worthiness of the student’s research. It should be a brief, concise document that is at least 5 pages when double-spaced, not including references. A final draft of the proposal should be completed by May of the first year.

The MS proposal is developed with the help of the student’s advisor and
committee. The approach and procedure vary somewhat from advisor to advisor, so students should discuss the process with their research advisor early. The purpose of the proposal is to create a research plan. Actual activities may vary as conditions and initial results dictate. The research proposed should be worthwhile and tractable. At the center of the proposal, there should be a clear hypothesis to be tested and/or a set of objectives. The material before the hypotheses/objectives should give the necessary background and lead to why the objectives are worth pursuing. After the objectives are stated, a research plan should be presented aimed at attaining the objectives. Students should go over the central parts of the proposal, especially the objectives, with their advisor, and then produce an initial draft.

The advisor will review the first draft and offer suggestions for changes. Upon approval of the advisor, electronic or hard copies will be distributed to the other committee members for their comments. Generally, committee members do not retain a copy, but the student should check on their preference. The document must have a cover page (located on the EEES website under Forms).

The proposal for the dissertation has no set length requirements. PhD students should discuss the proposal in depth with their Major Advisor and Advisory Committee members. The dissertation proposal is part of the comprehensive exam for PhD students.

5.3.1 Proposal Text – Introduction
The introduction should include some brief introductory remarks and a review of the literature that is relevant to the research objectives. The literature review should be current and should be organized to support those objectives. For the dissertation proposal, the literature review may be separate from the introduction and may be published as a review paper.

5.3.2 Research Hypotheses/Objectives
This section should be written first (in conjunction with the student advisor for a master’s thesis). Begin this section with a paragraph summarizing the major goal of the research. The major objective whenever possible should be stated as a hypothesis with tasks outlined for testing the hypothesis. For example:

Hypothesis: The rate of alkaline hydrolysis of carbaryl is inhibited in the presence of dissolved natural organic matter (NOM).

Tasks:
- Measure the rate constant of the hydrolysis of carbaryl in deionized, distilled water within the pH range of 6 to 10.
- Measure the rate constant of the hydrolysis of carbaryl within the pH range of 6 to 10 and vary the concentration of dissolved NOM from 1 mg C/L to 45 mg C/L.

- Identify reaction products from the above tasks to confirm hydrolysis as the major degradation pathway.

- Analyze data with appropriate models to evaluate the effect of pH and NOM on hydrolysis of carbaryl.

For proposals of PhD work, three potential manuscripts are described with results from the hypotheses/objectives to be examined.

5.3.3 Experimental Plan and Methodology
This section should lay out the experimental approach that will be used to accomplish the tasks listed in the Objectives section. The approach should include the experimental design and a matrix of experiments to be conducted. The methodology should include procedures and analytical protocol or information about the development of those procedures. Information about the data to be collected and the use of the data should be provided, as well as methods of analysis including any statistics to be used.

5.3.4 Preliminary Results
Proposals for PhD work typically will include results from scoping and preliminary experiments that indicate the approach is working. MS proposals generally do not include preliminary results.

5.3.5 Significance of the Proposed Work
This section should be a brief summary of why it is important to conduct the proposed research. What are the expected results and how will they benefit the environmental engineering and science community?

5.3.6 Helpful Hints
Students should check with their advisor on the desired format for references, font, and other formatting items. Check the ACS Style Guide for detailed information.

Whenever possible, use the active voice. For example:

“The reaction produced 1-naphthol, carbon dioxide, and methylamine.”

Avoid: “1-Naphthol, carbon dioxide, and methylamine were produced in the reaction.”

Avoid starting sentences with numbers. For example:
“I added 125 mL of methylene chloride to the solution before mixing” or, “Before mixing, 125 mL of methylene chloride were added to the solution.”

**AVOID:** “125 mL of methylene chloride were added to the solution before mixing.”

Numbers less than or equal to ten should be spelled out. Numbers of 11 or more can be represented by Arabic numerals. However, if you are referring to an exact amount from a measurement, such as 1.0 mL, use numerals. For example:

“Five aliquots of 2.0 mL were added to each sample.”

Remember that *effect* is a noun and *affect* is a verb. Other words that are often confused are *there* and *their*; *site* (location), *sight*, and *cite* (reference); *loose* (adjective), *lose* (verb), and *loss* (noun); *choose* (present tense) and *chose* (past tense).

Avoid the use of reduce to mean decrease because reduce has a very specific chemical meaning.

For additional information on technical writing, the student is referred to the following books:

- The ACS Style Guides: A Manual for Authors and Editors edited by Janet S. Dodd;
- How to Publish a Scientific Paper by Robert A. Day; and

### 5.4 Writing the Thesis or Dissertation

The writing process usually begins toward the end of the research period. The document must be written in a format that is acceptable to the Graduate School (MS or PhD). The Graduate School offers guidelines for formatting the thesis or dissertation at: [http://www.grad.clemson.edu/Manuscript/format.php](http://www.grad.clemson.edu/Manuscript/format.php).

### 5.5 Review and Approval

After the final oral examination and review of the written document by the Advisory Committee, an MS or PhD candidate may be required to do more work. After a successful final oral examination, the committee members will provide any comments or corrections that must be made to the thesis or dissertation. It usually takes less than a week to make the needed corrections.
The advisor and members of the Advisory Committee must sign the GS-7M form. After obtaining the signatures, the student should visit the Thesis and Dissertation web page of the Graduate School:
http://www.grad.clemson.edu/Manuscript.php

Follow the directions for uploading the manuscript as a pdf file. The Graduate School will review the formatting and send an e-mail within one or two business days indicating the manuscript has been accepted or needs more attention.

**NOTE:** Before the thesis can be uploaded, all signatures (advisor, committee members, and Graduate School) must be present on the GS-7M form.

Here are the TOP 5 STEPS FOR OBTAINING GRADUATE SCHOOL APPROVAL OF THESIS/DISSERTATION:

1. Be enrolled! Students meeting with advisors/faculty, taking comprehensive or final examinations, using library, computer facilities or laboratories must be officially enrolled in at least one credit hour.

2. Follow Graduate School format specifications listed at:
   http://www.grad.clemson.edu/Manuscript/format.php.

3. Avoid common formatting problems

4. Make sure that all margins are set to 1.25 inches

5. Make sure the Table of Contents is formatted correctly:
   - All headings must be identical in content to those in the body of the document;
   - Every entry must have a page number;
   - All major sections (first-level headings) must be included. Lower-level headings can be included, but they’re not required;
   - Alignment and spacing of entries must be consistent;
   - The page number for each entry must be right-justified at the right margin;
   - There must be ellipses between the entry and the page number. The ellipses may NOT be created with individually typed periods. **Note:** you can use the ellipses instructions to help format your Table of Contents;
   - Do not list "Table of Contents" within your table of contents.

Send an electronic copy of the manuscript to the Graduate School and to the EEES Graduate Student Services Coordinator. Deadlines are published at:
http://www.clemson.edu/graduate/students/deadlines.html
A representative of the Graduate School will check the formatting and provide feedback via e-mail. The Graduate School will check the thesis or dissertation for adherence to format requirements. Contents and grammar should be reviewed by the student’s Advisory Committee. However, documents submitted to the Graduate School with significant problems in content and/or grammar will not be approved.

Make corrections noted by the Graduate School and any final revisions required by your Advisory Committee members prior to submitting the final version.
6.0 FINANCIAL INFORMATION

6.1 Financial Assistance
Graduate students are eligible for financial assistance if they are (a) enrolled in full-time graduate studies and (b) in good academic standing; i.e., not on probation. Tuition is paid directly to the University by the department for TAs and by the faculty member through a research grant for RAs. Students receiving financial assistance must pay all required University fees. EEES is not permitted to pay fees directly to the University; therefore, the stipend contains the fees and is spread over the entire year in the stipend checks. To receive reduced fees for a particular semester, a qualified student must be on the department’s payroll prior to the beginning of that semester.

Financial support is awarded based on resources available, academic merit, educational and employment discipline as well as on the research interests of the student. If students change their interest area after support has been extended, support eligibility is reviewed. Only PhD students and MS students pursuing research are eligible for assistantships. Non-thesis MS students are not eligible for assistantships but are eligible for internships or other forms of support.

6.2 Assistantship Award Policy and Funding
Assistantships are awarded by the EEES Department based on many factors, including GPR, GRE scores, recommendations, research experience, previous schools, area of study, application essay, English language ability, and (in some cases) American citizenship.

The EEES Department uses two different sources for funding graduate students: 1) State of South Carolina monies, and 2) funds from contracts, grants and donations. Students supported by state funds normally are assigned teaching assistant duties while those supported by research contract or grant funds are assigned research duties. All assistantships may be subject to time limits as described below (depending upon the degree being pursued) and are contingent upon satisfactory performance and progress toward the degree by the student.

Assistantships for MS students normally extend for a maximum of two years. The same time limit applies to fellowships awarded by the EEES Department.

Assistantships for PhD students normally extends for three years beyond the MS degree. The same applies to fellowships awarded by the Department.

Continuation of assistantships and fellowships is contingent upon satisfactory academic performance, as well as satisfactory performance of assigned duties.
associated with the assistantship.

All research contract and grant supported graduate assistantships are subject to continued funding by the contracting agency. If a research contract or grant is terminated before a student has completed the degree program, the department will endeavor (on an individual basis) to provide financial support to allow continuation of the student’s program. This might involve teaching assistant responsibilities, where appropriate. The foregoing statement should not be construed as an assurance of funding. The student is expected to complete their degree program in a timely fashion.

All graduate students holding a teaching, research, or graduate assistantship appointment at Clemson University shall be compensated based on a standard full-time equivalent (FTE) rate (12-month basis) established by the faculty of EEES. This rate shall also serve as the basis for all rate adjustments described in the section below. Three standard FTE rates are used; one for Master’s students, one for PhD students (i.e., pre-comprehensive exam) and another for PhD candidates (i.e., post-comprehensive exam).

Compensation at a rate exceeding the standard FTE rate is allowed according to the following guidelines:

- Students may be offered an incentive to enroll in an EEES graduate program. Such funds are typically offered once. The Department Chair will determine the source of funds.

- Students may receive funding in addition to their FTE stipend in the form of a scholarship from the Dean of the College and/or Clemson University.

- Students may receive compensation derived from a fellowship, traineeship, or similar form of award (e.g., NSF, EPA and NRC fellowships) in which the awardee is selected competitively from a group of applicants on the basis of scholarly excellence. When the value of such a fellowship exceeds the FTE stipend, the fellowship takes the place of the stipend. When the value of the award is less than the FTE stipend, the awarded amount may be added to the FTE stipend up to a total of 1.5 FTE.

**NOTE:** The student is responsible for submitting the required paperwork to initiate the raise.

### 6.2.1 Fellowships

There are internal and external sources of fellowship funding. EEES has fellowships that have been established by alumni and other supporters of the department that are used as supplements. The awards are made by faculty and are based on student performance in academics, teaching, and research as
well as service to the department and university. Advisors may nominate their students for these awards on an annual basis.

External sources of fellowships include federal agencies, professional societies, and companies. Federal agencies such as the National Science Foundation, the Environmental Protection Agency, National Oceanic and Atmospheric Administration, the Department of Defense, and others have annual competitions for support of graduate study that includes full tuition and a significant stipend. Professional societies also have competitions for financial assistance; usually these awards are supplemental rather than full support. Some of the societies that hold such competitions include the Geological Society of America, American Association of Petroleum Geologists, and Society for Sedimentary Geology, Sigma Xi, Society of Environmental Toxicology and Chemistry, American Water Works Association, Air and Waste Management Association, and others. Companies that offer fellowships include Brown and Caldwell, BMW Group, and others. Information about these sources can be found on the M drive/Everyone/Fellowship Information. Contact the Graduate Program Coordinators for more information and advice.

6.2.3 Internships
Another opportunity for financial assistance that is often available is an internship. The U.S. Geological Survey and the U.S. Department of Energy are two examples of organizations that commonly sponsor internships. Consulting firms in the area also may have opportunities. Students are encouraged to check with the Graduate Program Coordinators and the Student Services Coordinator about possibilities. Internship announcements are posted on the Department’s web site under Student Opportunities: https://www.clemson.edu/cecas/departments/eees/students/internships/index.html

6.2.4 Work Load
The normal graduate assistantship workload is 20 hours per week (average). Students are not allowed to work over 28 hours per week. Students should be aware of both their academic and work obligations, and are encouraged to discuss any problems with faculty.

6.2.5 Responsibilities
The responsibilities of RAs vary according to the specific grant project(s) from which they are being paid, and are established at the discretion of the faculty member. The work performed by an RA does not necessarily correlate with their thesis or dissertation research.

Teaching assistants play an important role in the department by teaching the laboratories that parallel the introductory courses in Geology, Environmental Engineering, Biosystems Engineering, and Physical Science, serving more than
400 students per semester. TAs may also be assigned to the graduate laboratory classes or as graders for specific classes. In general, TAs are required to work approximately 20 hours per week. Specific TA duties and time requirements are described below. New TAs are required to participate in training classes by the university and the department.

**Teaching:** The primary duty for a TA assigned to geology or physical science laboratories is to teach three laboratory sections per week. Different types of labs vary in length and in the number of meetings per week. But, in general, TAs will spend between six and eight hours each week in the classroom. The TA is the instructor of these labs. Therefore, the normal responsibilities and rewards of teaching come with the job. Each year an award is presented to the most outstanding graduate teaching assistant in the department; the recipient is chosen by the faculty based on nominations received from students and faculty involved in teaching introductory courses.

**Lab Preparation and Clean-Up:** Teaching assistants must prepare for each lab session in two ways. First, they must work through the material ahead of time to develop their lesson plans. This should be done in conjunction with their Lab Supervisor. Weekly meetings with the Lab Supervisor are held to keep labs on track and in step with other similar lab sections. Our goal is to give students a consistent experience no matter which lab TA they have. Second, materials and equipment must be set up for lab and put away afterwards, and the lab room must also be cleaned after each lab session. The TAs will spend between two and four hours per week with this preparation and clean-up.

**Grading, Test Preparation, and Record Keeping:** TAs grade all assignments, large and small, given in their labs. Some grading will be required almost every week. More significant grading will occur after major tests. In general, TAs create their own quizzes and homework assignments; major tests will be created cooperatively by all TAs with the guidance of the Lab Supervisor. Accurate and up-to-date records of grades and attendance must be kept by the TAs in a location and format determined by the Lab Supervisor. Time required for these duties varies greatly throughout the semester; a broad range is probably between one and six hours per week.

**Office Hours:** TAs must hold one office hour for each lab session taught (typically this amounts to three office hours per week).

**Other Required Assistance:** From time to time TAs or lecture instructors will be asked to assist other TAs with activities such as field trips and proctoring examinations. Additionally, because of planned or unplanned absences, a TA may occasionally have to take another TA’s labs or office hours. It is the responsibility of the TA to make coverage arrangements with the approval of the Lab Supervisor. These cases are not common and rarely exceed one to two
hours per week.

In addition to these weekly duties, new TAs are required to attend university TA training before the semester begins. This normally lasts two days. The Department also holds a required one-day training session during the first week of the fall semester.

**Graduate Laboratory TAs:** TAs assigned to the graduate laboratories will work closely with the laboratory instructor(s). Typical duties may include preparing chemicals for the laboratory exercise, assembling apparatus, operating analytical instrumentation, troubleshooting instrumentation, instructing student about use of instrumentation, and supervising clean-up after the laboratory exercise. Specific duties will be assigned by the course instructor.

**Graders:** Graders will work with the course instructor. Typical duties may include preparing homework assignments, preparing and posting homework keys, grading homework, grading quizzes, grading exams, keeping records of grades, and holding office hours. Often courses with assigned graders have weekly homework and/or quizzes. Specific duties will be assigned by the course instructor.

### 6.2.6 Start of Pay

Students are appointed to a graduate assistantship at the beginning of the first semester if the student is present and available for a work assignment at that time. The university is on a semi-monthly pay cycle. Employees are paid on the 15th and the last day of the month. New employees will have a two-week lag before being paid. The lag pay is paid out after termination of assistantship. Otherwise, pay will begin when the student is available for work. Students with continuing research assignments should report to their research advisor. All other students should report to the Graduate Program Coordinator.

New graduate assistants must report to the departmental staff, to make an appointment with the Collage Human Resources staff to complete hiring paperwork. International students will need an Employment Verification Letter signed before going for their Social Security card.

International students should have their offer letter with them upon arrival. They will need to check in at the International Office (108 Long Hall). After the student has been in the US for 10 days they should then go to the Social Security Administration in Anderson, SC, for a Social Security Number or SS letter or they should meet with the Social Security Administration representative in Martin Hall on the dates indicated by the Graduate School. Then an appointment must be made with the Foreign National Payment Coordinator in the International Office in 108 Long Hall who will complete the necessary
paperwork to assist the student with getting on the payroll. International students should be sure to bring the following:

- U. S. Visa;
- Unexpired foreign passport;
- I94; and
- IAP66/I20.

It is mandatory to call for an appointment before going to the Foreign National Payments Coordinator’s office. The telephone number is 656-5589.

6.2.7 Termination of Pay
Pay for any session will end when the student leaves Clemson University or is no longer available for work assignments. Normal termination dates for fall and spring semesters for students not continuing into the next session is Graduation Day. Any deviations from these dates must be approved by the student's research advisor or the Department Chair.

6.2.8 Reduction of Pay
Normally, 20 hours per week will be submitted on each payroll for each half-time graduate assistant. However, less than 20 hours may be submitted for a student, with the pay reduced accordingly, if the amount of time worked by the student consistently deviates from the required 20 hours per week average. Due to the procedure in which time sheets are currently used, it may be necessary to implement any pay reductions in the pay period following the one in which the work deficiency actually occurred. Pay also may be withheld from students who violate the vacation policy, as stated below in the section on "Vacations."

6.2.9 Summer Enrollment
Students receiving any assistantship or fellowship must enroll in six credit hours for the long Summer Session. Any student not on an assistantship but using faculty time and/or university facilities must register for a minimum of three credit hours each session (including any student actively working on a thesis, dissertation or enrolled in non-thesis special project). Only students not active and not physically present as a student at Clemson need not register (See Table below).

6.2.10 Students without Assistantships
Students who enter a graduate program in the EEES Department without an assistantship can apply for future consideration with the Department Chair. The probability of receiving financial assistance in such cases is not high.
6.2.11  Deferment of Fees
Graduate assistants may choose to defer fees. This is accomplished easily by registering online. Persons in the fee assessment area will have a list of all graduate assistants. Anyone listed may sign a note to defer these costs and they will be deducted from the first six full paychecks of the semester. It is not possible to defer fees for summer sessions. These must be paid by the student for each summer session. EEES is not permitted to pay fees directly to the university; therefore, return of fees to graduate assistants is spread over the entire year and included in stipend checks.
7.0 GENERAL DEPARTMENTAL INFORMATION
Students should not hesitate to ask questions concerning departmental policies and procedures. The Graduate Student Services Coordinator’s task is to assist students with such questions.

7.1 Notices
Notices of interest to graduate students will be e-mailed directly to students. To ensure receipt of printed mailings, each student should have a current address and telephone number on file with the department. The department maintains a mail slot for each graduate student in the mail room in the Computer Lab (Room 144) of the Rich Laboratory. Graduate students who have a desk in Brackett have a mail slot in Brackett 201.

7.2 Vacations
Student vacation time can vary, but the following schedule is typical: two days at Thanksgiving and two weeks at Christmas. Students supported by an assistantship must consult with their advisor about scheduling of other vacation time.

7.3 Stipend Pay
New students going on the payroll for the first time will have a two-week lag before they will be paid. This “lag pay” is paid out after the student’s termination from the University.

7.4 Keys
Key requests for Rich Laboratory should be directed to Rodney Morgan, EEES Rich Lab/Machine Shop Supervisor (Rich Shop/Basement). For Brackett Hall, requests for keys to the graduate office should be directed to Briana Peele (Brackett 445). For other locations (e.g., CETL or the Biosystems Research Complex), consult with your advisor. The key(s) issued to a student are for their use exclusively. Keys must never be loaned to anyone else, not even another graduate student. Failure to observe this rule may result in the key privilege being withdrawn.

Request for Rich Lab student desk keys should be directed to Barbara Smith, Graduate Student Services Coordinator (Rich Lab 149).

7.5 Building Security
Rich Laboratory: During normal working hours only the doors in the reception area will be kept unlocked. At all other times all outside doors will remain locked and will not be propped open. All students entering or leaving the building should ensure that the outside doors remain locked.
Bracket Hall: At present, Brackett Hall is open 24 hours a day, 7 days a week (with exceptions for football games and holidays), so students may enter the building at any time without a key; this is subject to change, however. Because of the unlimited access, security is a major concern to all. **Always lock the graduate offices when leaving after 4:30 PM and on weekends! This applies to the mail room, computer room, etc.** The laboratories located in Brackett are locked and require permission from the various faculty responsible (see information below in Facilities and Equipment for details about the labs).

### 7.6 Parking

Ample parking is available at the Rich Laboratory – a parking permit is not required. The semi-circular parking area between the two buildings is for visitors only. Parking on campus requires a permit that can be purchased at Parking Services (656-2270).

### 7.7 Emergencies

The Clemson University Police Department (656-2222) is to be called for all major emergencies: fire, medical, police. They will ensure that the proper authorities are dispatched.

In case of tornado warning, take shelter in the auditorium of Rich Laboratory. Use stairwells; do not use the elevator.

Go immediately to the first floor of **Brackett Hall** via the back corner stairwell. Meet in the first-floor hallway at the back side of the building outside of rooms 130-135.

In case a fire, exit the building immediately. Use stairwells; do not use the elevator.

### 7.8 Campus Shuttle Bus

Clemson University supplies a shuttle bus to transport students between the main campus and the Rich Laboratory during fall, spring and summer semesters. Trips are scheduled from 8:00 a.m. until 7:00 p.m. Monday through Friday (except during holidays and Fall Break). The shuttle makes one trip per hour from Epsilon Zeta Drive (located between Hendrix Center and Edwards Hall) to the Research Park. The shuttle leaves the Hendrix Center on the hour and arrives at the Research Park at approximately 20 minutes after the hour. Stops are at AMRL, Rich Lab, ITC (Computer Center), Library Depot. The return shuttle to campus leaves on the half-hour. Additional information may be found at: https://www.clemson.edu/campus-life/parking/transit/research-park.html

### 7.9 Desks

It is the goal of the EEES Department to provide a desk for each graduate student. However, due to the limited available space, it may not be possible to
accommodate each student. Therefore, a priority system for Rich Lab and CETL is used which first assigns a desk to each graduate assistant and graduate fellow, then to each unsupported MS thesis student, and then allocates desks to all other students on a temporary use basis. For Brackett, priority is given to hydrogeology TAs who teach on campus. After that, students are assigned space as it becomes available. New students should see Barbara Smith for Rich Laboratory and CETL desk assignments and Briana Peele for desk assignments in Brackett Hall. Due to limited availability, students will not be assigned desk space in more than one location.

NOTE: Study facilities for graduate students are intended solely for studying and interacting with students. They are not to be used for socializing or temporary housing. Students abusing these privileges will forfeit them.

7.10 Room Use Policies
The following rooms are to be used by reservation only:
- in Rich Laboratory: the auditorium, classrooms, conference room and the VIP office; and
- in Brackett Hall: conference room.

To make reservations, contact an administrative staff member in the building that the room is located in. Please note that no food or drink is to be taken into or consumed in the Rich Laboratory auditorium.

7.11 Computer Laboratory
The department maintains well-equipped computer laboratories for student use in Brackett 434 and Rich 144. The labs contain desktop computers with associated printers and peripherals. The computers are connected to the Internet and can be used to access the university mainframe. Doors are to be locked if the labs are unoccupied. Any problems with the machines should be reported to Betty Cowans in Rich Lab and Briana Peele in Brackett Hall.

There are several campus computer labs where both PC and Unix-based machines are available to all students at Clemson. The labs are operated by CCIT, the university-wide computer support group. The labs are scattered at various locations across campus, including one on the first floor of Brackett Hall. You need a university username and password to access computers in those labs.

7.12 Computer Center Account
Each graduate student is automatically assigned a unique computer I.D. providing access to the centralized computer facilities upon acceptance to the University. Notification of this assignment should have been received prior to orientation via U.S. postal service. This User ID is also published in the university telephone directory. In addition to the regular User ID, students can create a google account (UserID@g.clemson.edu). Students are allowed continuous use of
the g.clemson.edu email account when they graduate.

Should you decide to do this, you must either check both of these e-mail addresses or forward the clemson.edu e-mail address to the g.clemson.edu to make sure that you receive important information sent to you.

The Division of Computing and Information Technology (CCIT) offers numerous instructional short courses. Visit the website below for details: http://dcit.clemson.edu/menus/student.html

**7.13 Office Supplies**

The department does not furnish office supplies to graduate students for personal use. All research contract-related use of office supplies, including letterhead stationery, must be authorized by the faculty advisor.

**7.14 Student Advisory Council**

EEES graduate students have a Student Advisory Council comprised of students representing each of the research groups. A chair is elected from the members of the Council. The Council meets periodically to discuss issues of mutual concern. It also meets with the EEES Department Chair to jointly consider opportunities for quality improvements.

**7.15 Student Hosts**

EEES will provide each new student with a host to help answer questions concerning graduate studies, housing, roommate matching, what there is to do in Clemson, finances, registration, classes, professors, etc. Contact the Student Services Coordinator at 656-3278 to be assigned a host.

**7.16 Mail**

All personal mail is to be directed to a student's home address. The department is not to be used as one's mailing address. Outgoing mail, both U.S. and campus mail, can be placed in the appropriate receptacles in the reception area of Rich Laboratory. In Brackett, outgoing mail may be placed in the slots on the 2nd floor near the elevator and graduate student office.

The department maintains a mail slot for each graduate student in the mail room in the Computer Lab (Room 144) of the Rich Laboratory. Graduate students who have a desk in Brackett have a mail slot in Brackett 201.

**7.17 Departmental Copy Machines**

Graduate students may use the copy machine located in the Rich Laboratory reception area and in the Brackett mailroom in accordance with the following guidelines. The copier located in the Rich Lab copy/work room is for faculty, staff and TA use only.
The copier machine in the Brackett mailroom is available for work-related copying. This includes duplication of lab exercises, class handouts, tests, articles, reports, book excerpts, etc., that are relevant to a project or thesis research being conducted by graduate research assistants.

### 7.18 FAX

Students may use the department's facsimile machine for official EEES business purposes with authorization from their advisor. Personal transmissions may also be sent at the Student Union or other locations in downtown Clemson.

### 7.19 Departmental Seminars

During the fall and spring semesters, the EEES Department sponsors a weekly seminar on Friday at 2:30 p.m. EEES students and faculty give presentations about their research or other topics of interest to the department. Invited speakers from industry, government, and other academic departments are also included. Seminar is held in the Rich Laboratory auditorium in the fall and on campus in spring. Suggestions for speakers are always welcome. Please send ideas to the faculty member coordinating the seminar. All students and faculty are expected to attend. If a student cannot attend a particular seminar, he/she should inform their advisor ahead of time. The EEES curriculum requires that all resident students enroll for seminar credit for the fall and spring semesters. Attendance and other criteria for receiving credit will be given at the beginning of seminar each semester. Doctoral students are required to give at least one seminar each year. EES 9610 is offered both summer sessions in Rich 150 to provide an opportunity for all doctoral students to present.

### 7.20 Telephone Land Lines

Two telephones are located in the Rich Laboratory for student use. Those are 656-3275, and 656-1001. CETL has a phone in the basement (656-1751). There are no student phones in Brackett. Incoming calls, including those from prospective employers, should be directed to these telephones. Graduate students making research-related long distance calls at the request of an advisor should use the advisor's nine-digit authorization code. Students are authorized to place long distance telephone calls only with the permission of the appropriate advisor.

#### Telephone Numbers to Know

- EEES Department Rich Lab 656-3276
- EEES Department Brackett 656-3438
- Graduate School Office (E-108 Martin Hall) 656-4172
- Michelin Career Center (316 Hendrix Center) 656-0440
- Campus Police (Orange Aid Building) 656-2222
- International Student Services (108 Long Hall) 656-3614
Departmental telephone numbers and room numbers are available via the EEES home page.

7.21 Departmental Files
Departmental files maintained on the H drive should not be accessed by graduate students. Students should contact the Student Services Coordinator should they need information from a departmental file.

7.22 Photos
At the beginning of each semester, photos of matriculating students are taken not only for the department directory, but also, more importantly, for the recommendations you'll want later in life. This is the means by which we remember you (as if we could forget).

7.23 Student Travel
Department-specific travel information and guidelines from the Clemson University Travel Guidelines Index have been incorporated into this section. The complete Guidelines Index, including authority references and guidelines specific to university administration, is available at: http://www.clemson.edu/procurement/travel/.

Any questions regarding travel should be directed to Susan Culbreath in Rich 152. Summarized departmental procedures are as follows:

1. Complete Request to Travel form, obtain appropriate signatures (PI or faculty member responsible for the account number to which it will be charged) and submit to Susan Culbreath or Briana Peele.

2. Enter travel status according to guidelines outlined herein.

3. Upon completion of travel, complete a Travel Worksheet, obtain appropriate signatures, and submit to Susan Culbreath or Briana Peele for reimbursement.

NOTE: Travel forms are available on our web site. If you have trouble using the electronic forms, please see one of the staff for assistance.

When individuals file for reimbursement of travel expenses they are stating:
- They have followed the University’s travel policies;
- They have not nor will not receive reimbursement for these expenses from any other entity outside the University;
- None of the expenses are of a personal nature; and,
- All supporting documentation is on file with their department or business officer.
Under the Progressive Discipline Policy of the University, any employee who falsifies records or documents or willfully violates written rules, regulations or policies can be suspended or terminated from their job.

Travel reimbursements must be filed as soon as the trip is completed and within the same fiscal year in which the trip occurred. Travel reimbursement requests must be filed within 60 calendar days of the completion of the trip. Multiple trip reimbursement requests for trips of a repetitive nature should be claimed on a travel log form. These requests should be submitted at least quarterly. Any reimbursement request that is not submitted within 60 days or quarterly will require the traveler to submit and receive approval of a written request stating the reason for the delay with approval by the Dean/Department Chair or the Business Officer and the Directory of Procurement Services. Reimbursement will be made upon completion of the travel.

All travel vouchers submitted for reimbursement are required to have the signature of the traveler and one other person authorized to spend funds from the account numbers that appear on the travel voucher. All signatures must be original. No stamped signatures will be accepted.

Travelers are expected to exercise the same judgment when making travel arrangements and expenditures that a prudent person would exercise if traveling on personal business and expending personal funds.

Excess costs, circuitous routes, delays or luxury accommodations unnecessary or unjustified in the performance of an assignment are not considered exercising prudence.

Travel by commercial airlines will be in coach or tourist class, except where exigencies require otherwise.

Transportation to or from points of arrival and departure will be by the most economical method.

7.24 Expenses for Spouses
Reimbursements to an individual may cover only those expenses pertaining to that individual. It may not include expenses pertaining to other individuals, regardless of who paid the expense. Travel expenses for spouses, friends, or other individuals not traveling on official University business are not reimbursable.

7.25 Unauthorized Costs
Employees will be responsible for unauthorized costs and any additional expenses incurred for personal preference or convenience. No reimbursement for reduced fare advance purchase tickets will be made directly to employees prior to the completion of travel if charged on a personal credit card, since direct
payment by the University is available using the Departmental Purchase Card.

Movies, bar bills, laundry, room service, safes and security insurance, health or spa fees, etc. will not be subject to reimbursement on the travel expense report. These are considered personal in nature and should be paid by the traveler.

7.26 Meals
While on official travel within the State of South Carolina, actual expenses incurred in obtaining meals up to a maximum of $25 per day will be reimbursed.

While on official travel outside the State of South Carolina, actual expenses incurred in obtaining meals up to a maximum of $32 per day will be reimbursed.

<table>
<thead>
<tr>
<th></th>
<th>If you Depart Before</th>
<th>If you Return After</th>
<th>In State</th>
<th>Out of State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>6:30 a.m.</td>
<td>11:00 a.m.</td>
<td>$6</td>
<td>$7</td>
</tr>
<tr>
<td>Lunch</td>
<td>11:00 a.m.</td>
<td>1:30 a.m.</td>
<td>$7</td>
<td>$9</td>
</tr>
<tr>
<td>Dinner</td>
<td>5:15 p.m.</td>
<td>8:30 a.m.</td>
<td>$12</td>
<td>$16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$25</strong></td>
<td><strong>$32</strong></td>
</tr>
</tbody>
</table>

If an individual on non-overnight travel receives reimbursements for meals, this amount could be considered income and be reported on their W-2 tax form. For instance, meals on day trips are subject to tax withholding except when a business purpose for the meal can be documented. If you are claiming reimbursement for such business meals, documentation should include the name and affiliation of the person sharing the meal and the nature of the business discussed.

An individual must be in travel status (more than 10 miles from their residence or official headquarters) to be eligible for reimbursement of meals.

7.27 Lodging
Lodging expenses will be allowed subject to the following limitations, provided an original, itemized receipt is furnished. Lodging arrangements and any required deposits are the responsibility of the traveler and will be reimbursed as part of the lodging expenses upon completion of the trip.

Actual lodging expenses will be reimbursed, however the more moderately priced accommodations must be requested when a choice is available. Employees should request a state or government rate when available.
No reimbursement will be made for overnight lodging within **50 miles** of the employee’s official headquarters or residence.

The expense for shared lodging may be reimbursed to one employee if only one original itemized receipt is obtained. If the room is shared with other than a University employee, the single room rate will apply.

All necessary and reasonable tips for baggage handling will be reimbursed.

### 7.28 Miscellaneous Expenses

Employees are allowed one personal call, of short duration, per day. Charges for long distance telephone calls, telegrams, or fax charges made on official business will be allowed. A fixed charge by a hotel for telephone service may be reimbursed as part of lodging. It is the responsibility of the traveler and the department to substantiate whether calls are of a business or personal nature and whether they will be reimbursed. Charges for internet will be reimbursed.

### 7.29 Foreign Travel

Travel outside the continental United States, Alaska, Hawaii, Canada, Puerto Rico or the Virgin Islands requires approval prior to departure. Foreign travel funded from sponsored program activities must be approved in advance by Sponsored Programs Accounting.

While on foreign travel, actual lodging expenses will be reimbursed. Fees for the purchase of traveler’s checks, passports and visas will be reimbursed provided a receipt is furnished. All expenses claimed must be converted to U.S. dollars and the conversion rate and computation should be shown on each receipt.

When an employee is on foreign travel, meal expenses not exceeding federal rates will be reimbursed. These rates are listed at the following website: [https://aoprals.state.gov/web920/per_diem.asp](https://aoprals.state.gov/web920/per_diem.asp)

The Provost Advisory Council approved a risk management recommendation to require all Clemson students to obtain international travel insurance when traveling abroad. This applies to both faculty led and semester abroad programs.

The cost is $31 per month and includes $100,000 basic medical (no deductible), medical evacuation/repatriation and up to $2,000 to transport a family member to a patient hospitalized for more than six days.

Faculty and staff traveling with the student groups may also be covered under the student policy at this cost.

Contact Linda Rice in the Office of Risk Management at 656-3354 for additional
information.

7.30 Travel by Automobile and Rental Cars
Automobile transportation may be used when common carrier transportation cannot be arranged satisfactorily, or to reduce expenses when two or more University employees are traveling together.

When planning to travel by car, see Betty Cowans or Briana Peele. They will then contact Enterprise in advance to rent a vehicle. Please provide the following information.

- Account number to be charged Name of driver;
- Type of vehicle (car, minivan, 12-or 15-passenger van);
- Destination of trip;
- Purpose of trip;
- Date and time of pick-up (must be between 7:30 AM and 4:30 PM, Monday- Friday); and
- Date and time of return

You must give at least three-day notice to request a vehicle. (NOTE: make your request well in advance in order to secure a van.) Should you need to cancel the request, please notify Betty or Briana so that they can cancel your order; otherwise, we could be charged for the vehicle even if it is not used.

University employees may use their own automobile for official travel provided the University would incur no added expenses above that of other forms of transportation available. Reimbursement for personal automobiles is as follows:

- $0.54 per mile for travel to and from nearby airports or train depots when official travel is by airplane or train or should an employee opt to use their own vehicle.

- Taxi fares and reasonable tolls will be reimbursed to the individual. Receipts must be furnished if claiming airport, hotel or parking garage parking of more than $25.

- No reimbursement will be made to operators of state owned vehicles who must pay fines for moving or non-moving violations.

Enterprise has the state contract for car rentals. If you have questions see one of the staff for help.

7.31 Registration Fees and Receipts
Registration fees in the amount necessary to qualify individuals to attend conventions, meetings, conferences, etc. are allowed. See Susan Culbreath for help with this.
You must submit receipts for expenditure categories of $25 or more (e.g. 2 taxi charges of $15 and $20 require receipts to be reimbursed). All receipts and paid bills should be originals and must be submitted with your reimbursement form. In rare occasions, a receipt may not have been provided to the traveler or the traveler may misplace the receipt. In which case, a detailed explanation signed by the traveler may be substituted and included with an acceptable proof of payment such as a canceled check or a scanned copy of a credit card statement.

7.32 Departmental Laboratory and Field Equipment

Teaching Lab (Rich 113)
With permission from David Lipscomb (Rich 130B) the Teaching Lab is available for use during the summer when no classes are offered. The lab must be cleaned and available for instructional use at least one week before classes begin. Equipment and supplies from the Teaching Lab may be used if prior permission is obtained from the David Lipscomb. A log book is available for check out of equipment. All equipment must be returned in good working order. Supplies must be replaced.

Instrumentation Lab (Rich 114)
The Instrument Lab is a joint use facility. All users must comply with procedures to record instrument use in log books (electronic or paper) and keep the common areas clean. Instrument use requires prior approval by the instrument care taker or David Lipscomb (Rich 130B).

A wide range of other equipment for chemical analysis is also available on campus. Much of the analytical equipment in other departments can be used for thesis research by students in EEES by making arrangements through their advisor.

Petrophysics Lab (Rich 128)
The department maintains a petrophysics lab in 128 Rich Lab. The purpose of this lab is to measure hydraulic properties of aquifer samples and soils. The lab contains a suite of flexible wall permeameters for measuring saturated permeability. In addition, the lab contains a Hassler cell for making permeability measurements under confining pressure and a Boyle’s Law helium porosimeter. A capillary pressure vessel is also available. Ask Dr. Murdoch about using this lab.

Thin Section Preparation Lab (Brackett B04)
This laboratory is located in the basement of Brackett Hall (Room B04). It contains several rock saws, a trim saw, a thin-section cutoff saw, and a thin-section grinder. Laps are available for final polishing of samples. These instruments allow the complete preparation of standard thin sections for
petrographic study, or polished sections for microprobe analysis.

The lab also contains two sieve shakers and associated sieve pans for grain- size distribution analyses. See Scott Brame about using the saws or polisher or Dr. Murdoch if you need to use a sieve shaker. Petrographic microscopes are located Brackett 323. One microscope has a 35 mm camera for taking photomicrographs, and another has a video camera linked to a TV monitor to display images from the microscope. An automated Swift Model F point-counting stage is also available for obtaining modal analyses. The department also owns a digital camera with a special microscope adapter. Consult Dr. Coulson or Dr. Murdoch before using the microscope equipment.

**Field Equipment**
The department has a variety of field equipment that can be used for geophysical and hydrogeological studies. The equipment is stored at various locations in the department and elsewhere on campus. Some of the Equipment is used in the Hydrogeology Summer Field Camp. Ask Dr. Moysey if you are interested in using the geophysical instruments and Dr. Murdoch about the hydrogeology field equipment.

**Geophysical instruments**
- Pulse Ekko 100 low frequency ground penetrating radar Pulse Ekko 1000 high frequency GPR
- GR-110 Exploranium portable gamma ray scintillometer EM-34 electromagnetic ground conductivity meter Surface electrical resistivity instrument
- Fluxgate magnetometer
- Drilling Rig
- CME 45 drill rig
- Augers (4” solid stem; 8” hollow stem) Diamond bit core barrel
- Hydraulic hammer
- Geoprobe sampling equipment
- Well Pumping Test Equipment
- 5 Parascientific precision transducers Druck portable transducer
- 5 In situ Troll water level data recorders 15 kw Kubota generator, Honda generator
- 25, 7.5, 5, 3, and 1/3 hp submersible pumps
- 2 Campbell Scientific CR10X data acquisition systems 2 Grunfos variable rate sampling pumps

**Vadose Zone Equipment**
- Portable mini-Permeameter 2 Guelph permeameters
- 7502B time domain reflectometry soil moisture device
**Water Chemistry**
- pH meters
- DO meters
- conductivity meters
- turbidimeters
- temperature probes
- ORP probes

**Stream Gauging**
- Swoffer current meter
- Ohio current meters
- Pygmy meter

**Borehole Geophysics**
- Logging instrument with caliper tool and capabilities for measuring single point resistance
- Gamma ray
- Temperature

**Hydraulic Fracturing Equipment**
A specially designed system for creating and monitoring shallow hydraulic fractures is available. This system consists of a slurry mixer and pump with related equipment for controlling the fracturing process and monitoring associated ground deformation. Dr. Murdoch is in charge of this equipment.

**Bob Campbell Geology Museum**
The Bob Campbell Geology Museum is located in the South Carolina Botanical Gardens adjacent to the Heritage Corridor Visitor’s Center. Patrick McMillan is Director of the Geology Museum (see Appendix A). The museum contains displays of natural mineral and fossil specimens and faceted gemstones with a combined worth exceeding $2,000,000. The Bob and Betsy Campbell Geological Collection, which includes a splendid fluorescent mineral display, and the Paul H. Benson, Jr. Collection of gemstones and cabochons, are the two most prominent exhibits.

The chief purpose of the Bob Campbell Geology Museum is to acquire and display geological materials of scientific, historic, aesthetic, and educational value. It serves also to stimulate interest in the study and research of geological materials through providing access to specimens for observation and analysis. The museum contributes to the University’s public outreach programs by developing educational exhibits and offering guided tours. Each year thousands of K-12 students visit the museum on class field trips.

**7.33 Departmental Shops**
The EEES Department maintains two well-equipped machine shops staffed by Rodney Merck and Rodney Morgan. Any request for services of the
departmental technician must be made in writing (the work order request form can be found on the department website: http://www.clemson.edu/ces/eees/form-files/index.html).

Under no circumstances is anyone to use any of the department's machine shop equipment without prior authorization and instruction as to proper use of the equipment.

7.34 Receiving Supplies
Supplies will normally be delivered to the receiving room in the Rich Laboratory or to room 445 in Brackett Hall. When they are checked in, a copy of the packing list will be placed in the package and your name will be placed on the outside. If the contents do not match the packing list, notify David Lipscomb at llipsco@clemson.edu.

NOTE: Do not pick up any boxes that have not been checked in.

7.35 Rich Laboratory Cantina Policy
Every Cantina user should abide by the following rules: (a) rinse all recyclable materials before throwing them in the container; (b) do not leave dirty dishes by or in the sink (all dishes should be dried and stored in the cabinet); (c) cover food when using microwave; (d) clean microwave and toaster oven of food spills; (e) clean tables after use; and (f) do not leave food in the student refrigerator for more than 1 week.

7.36 Recycling and Resource Recovery
EEES faculty, staff, and students, out of a spirit of environmental sensitivity, collect and recycle aluminum, glass, two kinds of plastic, newspaper, white paper, and cardboard. Recycling containers are located in the hallways of buildings on- and off-campus.

7.37 Professional Memberships
Application forms for membership in various professional organizations may be obtained from appropriate faculty. A professional organization provides networking opportunities for future employment, and as a student member, usually a reduced membership fee. Membership also gives opportunities for attending conferences and presenting research results to a regional, national, or international audience. Students are encouraged to be active members of the joint student chapter of the American Water Works Association (AWWA) and Water Environment Federation (WEF). See David Ladner for more information. Graduate students are welcome to be involved in the Geology Club (see Alan Coulson), Engineers without Borders (see Mark Schlautman), and other student organizations.
7.38 Policy on Alcohol
Alcoholic beverages are prohibited for any activity held in facilities within the College of Engineering, Computing, and Applied Sciences, including the L. G. Rich Environmental Research Laboratory and Brackett Hall.

7.39 Final Checkout
Graduate students leaving for any reason should do as follows:
- Get a departure checklist from the Student Services Coordinator
- Turn in all keys to Rodney Morgan or Briana Peele
- Return all equipment and supplies to appropriate locations
- Clean assigned laboratory space
- Submit an electronic copy of your thesis or dissertation to the Graduate School
- Return all borrowed materials
- Complete the departmental Graduate Student Final Checkout Form and return to the Student Services Coordinator: https://www.clemson.edu/cecas/departments/eees/about/form-files.html
- Also make an appointment with for the Student Services Coordinator for your exit interview. You will need to bring the completed Interview Form with you. This form can be obtained from the website or the Student Services Coordinator. No student will be cleared with the Graduate School for graduation until the Checkout Form has been completed.
8.0 GENERAL SAFETY AND HEALTH POLICIES

8.1 Chemical Hygiene Plan
The Chemical Hygiene Plan details EEES policy and regulations concerning health and safety. This plan is required reading for all Rich Laboratory personnel. A copy of the Chemical Hygiene Plan is located in each laboratory area and at: http://www.clemson.edu/research/safety/chemsafety/chem-hygiene.html

Direct any questions on safety to your research advisor, the EEES Laboratory Manager, David Lipscomb, or the Research Safety Specialist, Samuel Forrest. New students will undergo safety training at the beginning of the fall semester each year. Students shall not begin work in the laboratory without first completing safety training.

8.2 Rich Laboratory Operating Policies
The following laboratory operating policies are designed to ensure a safe and secure working environment, and to provide a research environment that nurtures the acquisition of experimental results of the highest quality.

- No food or drink is to be brought into or consumed in any laboratory.
- To facilitate cleaning, nothing is to be stored on laboratory floors.
- Only scientific charts and similar educational or reference materials are to be hung from laboratory ceilings or walls.
- Nothing is to be affixed to the glass of the laboratory doors.
- No laboratory doors including the exterior doors are to be propped open.
- Nothing, including carts, is to be stored or left in the hallways.
- The instrument room is to be used exclusively for sample analysis. Samples, standards, etc. are to be prepared in a student's assigned laboratory and transported to the instrument room for analysis using a laboratory cart. In addition, samples are not to be left in the instrument room for any reason. Carts are to be used to transport samples back to the laboratory of origin.
- All laboratory benches are to be cleaned at least weekly; more frequently if needed.
- All laboratories are to be left clean and orderly prior to departing for the day.
- When conducting wet research in the laboratories, plastic containment trays are to be used, insofar as possible, to capture spills.
- All samples, bottles, standards, etc. are to be dated and identified as to contents and person responsible. The contents are to be properly disposed of and the bottles cleaned when no longer needed.
- A record of use is to be maintained for all hazardous chemicals used.
- Gloves and laboratory coats shall not be worn outside laboratories.
- All analytical balances are to be left clean after each use.
- Lights are to be turned off whenever vacating a room.
• All memos, notices, etc. are to be posted on the official bulletin board in the Cantina at Rich Lab or in the computer room (434) in Brackett Hall
• Suitably sized posters or photos may be affixed to student carrel walls using non-damaging tape or hangers.
• Student carrels are to be maintained clean and free of refuse.
• All refuse that cannot easily be placed in a trash receptacle is to be carried to and placed in the dumpster located by the parking lot opposite the loading dock.
• Both university vehicles are to be parked in their assigned spaces.
• The key code to the exterior doors is to be kept strictly confidential within the EEES community. Any hint of a breach in confidentiality is to be reported to David Lipscomb or Briana Peele immediately.
• Recycle paper and cans are to be placed in the appropriate containers.

8.3 Personal Protective Equipment

8.3.1 Eye and Face Protection
Eye and face protection devices which meet OSHA requirements and American National Standards for industrial eye protection should be the minimum eye Protection used for activities where there may be flying or falling particles or chemical splashes. Either safety or prescription glasses with side shields must be worn in any laboratory at all times, unless an exception has been made by the departmental representative. Visitors to any laboratory must wear safety or prescription glasses, preferably with side shields.

The wearing of contact lenses is strongly discouraged. Soft contact lenses are susceptible to absorption of vapors and may aggravate some chemical exposures, particularly if they are worn for extended periods. Manufacturers of soft lenses generally recommend they not be used in certain atmospheres.

8.3.2 Body Protection
Protection of the body from contact with solid and liquid contaminants will require some protective clothing. Such protective clothing may include boots, gloves, pants, coats, and head covers. Complete protection of the skin from contact with gases and vapors requires full-body protection such as an encapsulating suit.

Whenever in a laboratory, all EEES students, faculty, and staff must ensure that arms, legs, and torso are covered at all times. For example, one can wear either (a) long pants and a long-sleeved shirt, (b) a knee-length, long-sleeved laboratory coat, or (c) long pants and a waist-length laboratory coat. In addition, rubber and plastic aprons must be used whenever corrosive or irritating chemicals are handled. Because plastic aprons can accumulate static electricity, their use must be avoided in areas where flammable solvents could be ignited. Protective clothing will have to be discarded and replaced if they cannot
be effectively decontaminated.

Clothing materials should be selected for resistance to the chemicals to which they will be exposed, and for appropriate resistance to permeations. Glove materials are discussed in Appendix H of the Chemical Hygiene Plan.

8.3.3 Footwear
Closed-toed shoes must be worn at all times (e.g. sandals, thongs, and bare feet are not permitted). Shoes made of impermeable material such as leather are strongly recommended. Sneakers offer little protection against falling objects or chemical spills. High-heeled shoes pose a hazard and are not to be worn when working in laboratories.

8.3.4 Hazardous Waste Management
The concern for safe disposal of chemical wastes has increased dramatically in recent years. Legal and regulatory requirements, reinforced by public opinion, spurred the handling of hazardous wastes in a responsible way. Even laboratory personnel who work with relatively small amounts of chemicals have begun to recognize that the chemical wastes generated during their experiments are their responsibility and that waste management systems are necessary. No chemicals shall be skewered or discarded in the dumpster. Instead contact Samuel Forrest at Rich Lab or, if on campus, please complete the waste request form at the following link: http://www.clemson.edu/research/safety/hazardouswaste/

The Resource Conservation and Recovery Act (RCRA) of 1976 mandated a system for managing hazardous waste. Regulations adopted by the Environmental Protection Agency (EPA) carry out that mandate and now extend through South Carolina State Law to those who generate, store, transport, treat, and dispose of hazardous waste. The South Carolina agency responsible for enforcing EPA regulations is the Department of Health and Environmental Control (DHEC).

The L.G. Rich Environmental Research Laboratory, like most research laboratories, generates and stores small quantities of hazardous waste. EEES has a Hazardous Waste Management Plan for ensuring that laboratory wastes are managed to prevent harm to public health and the environment and to conform to the public's expectations and the government's requirements for proper waste management. The Hazardous Waste Management Plan is a separate part of the Student Handbook. All laboratory students are required to adhere to these regulations. Direct any questions you may have concerning this to your faculty advisor or the CHO.

In Brackett Hall, the most likely areas where exposure to hazardous chemicals may occur are:
• Labs 424, 426, and 427, used by Biosystems and Environmental Engineering students, TAs, and RAs; and
• Labs 423 and 425, used by students and TAs in the Introductory Geology and Physical Science Labs

Labs 424, 426, and 427 contain concentrated acids and solvents. Exposure to the chemicals should be minimized through use of protective gear such as lab coats, eye wear and gloves.

In the introductory geology labs, dilute hydrochloric acid is used to test for carbonate rocks. Although this is a very dilute solution, it is used by all the students and should be treated carefully. The location and accessibility of eyewashes in each lab should be ascertained. The physical science labs use several chemicals as well; although some are household chemicals, they should not be treated casually.

8.3.5 Radiological Materials Procedures
The South Carolina Department of Health and Environmental Control through a Radioactive Materials License regulate the use of radioactive materials in the department. The provisions of the license are implemented through the Clemson University Radiation Safety and Waste Management Manual. This manual is a separate part of the Student Handbook and is located on the EEES web site:
https://www.clemson.edu/cecas/departments/eees/

It contains detailed information on the acquisition, use, and disposal of radioactive materials. For exposure concerns and radioactive waste disposal please contact the Radiation Safety Officer (RSO), Konstantin Povod or follow this link:
http://www.clemson.edu/research/safety/radsafety/

8.3.6 Other Hazards
The department maintains several items of laboratory equipment for which safety is a concern with regard to their operation. Most notable are the rock saws and sieve shakers in the thin section preparation lab located in the basement of Brackett Hall (room B04). These should not be operated without prior instruction.

In the field, pumps and generators used in aquifer performance tests constitute a potential hazard. Students may also be in close proximity to drilling rigs. Hard hats are required to be worn at all times when a drill rig is being operated.

The use of geologic hammers is another source of accidents. Protective eyewear and clothing should be worn when attempting to break rocks or to collect samples, as rock chips may fly off and strike the user or other persons standing nearby.
9.0 PURCHASING

The procedure all students will follow for processing chemicals and supplies is described below.

9.1 Introduction
David Lipscomb orders all research supplies and equipment required by Rich Laboratory personnel and Briana Peele orders supplies required for Brackett Hall personnel (and other EEES personnel on campus). General office supplies, books, etc., are ordered by the administrative staff. All chemicals or supplies are to be ordered from contract vendors in BuyWays, if possible. Contact David Lipscomb if you need assistance activating your BuyWays account.

The department order form is used to order items not found in BuyWays: http://www.clemson.edu/ces/eees/form-files/index.html

9.2 Primary Vendors
The State of South Carolina has awarded contracts for laboratory equipment and supplies to the following (and others; look for an orange C beside the vendor name in BuyWays):
- VWR Scientific Products; and
- Fisher Scientific Company
10.0 ETHICS

All EEES graduate students are required to abide by a code of ethics. This code is shown below. A signed copy must be signed and turned in to Barbara Smith.

ENVIRONMENTAL ENGINEERING AND EARTH SCIENCES

CLEMSON UNIVERSITY

POLICY ON RESEARCH ETHICS

The effectiveness of the research infrastructure throughout the world is based on the personal and professional integrity of the people involved. The basic assumption that is central to all research endeavors is that researchers have done what they say that they have done. The Department of Environmental Engineering and Earth Sciences is part of that infrastructure and the research conducted here must withstand the highest scrutiny. Consequently, we must all ensure that our scholarly work is conducted and reported with the highest ethical standards. We must be careful in our record keeping and diligent in our efforts to always attribute credit where it belongs. In particular, we must guard against any activity that would bring the integrity of the department or the individuals within it into question. Among the activities to be avoided are:

Falsification of Data - ranging from fabrication to deceptively selective reporting of results or methods, including the purposeful omission of conflicting data with intent to falsify results;

Plagiarism - representation of another's work as one's own;

Misappropriation of Others' Ideas - the unauthorized use of privileged information, however obtained.

The undersigned attests that they recognize the importance of maintaining the highest ethical standards in research and covenants with the other members of the department to conduct their research and professional life in a manner consistent with those ideals.

NAME __________________________________________

SIGNATURE _______________________________________

DATE ___________________________________________
11.0 FACULTY AND STAFF

The current faculty and staff are listed on the EEES web site: https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/index.html