



Department of Engineering Education 2019–2020 Graduate Manual

Virginia Tech Department of Engineering Education

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COLLEGE OF ENGINEERING
ENGINEERING EDUCATION
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ENGINEERING EDUCATION GRADUATE PROGRAM

Our Mission: Preparing scholars to advance knowledge and address significant challenges facing engineering education.

The Engineering Education (ENGE) graduate program at Virginia Tech is ideal for students who are interested in becoming leaders in innovation and catalysts for change in society through rigorous research in the field of engineering education. The program strives to prepare students who are interested in a variety of professional goals, including engineering faculty positions in universities of all types, students who wish to pursue careers in policy, and students with a strong interest in educational research, corporate training management, university assessment or university administration.

The cross-disciplinary PhD program is designed specifically to prepare graduates for careers across the entire range of engineering education. The inherent flexibility of the program allows students to tailor their curriculum and research to prepare them to achieve their goals in engineering education. The Virginia Tech Department of Engineering Education offers a Graduate Certificate in Engineering Education and a Doctor of Philosophy (PhD) Degree in Engineering Education.

Purpose of the Graduate Manual

The Graduate Manual provides a detailed description of the requirements for all graduate programs offered by the Department of Engineering Education as well as descriptions of the procedures for completing the requirements of each program. Additional information concerning Graduate School requirements may be found in the Virginia Tech Graduate Policies and Procedures and Course Catalog: http://graduateschool.vt.edu/graduate_catalog/

If there is any doubt regarding the interpretation of any regulation or requirement in this manual, or if there are questions about the graduate program involving matters not covered in this manual, please consult with the Assistant Department Head (ADH) for Graduate Programs.

This manual includes the requirements, policies, and procedures adopted by ENGE for successful completion of graduate programs. The requirements set forth herein apply only to graduate programs in ENGE. The Virginia Tech Graduate School has established further and separate requirements, and ENGE graduate students must meet the requirements of both the Graduate School and the ENGE Department for successful degree completion. While Graduate School requirements may be mentioned occasionally in this document, students should consult the Graduate Policies and Procedures and Course Catalog for a complete description of those requirements.

The requirements, policies, and procedures set forth herein apply to students joining the ENGE Graduate Program on or after Fall Semester 2019. It is the responsibility of each graduate student in ENGE to understand and adhere to all applicable policies, procedures, and requirements included in the Graduate Manual.

The provisions of this manual do not constitute a contract, expressed or implied, between any applicant or student and the ENGE Department or Virginia Polytechnic Institute and State University. The University and the ENGE Department reserve the right to change any of the provisions, schedules, programs, courses, rules, regulations, or fees whenever University or departmental authorities deem it expedient to do so.

Administration of ENGE Graduate Programs

The ADH for Graduate Programs and ENGE Graduate Committee develop all requirements, policies, and procedures for the ENGE Graduate Program with input from students and faculty.

The Academic Programs Manager serves as administrative assistant to the Graduate Program, maintains all files for the graduate program, is the source of information on the graduate program including but not limited to: forms for carrying out graduate program and Graduate School requirements, course registration, application for admission and financial aid, grade changes, and other routine paperwork relating to the graduate program. Additionally, the Academic Programs Manager works on marketing for the department both internally and externally.

The administrative staff of the graduate program of the ENGE Department includes:

Department Head:	Dr. Jennifer Case 540.231.6555 jencase@vt.edu
ADH for Graduate Programs:	Dr. David Knight 540.231.2563 dbknight@vt.edu
Academic Programs Manager:	Tamara “Mara” Knott 540.231.9543 knott@vt.edu

Application for Admission to the ENGE Graduate Program

To expedite the application process, online applications are required. Complete applications include:

- Application for admission to the Graduate School
- Three letters of recommendation
- A statement of purpose and research interests (1000 word limit) for graduate study
- Official transcript(s) — can be either scanned official transcript(s) or electronic official transcripts provided by the institution's Registrar; original transcripts are required upon enrollment
- TOEFL scores for students whose first language is not English.

Unofficial transcripts are required even for applicants holding other degrees from Virginia Tech.

The application for admission to the Graduate School should indicate the semester and year for which the student is applying for admission.

Applicants can begin the online application process at: <http://graduateschool.vt.edu/applying>

TOEFL scores (if applicable) AND unofficial transcripts must be received by the Graduate School before the application is considered complete.

Graduate Student Orientation

Prior to the start of Fall semester, the ENGE Department conducts a mandatory orientation to the Department and the graduate program for new graduate students. This orientation provides new students with a review of ENGE graduate program requirements, procedures for fulfilling those requirements, guidance on selecting a faculty advisor, the graduate honor system, and other topics of importance to new students. For students serving as teaching assistants, additional Department and University training is also required. Additional orientation sessions may continue throughout the Fall semester and will be scheduled as needed.

Financial Assistance

The ENGE Department offers financial assistance for qualified graduate students in the form of graduate teaching assistantships (GTA) and graduate research assistantships (GRA); students must apply before the application deadline to be given full consideration for Fall funding. Additional fellowships are also available through the College of Engineering and the Graduate School; students are notified on a case-by-case basis when the Department is asked to make nominations for those fellowships. The monthly stipend for GTAs and GRAs varies depending on the nature of the assistantship. All assistantships carry a waiver of tuition, except those awarded during summer terms.

Fees included in enrollment (estimated based on 2019 data) include:

Engineering, Library, and Technology Fee - \$1087.5

Comprehensive Fees (Student Activity Student Cultural Activities, Health, Athletic, Transportation Services, Recreation Sports, Student Service) - \$1048.00

Commonwealth Facility & Equipment Fee - \$302.00

Students pay the Comprehensive fees and the Commonwealth Facility & Equipment fee. All other fees are usually paid for with each fellowship/assistantship. These are estimated fees and should be verified by visiting the Bursar's website.

Teaching assistants must be on campus for training beginning August 12. The dates of the ENGE Department PhD student orientation are coordinated with other training activities to avoid conflicts. A student who is awarded a full-time GTA is obligated for 20 hours of work per week throughout the semester for which the award applies. Typically a GTA is assigned to teach in the first-year engineering program. GRA awards are made to support research projects that are supervised by ENGE faculty; hence, the principal investigator for the research project is responsible for awarding the GRA. GRA offers should include a discussion of expectations for ongoing funding and advising relationships. A student receiving a full-time GRA is expected to work 20 hours per week during the semester for which the award applies; the principal investigator will assign duties. The duties of a student on a fellowship depend on the particular fellowship and are not covered in this manual.

Until required coursework is completed, students holding a full-time assistantship must carry a course load of at least 12 credit hours per semester, and not more than 18 hours. Until a student passes the qualifying exam, if funded on a GTA, they must be registered for at least one class unless receiving permission from the ADH for Graduate Programs. Students holding less than full-time GTAs or GRAs receive a proportionally smaller stipend and reduced tuition waiver and carry a proportionally lower workload. Graduate School policies govern whether additional or outside employment is allowed.

Continuing an Assistantship

Continued assistantship support is competitive and dependent upon funding available to the Department. For students pursuing a PhD, the terms of a GTA or GRA are contingent on satisfactory academic progress, satisfactory performance of GTA or GRA duties, and professional and personal conduct. At the end of each semester, the faculty members directly supervising the student will evaluate the quality and quantity of work performed (using materials such as student progress reviews and teaching evaluations) and make recommendations for continuance of GTAs or GRAs to the ADH. Similarly, the ENGE Graduate Committee reviews the performance of graduate students, with input from the supervisor and advisor, at the end of each semester (see Academic Eligibility). Students are typically awarded two years of support. After two years, funding is not guaranteed, but preference will be given to ENGE students over non-ENGE students for GTAs (note: performance reviews are taken under consideration). Request for renewal of assistantships will be considered along with new applications each semester. With input from advisors and supervisors, the ENGE Graduate Committee makes recommendations to the ADH for Graduate Programs who then awards assistantships for the following semester in consultation with the ADH for Undergraduate Programs.

Changing From a GTA/GA to GRA

A student who has been offered and accepted a GTA contract for a given semester may give up a GTA in favor of a GRA up to three weeks (21 days) before the Fall contract start date or before the end of the Fall semester for Spring classes. Beyond that time, a GTA may be vacated in favor of a GRA only with the consent of the ADH for Graduate Programs and the ADH for Undergraduate Programs. If the decision is reached that the GTA position cannot be vacated, the Department Head will be consulted before the decision is implemented. One consideration in the decision is the availability of qualified graduate students to fill the vacated GTA position.

Academic Eligibility

To remain academically eligible, a student must maintain a cumulative grade point average of 3.00 or better for all courses taken while in Graduate School at Virginia Tech. The ENGE Department continuously monitors the progress of each graduate student. Graduate student advisors review the progress of each of their ENGE graduate student advisees annually. Additionally, the Graduate Committee reviews student progress up until the student completes a preliminary exam. These reviews will consider the student's cumulative grade point average and their progress toward degree as represented by several data points (e.g., goal statement, course taking, advisor and supervisor reviews).

Any student with a cumulative grade point average below 3.00 for their prior semester of graduate work or whose review materials are found deficient will be placed on academic probation and may be required to appear before the Graduate Committee. The purpose of this appearance is to discover the source of the difficulties related to unsatisfactory progress and to outline adjustments that the student should pursue for improvement. In accordance with Graduate School and ENGE Departmental policy, any student who fails to meet these requirements in two successive semesters typically will be dismissed from the ENGE graduate program. The student's advisor will be consulted at all stages in this process.

Students may receive an "incomplete" in a course for a variety of reasons. If the "incomplete" is not resolved by the last day of classes of the next semester in which the student is enrolled for courses that appear on the student's Plan of Study, the student will be placed on academic probation and may be required to appear before the Graduate Committee. The purpose of this appearance is to discover the source of the difficulties and to outline adjustments that the student should pursue for improvement. Two successive semesters on probation will typically result in the student being dismissed from the ENGE graduate program. The student's advisor will be consulted at all stages in the process.

Start of Semester Defense Exception (SSDE)

Start of Semester Defense Exception (SSDE) is a special enrollment category for students who have fulfilled all degree requirements and are registering only to take the final oral examination. There are exceptions and procedures for being allowed to enroll in SSDE that can be found on the Graduate School website.

Continuous Enrollment

The Commission on Graduate Studies & Policies and University Council approved a resolution (2014-15H) that requires graduate students to be continuously enrolled for a minimum of three credit hours in all Spring and Fall semesters at the University from the time of initial matriculation in the degree program until graduation. There are exceptions and procedures for taking a Leave of Absence that can be found here:

http://graduateschool.vt.edu/academics/pg/adds_withdrawals

Scholarly Ethics and Integrity

Academic integrity is essential for maintaining the quality of scholarship in the Department and for protecting those who depend on the results of research performed by faculty and students. The faculty of the Department of Engineering Education expects all students to maintain academic integrity at all times in the classroom and in research and to conduct academic work in accordance with the high ethical standards of the profession. Students are expected to maintain academic integrity by refraining from academic dishonesty and conduct that aids others in academic dishonesty or that leads to suspicion of academic dishonesty.

The Graduate Honor Code establishes a standard of academic integrity and demands a firm adherence to a set of values. In particular, the code is founded on the concept of honesty with respect to the intellectual efforts of oneself and others. Compliance with the Graduate Honor Code requires that all graduate students exercise honesty and ethical behavior in all of their academic pursuits at Virginia Tech, whether these undertakings pertain to study, course work, research, extension, or teaching. Details on the Graduate Honor Code can be found on the Graduate School website.

It is recognized that graduate students have very diverse cultural backgrounds. The term “ethical behavior” is defined as conforming to accepted professional standards of conduct, such as codes of ethics used by professional societies in the United States to regulate the manner in which their professions are practiced. The knowledge and practice of ethical behavior shall be the full responsibility of the student. Graduate students may, however, consult with their advisors, Department Head, the international students office, or the Graduate School for further information on expectations and definitions.

All graduate students while being affiliated with Virginia Tech shall abide by the standards established by Virginia Tech, as described in the Graduate Honor System Constitution. Graduate students, in accepting admission, indicate their willingness to subscribe to and be governed by the Graduate Honor Code and acknowledge the right of the University to establish policies and procedures and to take disciplinary action (including suspension or expulsion) when such action is warranted. Ignorance shall be no excuse for actions that violate the integrity of the academic community.

Specific guidance regarding potential honor code violations on the Qualifying and Preliminary Examinations is described in the sections on those Examinations. In all written work completed for ENGE course and degree program requirements, students should be sure to cite sources of ideas and clearly identify direct quotes. To avoid plagiarism, students should use norms for citing direct quotes around any strings of text longer than three words that are directly copied from any other source.

Retention of State Property

When students leave the university for any reason, they must return all property belonging to the Commonwealth of Virginia to their faculty supervisor or other appropriate persons. It is unlawful to remove from the university campus any property that was purchased with state funds or sponsored research funds or developed while employed by Virginia Tech in any category. Some examples of items that cannot be taken away or destroyed are door keys, computer programs, laptops, books, original drawings and figures for research reports, and video or camera equipment.

The student and his or her advisor, mentor, supervisor, or the ADH for Graduate Programs should determine ownership of data and make arrangements for appropriate access. Students should recognize that they do not retain ownership over or responsibility for data collected for sponsored research.

Student Health Care

All full-time graduate students are required to pay a health-service fee. The Health Services Office provides limited medical care in the infirmary (McComas Hall) for all students when the university is in session and for those students who are required to work between terms. Persons are not eligible for health services when they are not registered. The fee does not provide health services for the student's family. Students who maintain 50-100% assistantship appointments and who have purchased the university-sponsored health care plan are eligible to receive a contribution towards their health insurance premiums. Visit www.grads.vt.edu for more information.

International students are required to have insurance for themselves and all family members. The insurance policy can be obtained through the university or through private U.S. and foreign insurance companies.

Students must report immediately to the Department Head any accident or injury occurring while they are on university business or related travel so it may be documented appropriately.

ENGINEERING EDUCATION GRADUATE CERTIFICATE

The education of future engineers is an increasingly critical issue for 21st century universities. Enhancing undergraduate education, however, requires enhancing the preparation of those who teach undergraduates. The success of calls for reform depends on educating a new kind of engineering professor — one who, in addition to conducting cutting-edge research in their specialty, also understands the theory and practice of teaching, keeps current with (and possibly conducts) research in engineering education, and leads colleagues to implement changes at program as well as course levels.

Goals and Objectives

The Graduate Certificate in Engineering Education is designed to serve as evidence that the holder has completed a set of experiences, including having teaching responsibility, to begin their preparation as a successful faculty member.

Target Population

Current graduate students in any Virginia Tech department wishing to demonstrate knowledge of educational theory and practice as applied to engineering topics.

Admission Requirements

Graduate students wishing to earn the Graduate Certificate in Engineering Education must be currently enrolled (not provisional) Master's or Doctoral students in good standing in any Virginia Tech discipline or major. For admission to the Certificate program, applicants must also satisfy at least one of three requirements:

1. Enrollment in a graduate program in the College of Engineering, or
2. A Bachelor's degree in any field of engineering, or
3. A Bachelor's degree in the physical or biological sciences or mathematics.

Applicants who do not meet any of the three requirements may request special consideration from the ENGE Graduate Committee. The Committee will stipulate additional coursework that the student would need prior to beginning studies for the Certificate and may recommend that the student be admitted on a provisional basis until the specified coursework is successfully completed. In general, the specified coursework will not count toward the credits required for the Certificate.

Application

To apply for the Engineering Education Graduate Certificate, please visit the Graduate School's website.

ENGE Certificate Course Requirements

***Note: the following outlines revisions to the ENGE Graduate Certificate that were agreed upon by the ENGE faculty in May 2019. These revisions will work through university governance during Fall 2019.

To earn the Certificate, graduate students must complete a minimum of 12 graduate credits, all of which must be taken for a letter grade, with the exception of 1 credit seminar courses.

Six (6) Credits of Required Core Courses:

ENGE XXXX: Graduate Student Success in Multicultural Environments (1 credit)

ENGE XXXX: Issues in Engineering Education (2 credits) [offered each Fall]

ENGE XXXX: Practical Applications (3 credits) [offered each Spring]

Six (6) Credits of Elective Courses:

Any 3-credit course with an ENGE prefix will meet this elective requirement.

Students may also choose to use select courses from the Graduate School or approved courses from the School of Education to meet this elective requirement. Examples of non-ENGE courses include the following:

GRAD 5104: Preparing the Future Professoriate (3 credits)

GRAD 5114: Pedagogical Practices in Contemporary Contexts (3 credits)

EDCI 5114: Advanced Educational Psychology (3 credits)

EDCI 5164: Principles of Instructional Design (3 credits)

EDCI 5604: Distance Education (3 credits)

EDCI 6644: College Teaching (3 credits)

GRAD 5984: Critically Engaged Teaching with Advanced Technology (3 credits)

STS 6614: Advanced Topics in Technology Studies (Engineering only) (3 credits)

ELPS 6424: Institutional Effectiveness & Outcome Assessment in Higher Education (3 credits)

EDRE 5404: Foundations of Educational Research & Evaluation (3 credits)

EDRE 6605-6606: Quantitative Research Methods in Education I & II (3 credits each)

EDRE 6614: Qualitative Methods in Educational Research (3 credits)

Students may request to the ENGE Graduate Committee that other courses be added to the Pedagogy List and/or the Elective List.

ENGINEERING EDUCATION PhD DEGREE

Goals and Objectives

The ENGE PhD program develops diverse scholars who are dedicated to improving engineering education and practice. Students in the PhD program are trained to conduct education research, understand contextual influences, and translate research to practice. Students who graduate from the program are prepared for various career paths.

The learning outcomes graduates are expected to demonstrate include the ability to:

- Identify significant challenges facing engineering education
- Design, conduct, and critique engineering education research
- Understand relationships between sociocultural influences and engineering education & practice
- Translate education research to practice
- Communicate the implications of engineering education research to various stakeholders
- Design and critique assessment plans for engineering-related courses and programs
- Apply pedagogical practices to engineering-related content

Engineering Education PhD Coursework Requirements

***Note: the following outlines revisions to the ENGE PhD that were agreed upon by the ENGE faculty in May 2019. These revisions will work through university governance during Fall 2019.

An ENGE PhD requires a minimum of 90 total credits beyond the Bachelor's degree, with the program of study subject to approval by student's advisory committee:

- *Eight (8) Credits of Engineering Education Qualifier Courses:*
 - ENGE XXXX: Issues in Engineering Education (2 credits)
 - ENGE XXXX: Disciplinary Literacy: Theorizing and Writing in Engineering Education (3 credits)
 - ENGE 5604: Engineering Education Research Methods (3 credits)

Guidelines: Qualifier courses must be completed prior to sitting for the qualifier exam. The purpose of these courses is to ensure that students have sufficiently made the adjustment to social science and that they can communicate within and understand the field of engineering education as it relates to: (1) theoretical concepts, (2) applied issues, and (3) means of inquiry for undertaking research.

- *Three (3) Credits of Practical Applications in Engineering Education (ENGE XXXX)*

Guidelines: The purpose of this courses is to ensure students can transfer their foundational knowledge (i.e., theory or conceptual knowledge) to actual work, emphasizing the importance of learning by doing. This course should be taken after the successful completion of the qualifying exam.

- *Five (5) Credits of Seminar Courses:*
 - ENGE XXXX: Graduate Student Success in Multicultural Environments (1 credit)
 - ENGE 5704: Engineering Education Graduate Seminar (1 credit X 4 semesters)

Guidelines: The purpose of these courses is to create an opportunity for students to actively engage with colleagues about topics relevant to engineering education. It is recommended that students complete the seminar requirement in their first four semesters. Although enrollment is not required beyond four semesters, all graduate students should regularly attend seminar.

- *Specialization Courses (36 credits)*
 - *Engineering cognate (engineering): 12 credits*
 - *Social science cognate (education or social science): 12 credits*
 - *Electives (engineering or education theory or methods): 12 credits*

Guidelines: Each cognate represents a collection of open-electives providing broad support to a student's career development and research specialization. A cognate area will not be titled and will not be listed on a student's transcript, but rationale is required in the plan of study approval process. To ensure that the PhD is sufficiently interdisciplinary, courses should be taken from a variety of departments across the three areas listed above. The *engineering cognate* is included to ensure students have graduate-level understanding of engineering concepts and should include a coherent set of courses from an engineering discipline other than engineering education. The *social science cognate* is included to ensure students have graduate-level understanding of education or other social science concepts and should include a coherent set of courses (ENGE courses are acceptable). In addition to having cognates with ties to different disciplinary content domains to ground research, teaching, or future opportunities, we believe being immersed in two domains rooted in different epistemologies (i.e., engineering and social science) is essential for our graduates (any course substitutions should be grounded in this rationale). The *electives* category is included to ensure students continue developing theoretical and methodological expertise related to their area of specialization or interest. They may also be permitted to expand their engineering coursework, in particular for those who seek a Master's in an engineering discipline or seek to obtain a faculty position within a traditional engineering discipline. A Plan of Study is signed by a student's committee and the Assistant Department Head for Graduate Programs.

- Constraint 1: There needs to be at least one quantitative and one qualitative social science methods course
 - Constraint 2: Courses should collectively align toward a student's interests
- *Minimum of Thirty (30) Credits of Dissertation Research Hours*

Additional Information pertaining to courses

- Normally the student will have no more than nine (9) credits among 5974 and 5984 independent study/special study courses
- Normally categories defined above are mutually exclusive
- At least nine (9) credits will normally be at the 6000 level, relevant to the student's research (do not have to be ENGE courses)
- Up to thirty (30) credits from a Master's degree may be counted toward the PhD at the discretion of the student's advisory committee

Timeline and Progress to Degree

Students pursuing a graduate degree in the ENGE Department must satisfy the requirements of the Graduate School and the ENGE Department. The requirements of the Graduate School are integrated into those of the ENGE Department and hence will not be treated separately herein. For a discussion of general Graduate School requirements, the reader should see the Graduate Catalog. A summary of the suggested timeline for early coursework is presented in Table 1.

Table 1. Suggested course taking for ENGE required courses.

	Fall	Spring
Year 1	Issues [2] Research Methods [3] Disciplinary Literacy [3] ENGE Seminar [1]	Grad Student Success Seminar [1] Seminar [1]
Year 2	ENGE Seminar [1]	ENGE Seminar [1] Practical Applications [3]

A summary of the typical timeline for completing program requirements is presented in Table 1. Details about semester reviews are presented in sections that follow.

Table 2. Suggested program timeline (note: timeline may vary considerably by student).

Major Activity	Time Frame (assumes August start)
Select an Advisor	By End of Spring Break, Semester 2
Complete Coursework	Semesters 1 – 6
Qualifying Examination	Before Start of Semester 3
Plan of Study*	Semester 3
Preliminary Examination**	Semesters 3 – 6
Research Proposal*	Semesters 4 – 7
Research Progress Update Meeting*	Semesters 5 – 9
Final Examination or Dissertation Defense **	Semesters 6 – 10+

*Form required by department and/or graduate school

** Scheduled through the graduate school online registration form

Graduate Advisor Selection

For students pursuing the PhD, the advisor must be an ENGE faculty member and should have particular expertise in the area of research the student intends to pursue. Graduate School policy includes provisions to change advisor, if necessary, after filing the plan of study. In all cases, the faculty member must give their consent to serve in the capacity of graduate advisor.

To allow ENGE PhD students sufficient time to develop their research interests, the Department encourages prospective and new students to meet with as many ENGE faculty members as possible (before selecting an advisor). Considerations should include research interests, work styles, personalities, and funding opportunities. Incoming students will be assigned a temporary first year advisor, who will act as one point of contact for questions during the first several months of the program. This relationship is meant to be temporary from both the student and faculty perspective—it may turn into a longer-term advising relationship, but there is no expectation that it will be the case on either side. A preliminary advisor decision must be made by the end of Spring Break during a student's first year, and a final advisor decision must be made before filing the Plan of Study.

Recommendations for advisor selection in tandem with the recruiting process are outlined below:

1. Students should be given agency to choose their advisor *and* to change their mind.
2. Students should not be required to select their advisor too soon. The department advocates a “shop around” approach to encourage students to identify advisors with both the appropriate research and work style.
3. Faculty should be aware of the applicant pool and each applicant's advisor status.
4. Faculty should have the opportunity to interact with each student before the student selects an advisor.
5. The Graduate Program should be able to depend on faculty to participate in both the recruiting and admissions processes.

Changing Advisors

If the student or advisor wishes to change advisory committee membership after the Plan of Study is submitted, they must submit a form through the Graduate School:

<http://graduateschool.vt.edu/academics/what-you-need-to-graduate/forms.html>

PhD Advisory Committee

For the PhD, a graduate advisory (research) committee is required. The graduate advisor serves as the chair of the student's graduate advisory committee, and the student should seek the assistance of their advisor in identifying faculty members who might serve on the committee. The committee should be composed of those faculty members who can best assist the student in completing their graduate research. Each member is added to the student's committee after consenting to serve.

For students pursuing the PhD in Engineering Education, the advisory committee must include a minimum of four members; the committee should be composed of a minimum of three ENGE faculty members (including the advisor) and one member outside of the Department. Affiliate Faculty can count as either internal or external to the department. The Graduate School requires that at least four members hold PhDs.

Committee members are expected to attend meetings as a collective body. If needed, a member of the committee may attend a meeting by video or telephone connection. However, the student's advisor must be physically present at all such meetings (unless on research leave or a similar distant and extended assignment). Faculty participation on graduate student committees is considered to be an important part of ENGE faculty responsibilities, and ENGE faculty members are expected to attend all committee meetings for graduate students they advise or on whose committees they serve.

Members of the PhD graduate advisory committee are recommended by the student and their advisor and approved by the ADH for Graduate Programs. The Department's Plan of Study form includes a section for providing a short justification for the selection of each member of the PhD Committee.

If a proposed member is not a Virginia Tech faculty member or not tenure track, a bio sketch of that proposed member must also accompany the request. In these cases, the Graduate School's required form for University registration of non-tenure track and non-VT faculty members should also be completed.

Plan of Study

After identifying a graduate advisor and dissertation committee, a student defines their plan of study in consultation with their advisor. The courses listed on the plan of study must include, but are not limited to, all courses required for the PhD. Students must justify their specialization courses (as a cohesive whole), as outlined previously.

A plan of study is required of all students pursuing graduate degrees at Virginia Tech. The PhD Plan of Study form can be found on the ENGE Graduate Student Resource website.

To allow ENGE PhD students sufficient time to select an advisor and committee, the plan of study should be submitted by the end of the 3rd academic semester as suggested by the Graduate School. An extension may be granted under extenuating circumstances with written permission from the ADH for Graduate Programs.

The Graduate School allows as much as 50 percent of the graded credit hours beyond the baccalaureate for the doctorate, obtained at an accredited institution, to be considered for transfer toward the degree. All such credits must have earned grades of "B" or better, have been earned while the student was in good standing, and be acceptable for graduate degree credit at the "home" institution. Grades of "S" or "P" are not acceptable unless the course is only offered on a pass/fail basis. All transfer courses must be acceptable to the student's advisory committee and must have been completed within the time limits prescribed for satisfying degree requirements. Credits are transferred when they are entered on the plan of study and approved by the Graduate School. Transferred courses count only as credit hours and are not included in calculation of the GPA.

The plan of study approval process includes review and signed approval by the student's advisor, graduate committee members, and the ADH for Graduate Programs. The Plan of Study is to be submitted to the Academic Programs Manager for electronic approval by the ADH for Graduate Programs and the Dean of the Graduate School.

Required PhD Milestones and Examinations

All ENGE PhD students are required to complete the following milestones in the order listed:

1. Qualifying Examination*
2. Preliminary Examination
3. PhD Research Proposal
4. Progress Report
5. Final Examination (Defense)

**The ENGE Graduate Committee administers the Qualifying Examination, and the student's advisory committee administers all others.*

Additionally, all students are required to submit materials for the departmental review process; details will be communicated to students each semester. Failure to complete this requirement in a timely manner may result in loss of funding and/or a hold on the student's account.

Qualifying Examination

Students should complete the ENGE Qualifier courses (see above) within the first year of enrollment in the PhD program enabling them to take the Qualifying Exam in August prior to the start of the second year. For students who begin the program in January or those who have unusual circumstances, the exam may be completed in the second August following program matriculation. Students with an "incomplete" in any of these courses will not be permitted to attempt the Qualifying Exam until each "incomplete" is resolved and a passing grade earned. Qualifying Exam dates will be announced well in advance of the exam.

The Qualifying Exam serves the purposes of a) continual assessment of program and core courses, b) evaluation of student learning outcomes; and c) evaluation of student preparedness for doctoral study within a social science field. This examination assesses the student's understanding of the field of engineering education and the major theoretical concepts, applied issues, and means of inquiry for undertaking research in the field. It is a combination of written materials and an oral examination. The rubric for the qualifying exam will be provided to students in advance. The Qualifying Examination must be completed before the Preliminary Examination.

Qualifying Exam Components

***NOTE: These processes are being implemented for a second time in August 2019. The Graduate Committee reserves the right to tweak some of these plans for the 2020 exam based on feedback from this second administration. Any changes will be communicated to students in early Spring 2019.

- **Narrative (up to 5 pages):**
 - Each student should complete a narrative describing their progression into the engineering education field over the course of their first academic year. They should describe their coursework, assistantship opportunities, and development as an engineering education researcher. Importantly, students should describe how and why their research interests have been shaped. Furthermore, they should describe their professional goals for the next academic year, the rest of the program, and

- beyond the program. Finally, this narrative should include a subsection describing how they approached and prepared for the qualifying exam as well as a subsection describing how their thinking has developed after reviewing their class assignments from the core classes.
- This narrative may be discussed and reviewed with other students, faculty, and the advisor.
 - **Two Mini Research Studies (approx. 2,000 words apiece):**
 - Students will be given a prompt and asked to design two mini research studies for that context (approx. 2,000 words apiece). Such an ask of engineering education researchers happens quite often, so this does replicate practice.
 - Important note: this is not a prospectus for the dissertation. We do not want to ask students to narrow their focus too early in a program.
 - These studies should include a brief introduction that motivates the study, a theoretical underpinning section, and a research methods section. One study should be a quant-based approach, the other should be a qual-based approach, and different theoretical/conceptual frameworks should be used in each study.
 - Re-using text between the two studies is acceptable. Citations from the core classes are sufficient for formulating these studies, but students are welcome to use outside sources as they wish.
 - This should be only the student's individual work with no outside assistance.
 - **Oral Exam (45 mins)**
 - Each qualifying class will have a list of concepts/themes that will be provided to students and faculty by May. The concept lists will be generated by the faculty member teaching the class and reviewed by the Graduate Committee and then the full faculty. Students should be conversant in the topics and be able to talk across topics and understand the relationship between topics—the goal is to demonstrate fluency in the field.
 - Students are encouraged to work with peers and faculty members throughout the summer to review their understanding of these concepts.
 - During the exam, faculty panels will select some of these concepts and ask students to demonstrate their understanding. Students may bring notes to the exam, but the expectation is that students will be conversant and not reliant on the notes.
 - Faculty may ask questions about the mini research studies as well. An example question might be: "In your research study, you proposed to explore X. Please explain the alignment across your research questions, selected frameworks, and proposed method."
 - Faculty may also ask questions related to students' narratives.

Faculty members will work hard to communicate exam results to students quickly. Same-day decisions should not be expected. Each faculty panel will submit a single rubric for each student's materials along with any Revise & Resubmit recommendations that will be vetted by the full graduate faculty before it is sent to students. Consistent with other exam milestones, two or more "fail" votes by Graduate faculty panelists will trigger a request for students to complete additional tasks if they believe students are not fully grasping certain concepts, having

insufficient rationale for their programs, or if writing needs additional work. Revise and Resubmit plans will be based on a holistic assessment of both the portfolio and the oral examination and will be tailored for individual students. Students who need to complete a Revise & Resubmit plan will be placed on academic probation within the department during the Fall semester to communicate the urgency with which tasks should be completed, and advisors will be responsible for working with students until tasks are sufficiently completed. Once the advisor signs off on sufficient completion of the tasks and submits a statement in writing to the Assistant Department Head for Graduate Programs, the student will have completed the Qualifying Exam milestone. Students will have the Fall semester to complete the Revise & Resubmit process. Failure to do so will result in program dismissal. If there are extraordinary circumstances, extensions to this timeline may be requested in writing to the Graduate Committee who will have decision-making authority on each of those cases.

As with all grades, the Graduate School permits students to appeal the exam result. Normally, appeals are directed to the course instructor, but the Qualifying Exam does not have an instructor. Therefore, the procedures are as follows. If appealing a result on the Qualifying Exam, the student should speak with their advisor. If the ADH for Graduate Programs is serving as the advisor, the student will need to find a member of the graduate faculty willing to serve as an advocate. The student and advisor/advocate will submit a written appeal to the ADH for Graduate Programs. The ADH and Graduate Committee will determine the appropriate course of action for addressing the appeal. Grounds for appealing an exam decision are governed by the Graduate School.

Extensions on submissions for the Qualifying Exam will only be granted under extenuating circumstances in consultation with the Graduate Committee and/or Department Head. Extenuating circumstances are usually personal or health problems that we define as: “Exceptional, short-term events which are outside of a student’s control and have a negative impact upon their ability to complete the Qualifying Exam.” It is the responsibility of the student to notify the ADH for Graduate Programs at the earliest opportunity if there are any extenuating circumstances that might have a bearing on qualifying examination performance. Students with disabilities documented by the SSD office who wish to seek accommodations on this examination or any other listed above must submit their request in writing to the ADH for Graduate Programs no less than 30 days prior to the start of the examination. SSD typically does not allow accommodations for take-home examinations. However, the Graduate Committee is committed to working with students and SSD.

Preliminary Examination

The Preliminary Examination in Engineering Education is a vital and required step towards students’ preparation for undertaking doctoral level research. The purpose of this examination is to assess one’s readiness to pursue creative, original, independent research at a level typically expected of PhD students. Along with the Qualifying Examination, the Preliminary Examination is one component required to gain status as a doctoral candidate in the Department of Engineering Education. The Qualifying Examination must be completed before the Preliminary Examination. Engineering Education PhD students advance to candidacy after successfully passing the Preliminary Examination but must still write and defend a research proposal before beginning their research.

Preliminary Examinations must be scheduled through the Graduate School. This document supplements Graduate School policies listed in the Graduate Catalog. The purpose of this description is to establish common expectations for the Preliminary Examination and Proposal Defense, and to protect both ENGE students and faculty.

The Preliminary Examination for ENGE PhD students includes both written and oral components. The written portion of the examination is completed over a period of up to four weeks of writing. A common format is approximately three or four questions related to the research area of interest to the student based on a prospectus developed by the student in consultation with their advisor. If a student wishes to complete the exam in a shorter two-week time period, that is perfectly acceptable. Students should not expect reprieves from their assistantship expectations over the full four-week period. The final product that committees will review should not move in level of expectations relative to the length of the exam period — questions should be answerable in a two-week period if students wish to focus on the exam in that time frame. Extensions of more than 24 hours beyond the original deadline, which would only be granted under extraordinary circumstances, should only be granted in consultation with the Department Graduate Committee.

The oral portion of the Examination is administered at least two weeks after completion of the written portion and must be scheduled through the Graduate School. Faculty serving on ENGE PhD committees should be given at least two full weeks to read and review the Preliminary Examination written responses.

The Preliminary Examination is to be solely the work of the PhD candidate, and no outside assistance from other individuals is allowed, including proofreaders or writing assistance. To do otherwise will be considered a violation of the honor code, and cases will be forwarded to the Graduate Honor System. Students must be registered during the semester the Examination is taken. Students may not schedule the Preliminary Examination until they have an approved Plan of Study.

The student's advisory committee administers the Preliminary Examination. To pass the - examination, a degree candidate must have a favorable vote from a majority of the examining committee, with a maximum of one negative vote. All members of the student's advisory committee must attend the oral portion of the examination; virtual attendance is acceptable when necessary. If performance on the Preliminary Examination is unsatisfactory, one full semester must lapse (15 weeks) before the Examination is administered a second time. The student will be expected to re-take the exam within 12 months of the first result of the oral examination. Extensions to this timeline may be requested in writing to the Graduate Committee who will have decision-making authority on each of those cases. Students failing the Preliminary Examination twice will be dismissed from the program. The result of the examination is recorded through the Electronic Signature Approval System (ESS) on the day of the oral portion of the examination. Each member of the student's advisory completes the electronic examination card. Advisory committees reserve the right to alter a plan of study based on performance on the Preliminary Examination, for example, to require coursework addressing a deficiency not serious enough to warrant failure of the Examination.

The oral examination portion of preliminary examination scheduling will be processed digitally through Electronic Signature Approval System (ESS) at <https://ess.graduateschool.vt.edu/>. Students will sign into the ESS to request their preliminary examination. Advisory committee members will sign into the ESS to approve the preliminary examination request as well as electronically sign the examination card (notification sent to the @vt.edu email address). The preliminary examination request must be submitted at least 2 weeks prior to the oral examination date. The ESS does not allow a student to request an exam date less than two weeks from the examination request submission date. It is important that students plan in advance with their advisory committee to ensure that all advisory committee members can attend the examination for the date/time requested. If any member of the advisory committee does not approve the preliminary examination request, the student will need resubmit with a new date/time. Requesting a room in the examination request does not reserve the room; students must reserve the room through the department's room reservation coordinator. Once an examination request is approved by the advisory committee and the Graduate School, an email confirmation will be sent to the student, advisory committee, and department staff coordinator with notification of the official examination scheduling. An examination should not be held without receipt of the notification email from the Graduate School. Please contact the Graduate School before the examination if you have not received a scheduling notification.

Research Proposal

To initiate dissertation research, the student is required to prepare a research proposal that describes the background, purpose, and methods of the research, the outcome anticipated, and the contribution to the field. This proposal must be in written form and must be presented to the advisory committee at a meeting where all committee members are present (in person, via phone or video teleconference). The student should consult with their committee regarding expectations for length, scope, and format. Signatures of each committee member on the proposal approval form signify approval of the proposed research effort (see the ENGE website for the form).

This form is delivered to the ENGE Graduate Program Coordinator for inclusion in the student's academic record. A student pursuing a PhD should demonstrate the ability to carry out original and creative research, and the results of the research should be sufficiently significant to be publishable in a major technical journal. Thus, the writing style, grammar, and spelling of the proposal and dissertation should reflect a high level of skill in written communication.

Progress Report

Between the research proposal and the Final Examination, the student is required to provide at least one progress report to their advisory committee at a meeting where all committee members are present. The time of this meeting is determined by the student's advisory committee, but can be no later than three weeks preceding the scheduled final defense. The advisory committee signs the progress report form (see ENGE website), and this form should be delivered to the ENGE Graduate Coordinator for inclusion in the student's academic record.

Final Examination

All graduate students pursuing a PhD are required to pass an examination with an oral component administered by the advisory committee. The examination is typically an oral defense of the dissertation. The Final Examination is a requirement of the Graduate School and must be administered during a semester in which the student is registered.

To schedule a Final Examination, *the student must submit their dissertation manuscript to their committee four weeks prior to the exam.* According to the Graduate School, scheduling requires the committee to have read the document before scheduling the defense, and ENGE departmental policy requires that faculty are given two weeks to read documents. The Graduate School policy states (see Graduate School website):

For scheduling of the **Final Examination, Thesis Master's and Ph.D. students** must have the thesis/dissertation ready for defense (as judged by Advisory Committee members **having read the document** and signed the examination scheduling request) and the student must be able to complete all other degree requirements within the semester when the examination is held: all coursework on the Plan of Study will need to be completed with grades of C- or higher and both the Plan of Study GPA and the overall GPA must be a 3.0 or higher by the end of the semester. Because some of the problem situations with deficient grades or credits require retaking courses or adding credits, the Plan of Study should be examined at the beginning of the semester in which a student plans to take the Final Examination.

Final Examinations are open to the public and must be advertised as soon as the exam is scheduled with the Graduate School. Students are required to submit their dissertation abstract (150-300 words) and their professional biography (50-100 words) to the Graduate Coordinator when they send the request to the Graduate School. The Graduate Coordinator then sends out the announcement as soon as time and date confirmation is received.

To pass the Final Examination, a degree candidate must have a favorable vote from a majority of the examining committee, with a maximum of one negative vote. If a student fails the Final Examination, there must be a lapse of one full semester (15 weeks) before rescheduling the examination. A student is allowed no more than two opportunities to pass the Final Examination.

The result of the Final Examination must be reported to the Graduate School through the Electronic Thesis and Dissertation (ETD) system. In addition, the student completes an exit interview with the ENGE Graduate Coordinator.

Dissertation

The dissertation must be submitted to the student's advisory committee at least four weeks prior to the Final Examination. The dissertation must be approved by all members of a student's advisory committee, usually upon successful completion of the Final Examination. If a committee member does not approve the dissertation, upon the faculty member's request, a written dissenting opinion can be bound with the final document. A successful candidate is allowed a maximum of one negative vote. Dissertations must be filed and approved electronically with the Graduate School through the Electronic Thesis and Dissertation (ETD) system. The student, advisor, committee members, and the ENGE Graduate Program Coordinator are notified once the ETD process is complete and the document is available online.

ENGE Graduate Faculty

Numbers in parentheses indicate year of first tenure-track appointment at Virginia Tech. More detailed information can be found about ENGE faculty at:

<https://enge.vt.edu/People/researchfaculty.html>

Diana Bairaktarova | Assistant Professor (2015), PhD, Engineering Education, Purdue University

Jenni Case | Professor, Department Head (2017), PhD, Faculty of Education, Monash University

Richard M. Goff | Associate Professor (1996), PhD, Aerospace Engineering, Virginia Tech

Jacob Grohs | Assistant Professor (2015), PhD, Curriculum & Instruction, Virginia Tech

Andrew Katz | Assistant Professor (2019), PhD, Engineering Education, Purdue University

David Knight | Associate Professor, Assistant Department Head for Graduate Programs (2013), PhD, Higher Education, Pennsylvania State University

Walter Lee | Assistant Professor (2015), PhD, Engineering Education, Virginia Tech

Vinod K. Lohani | Professor (1998), PhD, Civil Engineering, Virginia Tech

Jeremi London | Assistant Professor (2018), PhD, Engineering Education, Purdue University

Holly Matusovich | Associate Professor, Assistant Department Head for Undergraduate Programs (2009), PhD, Engineering Education, Purdue University

Lisa D. McNair | Associate Professor (2005), PhD, Linguistics, University of Chicago

Homero Murzi | Assistant Professor (2018), PhD, Engineering Education, Virginia Tech

Marie C. Parette | Professor (2004), PhD, English, University of Wisconsin, Madison

Nicole Pitterson | Assistant Professor (2017), PhD, Engineering Education, Purdue University

Kenneth Reid | Associate Professor (2014), PhD, Engineering Education, Purdue University

Bevlee A. Watford | Professor (1992), PhD, Industrial & Systems Engineering, Virginia Tech

ADDITIONAL VIRGINIA TECH POLICIES

Equal Opportunities/Affirmative Action Policy

(See Policy 1030, "Affirmative Action Policy")

Virginia Tech does not discriminate against employees, students, or applicants on the basis of race, color, sex, sexual orientation, disability, age, veteran status, national origin, religion, or political affiliation. The University is subject to titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 503 and 504 of the Rehabilitation's Act of 1973, the Age Discrimination in Employment Act, the Vietnam Era Veteran Readjustment Assistance Act of 1974, Federal Executive order 11246, Governor Gilmore's State Executive Order Number Two, and all other rules and regulations that are applicable. Anyone having questions concerning any of those regulations should contact the Equal Opportunity/Affirmative Action Office, 336 Burruss Hall, Blacksburg, Virginia 24061, 540.231.7500, TDD 540.231.9460. Individuals with disabilities desiring accommodations should contact the Dean of Students office, 540.231.3787, TDD 800.828.1120.

Sexual Harassment Policy

(See Policy 1025, "Sexual Harassment Policy")

Sexual harassment is considered to be a form of discrimination based on sex and falls within the statutory prohibitions against sex discrimination. The University is committed to maintaining a working and study environment free of sexual harassment. Accordingly, in compliance with Section 703 of Title VII of the Civil Rights Act of 1964 and Title IX of the Education Amendments of 1972, it is the University's policy not to tolerate any verbal, nonverbal, or physical behavior, which constitutes sexual harassment. Personnel with supervisory responsibilities are required to take immediate and appropriate action when incidents of alleged sexual harassment are brought to their attention. Violations of the policy prohibiting sexual harassment may lead to disciplinary actions, including reprimand, suspension, or termination of employment or academic status.

Sexual harassment is defined as unwelcome sexual advances, request for sexual favors, and other verbal, or nonverbal, or physical conduct of a sexual nature when:

- Submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic decisions, or
- Submission to or rejection of such conduct by an individual is used as the basis for employment or academic decisions, or
- Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment

Faculty, staff, students, and applicants for employment or admission with complaints of sexual harassment should contact the University EO/AA Office on a confidential basis and request an informal investigation. Faculty, staff, and students may file formal complaints outside the University. Students may file formal complaints with the Office of Civil Rights of the Department of Education. Faculty may file formal complaints with the Equal Employment Opportunity Commission. Staff may contact the State EEO Office or the Equal Employment Opportunity Commission.

Acceptable Use Of Information Systems At Virginia Tech

(See Policy 2015, "Acceptable Use of Computer and Communication Systems")

General Principles

Access to computer systems and networks owned or operated by Virginia Tech imposes certain responsibilities and obligations and is granted subject to University policies, and local, state, and federal laws. Acceptable use is always ethical, reflects academic honesty, and shows restraint in the consumption of shared resources. It demonstrates respect for intellectual property, ownership of data, system security mechanisms, and individuals' rights to privacy and to freedom from intimidation and harassment.

Guidelines

In making acceptable use of resources the student must:

- Use resources only for authorized purposes.
- Protect your user ID and system from unauthorized use. You are responsible for all activities on your user ID or that originate from your system.
- access only information that is your own, that is publicly available, or to which you have been given authorized access.
- use only legal versions of copyrighted software in compliance with vendor license requirements.
- be considerate in your use of shared resources. Refrain from monopolizing systems, overloading networks with excessive data, degrading services, or wasting computer time, connect time, disk space, printer paper, manuals, or other resources.

In making acceptable use of resources you must NOT:

- Use another person's system, user ID, password, files, or data without permission.
- Use computer programs to decode passwords or access control information.
- Attempt to circumvent or subvert system or network security measures.
- Engage in any activity that might be purposefully harmful to systems or to any information stored thereon, such as creating or propagating viruses, disrupting services, or damaging files or making unauthorized modifications to University data.
- Use University systems for commercial or partisan political purposes, such as using electronic mail to circulate advertising for products or for political candidates.
- Make or use illegal copies of copyrighted materials or software, store such copies on University systems, or transmit them over University networks.
- Use mail or messaging services to harass or intimidate another person, for example, by broadcasting unsolicited messages, by repeatedly sending unwanted mail, or by using someone else's name or user ID.
- Waste computing resources or network resources, for example, by intentionally placing a program in an endless loop, printing excessive amounts of paper, or by sending chain letters or unsolicited mass mailings.
- Use the University's systems or networks for personal gain; for example, by selling access to your user ID or to University systems or networks, or by performing work for profit with University resources in a manner not authorized by the University.
- Engage in any other activity that does not comply with the General Principles presented above.

Enforcement

The University considers any violation of acceptable use principles or guidelines to be a serious offense and reserves the right to copy and examine any files or information resident on University systems allegedly related to unacceptable use, and to protect its network from systems and events that threaten or degrade operations. Violators are subject to disciplinary action as prescribed in the Honor Codes, the University Policies for Student Life, and employee handbooks. Offenders also may be prosecuted under laws including (but not limited to) the Communications Act of 1934 (amended), the Family Educational Rights and Privacy Act of 1974, the Computer Fraud and Abuse Act of 1986, The Computer Virus Eradication Act of 1989, Interstate Transportation of Stolen Property, The Virginia Computer Crimes Act, and the Electronic Communications Privacy Act. Access to the text of these laws is available through the Newman Library Reference Department.

Virginia Tech Principles of Community

Virginia Tech is a public land grant University, committed to teaching and learning, research, and outreach to the Commonwealth of Virginia, the nation, and the world community. Learning from the experiences that shape Virginia Tech as an institution, we acknowledge those aspects of our legacy that reflected bias and exclusion. Therefore, we adopt and practice the following principles as fundamental to our ongoing efforts to increase access and inclusion and to create a community that nurtures learning and growth for all of its members:

- We affirm the inherent dignity and value of every person and strive to maintain a climate for work and learning based on mutual respect and understanding.
- We affirm the right of each person to express thoughts and opinions freely. We encourage open expression within a climate of civility, sensitivity, and mutual respect.
- We affirm the value of human diversity because it enriches our lives and the University. We acknowledge and respect our differences while affirming our common humanity.
- We reject all forms of prejudice and discrimination, including those based on age, color, disability, gender, national origin, political affiliation, race, religion, sexual orientation, and veteran status. We take individual and collective responsibility for helping to eliminate bias and discrimination and for increasing our own understanding of these issues through education, training, and interaction with others.
- We pledge our collective commitment to these principles in the spirit of the Virginia Tech motto of Ut Prosim (That I May Serve).