Department of Engineering and Public Policy

Peter Adams, Interim Department Head
Deanna H. Matthews, Associate Department Head for Undergraduate Affairs
Location: Baker Hall 129
www.cmu.edu/epp (http://www.cmu.edu/epp)

The Department of Engineering and Public Policy (EPP) is a unique department that works on problems at the interface between technology and society. Society is largely responsible for setting the goals and framing the problems that engineers and scientists work on. However, technologies designed by engineers and scientists profoundly change the societies in which they operate. Technology has enabled a healthier, richer, and more productive society. At the same time, technology has contributed to the creation of many of the more serious problems our society faces.

Technology can help us build a happier, freer, and more fulfilling life, while maintaining risks and undesirable impacts at acceptable levels. But that does not happen automatically. It takes careful hard work by people who understand both technology and the society in which they live. In order to do their jobs responsibly and well in today’s world, engineers and scientists must develop an understanding of the interface between technology and society and a command of the skills necessary to work at that interface.

The undergraduate degree programs of the Department of Engineering and Public Policy (EPP) have been designed to allow undergraduate students at Carnegie Mellon University to add this important dimension to their traditional engineering or science education. EPP additional major graduates, for the most part, will enter traditional engineering or science careers, but will carry with them a set of insights and skills that will help them to better deal with issues in technology and policy, and better exercise their ethical and social obligations as practicing professionals.

Overview of the Undergraduate Programs in EPP

The undergraduate additional major programs in EPP combine the strong foundation in mathematics and physical sciences, and the development of engineering or science skills with a rigorous preparation in the analysis of social and political problems. The curriculum includes subject matter which is not part of traditional technical or social science curricula, but which contains elements of each. Students complete courses in four core areas: economics, statistics, decision-making, and communication. Breadth is achieved through EPP Technology-Policy elective courses. Finally, students apply their skills in a project preparatory course and two interdisciplinary problem-solving projects. Problem areas for these projects are chosen from local, state, and national situations, and include such topics as climate change, energy systems, technological innovation, telecommunications issues, computer security and privacy, risk analysis and communication, among others. Students from several CMU colleges enroll in these projects courses exposing EPP additional majors to working in truly interdisciplinary teams.

The advantage of the additional major is the added set of skills and perspectives, which allow a graduate of the program to improve the quality, sensitivity, and social responsiveness of their work, and the work of their colleagues. Employers recognize these skills and often view our graduates as more attractive for a traditional engineering or technical position. Firms contact the EPP department every year to recruit EPP graduates because of their satisfaction with the knowledge and skills acquired by EPP students.

The additional major also opens up a collection of other options that are not available to most technical graduates. These include jobs in policy analysis in federal, state, and local government or in public policy consulting firms. Alumni also pursue careers in companies to deal with issues like government regulation, environmental control, worker health and safety, product liability and safety, telecommunications policy, energy systems, and the social impact of large technological systems.

Students also choose to continue their formal education, doing graduate work in engineering, the social sciences, law, or interdisciplinary programs.

Faculty Advisors

Faculty in several departments serve as advisors and information resources to students selecting the EPP undergraduate programs. Given the interdisciplinary perspective of EPP, students may find that a faculty member outside their traditional major can provide support and guidance with EPP-related courses and career paths. The EPP Associate Department Head for Undergraduate Affairs is Deanna Matthews. Dr. Matthews can provide general academic advice and guidance for all EPP undergraduates. Other faculty affiliated with the undergraduate programs in EPP are:

- Civil Engineering: Peter Adams, Jared Cohon, Scott Matthews, Mitch Small
- Chemical Engineering: Neil Donahue
- Computer Science: Lorrie Cranor, Doug Sicker
- Economics: Nicholas Muller
- Electrical and Computer Engineering: Jon Peha, Marvin Sirbu
- Engineering and Public Policy: Daniel Armanios, Alex Davis, Erica Fuchs, Paulina Jaramillo, Deanna Matthews, Granger Morgan
- Institute for Politics and Strategy: Baruch Fischhoff
- Mechanical Engineering: Jeremy Michalek, Edward Rubin, Kate Whitefoot
- Material Science and Engineering: Jay Whitacre
- Social and Decision Sciences: Paul Fischbeck

EPP Program Educational Objectives

Students who earn an additional major in Engineering and Public Policy at the undergraduate level do so in conjunction with a traditional engineering major. The elements of the EPP undergraduate program broaden the traditional scope of technical analysis to encompass an engineering solution’s potential impact on society. Thus, our graduates have all of the skills as their peers in traditional engineering majors, but with a broader societal perspective and additional analysis skills. This enables our graduates to understand the interface between technology and society and to help solve the complex, interdisciplinary systems problems facing our world in their careers. Students will be able to work in a variety of career fields, including technical and non-technical, in industry, government or elsewhere where these broad skills are needed.

Additional Major in Engineering and Public Policy

The EPP department offers an additional major in Engineering and Public Policy (EPP) with each of the five traditional engineering departments in the engineering college. The engineering additional major leads to a fully accredited engineering degree that prepares students for traditional technical careers. EPP additional major engineers are not educated to be a different kind of engineer. Rather, their education is intended to enable them to be better, more socially responsible engineers in the traditional technical fields.

Additional Major in Science, Technology, and Public Policy

The EPP department offers an additional major in Science, Technology and Public Policy (STPP) for students outside of the engineering college who are earning a B.S. degree. This includes students in the Mellon College of Science, the School of Computer Science, Tepper School of Business, and select majors in the Dietrich College and College of Fine Arts. Similar to the additional major in Engineering and Public Policy, the additional major in Science, Technology and Public Policy is meant to broaden the perspectives on a student’s primary major and provide additional skills for future careers.

Minor in Technology and Policy

The department also offers a minor in Technology and Policy for non-engineering majors. The Technology and Policy minor exposes students to issues at the interface of science, technology, and society, and how interdisciplinary approaches are needed to solve complex problems.

Career Options with EPP Additional Majors

Students who select one of the EPP additional majors graduate with an accredited engineering degree or complete science degree, and thus have all of the options for traditional technical careers as their single major classmates. A large portion of our additional major students pursue traditional technical careers after graduation in areas such as product development, consulting, project management, etc.

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EPP Student Outcomes

By the end of the combined B.S. programs in a traditional engineering program and the EPP program, students should have attained the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The additional major in Engineering and Public Policy is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Course Requirements for the Additional Major in EPP

Minimum units for the additional major 106

Students pursuing an additional major in EPP must complete three sets of requirements: courses for the EPP additional major, courses for their traditional disciplinary major, and general education courses. The student should refer to the relevant sections of this catalog for the required courses in the traditional disciplinary major. The EPP additional major is designed to be completed with a traditional disciplinary major in the standard four-year time frame. However, additional units or course work may be required. Some courses for the EPP additional major may also satisfy requirements for traditional disciplinary majors or for general education courses.

Overview

Course                                  Units
19-101 Introduction to Engineering and Public Policy 12
19-201 EPP Sophomore Seminar 1
73-102 Principles of Microeconomics 9
36-220 Engineering Statistics and Quality Control 9
(9 or other approved statistics course) 1
19-301 Decision Making Methods for Engineers and Scientists 9
or 88-223 Decision Analysis 9
or 88-302 Behavioral Decision Making 9
or 84-369 Decision Science for International Relations 9
(9 or other approved decision science course) 1
19-325 Technology and Policy Writing for Lay Audiences 9
or 76-270 Writing for the Professions 9
(9 or other approved writing course) 1
19-351 Applied Methods for Technology-Policy Analysis 9
19-451 EPP Projects I 12
19-452 EPP Projects 12
Three EPP Technology-Policy Electives min. 24

Introductory Courses

Course                                  Units
19-101 Introduction to Engineering and Public Policy 12
19-201 EPP Sophomore Seminar 1

The two introductory courses prepare students for the additional major experience through discussion and assessment of technology-policy interactions. 19-101 Introduction to Engineering and Public Policy may be taken as the second introductory engineering course during the first year for engineering students. 19-201 EPP Sophomore Seminar is required in addition to any corresponding seminar course in a student’s traditional degree program.

Core Area Courses

73-102 Principles of Microeconomics 9
36-220 Engineering Statistics and Quality Control 9

EPP Decision Science elective - one of the following, or other approved course:
19-301 Decision Making Methods for Engineers and Scientists 9
88-223 Decision Analysis 12
88-302 Behavioral Decision Making 9
84-369 Decision Science for International Relations 9

EPP Writing and Communications elective - one of the following, or other approved course:
19-325 Technology and Policy Writing for Lay Audiences 9
76-270 Writing for the Professions 9

The four core area courses provide the foundational skills in the social sciences that are needed for robust analysis of policy problems. 73-102 Principles of Microeconomics should be taken as a GIT General Education course.

36-220 Engineering Statistics and Quality Control is required for all CE, ME, and MSE students in their traditional engineering majors. CHE students will substitute 36-220 for 03-232 Biochemistry I. ECE students, who take 36-217 Probability Theory and Random Processes for their traditional engineering major, may take 36-220 or 36-226 Introduction to Statistical Inference. Students should complete the statistics requirement by the end of sophomore year. A statistics course is a prerequisite for the EPP Decision Science elective.

The EPP Decision Science elective fulfills either the GIT General Education Social Analysis and Decision Making requirement or a GIT General Education free elective. The EPP Writing and Communications course fulfills the GIT General Education Writing and Expressions requirement.

Technology-Policy Electives

- At least 3 courses of EPP Technology-Policy electives (24 units minimum)

EPP Technology-Policy Electives include courses that belong to three categories. First, EPP Technology-Policy Electives include courses that synthesize engineering analysis and social analysis perspectives and apply them to problems with substantial societal and technological components. Specific areas of interest for these courses are (1) energy, resources, and the environment, (2) risk assessment, (3) technology innovation, (4) urban engineering, (5) information and communication technology, and (6) product engineering and design, among others. Second, EPP Technology-Policy Electives include courses that teach methods or analysis skills necessary for solving complex problems. Examples include mathematical or statistical courses related to optimization or estimation, or economics courses related to economic analysis. Finally, EPP Technology-Policy Electives include courses that provide technical background for policy relevant issues. These courses are fundamental for understanding our current engineering systems and how proposed changes can be implemented. Examples include courses on electricity systems, engine design, or atmospheric systems. A sample of courses for EPP Technology-Policy Electives is below, a full list of approved courses is available from the department.

Course                                  Units
19-211 Ethics and Policy Issues in Computing 9
19-355 Special Topic: Cryptocurrencies, Blockchain, and Applications Var.
19-425 Sustainable Energy for the Developing World 9
19-443 Climate Change Science and Adaptation 9
19-458 Special Topics: Organizational Theory for Engineers 9

Qualifying courses for EPP Technology-Policy Electives are determined each semester. The majority of 19-xxx EPP departmental courses are considered EPP Technology-Policy electives. Exceptions will be identified when the courses are offered. 19-201 and 19-351 are required courses for the EPP additional major and may not be used as EPP Technology-Policy electives. Courses from other departments also are acceptable as electives. Students should work with their advisors to define areas of concentration or a selection of breadth courses for the EPP Technology-Policy Electives.

Students are required to take at least three EPP Technology-Policy electives for a minimum of 24 units. Units may be added in any combination, but a maximum of one 3-unit course is permitted. Up to 9 units of research may be used with approval. Students may not use a required course from their traditional disciplinary major for these elective units. However, students...
may use an elective course from their traditional major requirements to meet the requirements of both their traditional engineering major and an EPP Technology-Policy elective, but the units for the course will not be double-counted toward units required for their degree. Some EPP Technology-Policy elective courses may fulfill requirements for CIT General Education categories (e.g., 19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech is an I&I course), otherwise students use Free Elective units to complete this requirement.

Capstone Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-351 Applied Methods for Technology-Policy Analysis</td>
<td>9</td>
</tr>
<tr>
<td>19-451 EPP Projects I</td>
<td>12</td>
</tr>
<tr>
<td>19-452 EPP Projects</td>
<td>12</td>
</tr>
</tbody>
</table>

The capstone courses synthesize the technical skills and knowledge from a student’s traditional major with the social science skills and broad perspective of the EPP major.

19-351 Applied Methods for Technology-Policy Analysis is a preparatory course for the EPP Projects. 19-351 may be completed as a co-requisite of 19-451 EPP Projects I. The course fulfills CIT General Education free elective units.

19-451 and 19-452 EPP Projects are technology/policy projects which deal with research and development of recommendations for solving actual and critical problems currently affecting society. The students, faculty, and graduate student managers for the project are drawn from EPP, Social and Decision Sciences, and the Heinz College, and other CMU departments, and hence bring different areas of expertise to the structuring and solution of the problem. The topics for EPP Projects are drawn from diverse areas such as environmental systems and resources, public transportation, urban engineering problems, energy and fuel utilization, the interaction of law and technology, strategic materials and vulnerability of supply, technical issues in national security, and problems in automation, robotics, and communication technology. Students use Free Elective units to complete this requirement.

Notes on EPP additional major requirements

Students should follow the suggested curriculum timelines for completing the math, science, and engineering course requirements of the traditional major with the exception of 36-220 which should be taken as early as possible and no later than the end of sophomore year.

All students must complete 76-101 Interpretation and Argument. Some courses as noted above may be used to fulfill requirements of general education courses. Acceptable courses for the CIT General Education requirements are maintained by the CIT Dean’s Office. Students must submit a plan during their first-semester as an EPP student (usually Fall sophomore year) for these general education courses demonstrating their relevance to EPP.

Students must complete the minimum number of units as required by their traditional major for graduation. In some cases, students completing the EPP additional major may need to complete additional units to meet all requirements for the traditional major and EPP additional major.

In addition to any other graduation requirements (e.g., regarding course work, minimum QPA, pass/fail course work, etc.) of the student’s traditional disciplinary major, students must earn a minimum QPA of 2.0 in all courses required for the EPP major.

Side-by-side curriculum charts (http://www.cmu.edu/epp/prospective/undergraduate/epp-additional-major/curriculum-charts/) of the curricula for the traditional engineering majors alone versus the traditional engineering majors with the EPP additional major can assist students in determining the course requirements and scheduling needed to complete the degree requirements.

A proposed semester plan is below. Students work with their faculty advisors to determine the best sequence of courses given the varied requirements in the traditional majors.

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-101 Introduction to Engineering and Public Policy</td>
<td>First-year Spring</td>
<td>12</td>
</tr>
<tr>
<td>73-102 Principles of Microeconomics</td>
<td>First-year Fall or Spring</td>
<td>9</td>
</tr>
<tr>
<td>19-201 EPP Sophomore Seminar</td>
<td>Sophomore Fall</td>
<td>12</td>
</tr>
<tr>
<td>36-220 Engineering Statistics and Quality Control</td>
<td>Sophomore Fall or Spring</td>
<td>9</td>
</tr>
<tr>
<td>EPP Writing and Communications Elective</td>
<td>Sophomore Fall or Spring</td>
<td>12</td>
</tr>
<tr>
<td>EPP Decision Science Elective</td>
<td>Junior Fall</td>
<td>12</td>
</tr>
</tbody>
</table>

Course Requirements for the Additional Major in STPP

Minimum units required for additional major 106

The requirements for the Science, Technology and Public Policy additional major are similar to those for the Engineering and Public Policy additional major. Some courses may fulfill some major requirements or ‘general education’ requirements in other colleges. Other courses will use student’s elective spaces or free elective units. Core courses required for a student’s major will not be allowed to double-count for Technology Policy electives, but elective courses can be selected that fulfill both major elective requirements and Technology Policy electives. Students pursuing the STPP additional major should work with their advisors to determine how best to fit the additional major requirements into their course load.

Introductory Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>19-101 Introduction to Engineering and Public Policy</td>
<td>12</td>
</tr>
<tr>
<td>19-201 EPP Sophomore Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

Core Area Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>73-102 Principles of Microeconomics</td>
<td>9</td>
</tr>
<tr>
<td>Statistics course — one of the following:</td>
<td></td>
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<tr>
<td>36-220 Engineering Statistics and Quality Control</td>
<td>9</td>
</tr>
<tr>
<td>36-226 Introduction to Statistical Inference</td>
<td>9</td>
</tr>
<tr>
<td>or other approved statistics course</td>
<td></td>
</tr>
<tr>
<td>19-301 Decision Making Methods for Engineers and Scientists</td>
<td>9</td>
</tr>
<tr>
<td>88-223 Decision Analysis</td>
<td>12</td>
</tr>
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<td>88-302 Behavioral Decision Making</td>
<td>9</td>
</tr>
<tr>
<td>84-369 Decision Science for International Relations</td>
<td>9</td>
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<td>or other approved decision science course</td>
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<td>19-325 Technology and Policy Writing for Lay Audiences</td>
<td>9</td>
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<td>76-270 Writing for the Professions</td>
<td>9</td>
</tr>
<tr>
<td>76-271 Introduction to Professional and Technical Writing</td>
<td>9</td>
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<tr>
<td>or other approved writing and communications course</td>
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Technology-Policy Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tr>
<td>19-351 Applied Methods for Technology-Policy Analysis</td>
<td>9</td>
</tr>
<tr>
<td>19-451/19-452 EPP Projects</td>
<td>12</td>
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<td>12</td>
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</tbody>
</table>

* Must be taken twice.

Fifth Year M.S. program in Engineering and Public Policy

Students, regardless of whether they complete an undergraduate additional major or not, may apply for the fifth year masters program that will lead to the additional degree of Master of Science in Engineering and Public Policy. This course of study will ordinarily require two additional semesters of study beyond that required for the undergraduate degrees in the primary major and EPP/STPP additional major. Some coursework towards the MS may be able to be completed during the student’s senior year, however no courses taken may count for both a BS program and the MS in EPP.

Students interested in the program must have a minimum 3.0 QPA and
should contact their advisor for details on the application process and course requirements.

**Bachelor of Science in Engineering and Public Policy and Master of Science in Public Policy and Management**

Highly motivated and talented students can earn the EPP additional major bachelor’s degree, and a master’s degree in the H. John Heinz College of Public Policy and Management in a five-year course of study. Students interested in the combined degree program should enroll in a standard additional major program in an engineering specialty and EPP. During the third year of study, the student applies to the Heinz College for admission to the master’s program; an academic record of B average or better is normally a prerequisite for admittance.

The five-year course of study is possible because of specific course load overlaps between the EPP and Heinz College programs: (1) some social analysis requirements in EPP, usually four semester courses, can be satisfied with Heinz College common core courses in economics and social science; (2) at least one project course is common and applicable to both curricula; (3) at least one additional EPP technical elective, engineering option, or project course will be accepted for Heinz College credit following the usual request to the master’s committee.

Students desiring this option should seek faculty advice and counsel in their sophomore year so that a curriculum satisfying all the degree requirements can be ensured. Contact the Associate Department Head for Undergraduate Affairs in EPP for more information. For general information on Heinz 3-1-1 programs please contact the Heinz College or refer to their website.

**Minor in Technology and Policy**

The department also offers a minor in Technology and Policy to non-CIT majors. This minor allows students outside of engineering to sample the EPP requirements and develop exposure and awareness to issues at the interface of science, technology, and society.

Pre-requisites: Students should have prerequisite knowledge in economics (73-102 Principles of Microeconomics or higher level economics course) and statistics (36-202 Methods for Statistics & Data Science or higher level statistics course) in order to pursue the Technology and Policy Minor.

**Course Requirements**

<table>
<thead>
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<tr>
<td>19-101 Introduction to Engineering and Public Policy</td>
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<td>or 19-351 Applied Methods for Technology-Policy Analysis</td>
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<tr>
<td>or 19-452 EPP Projects</td>
<td></td>
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<tr>
<td>xx-xxx Two EPP Technology-Policy Electives</td>
<td>18</td>
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</table>

EPP Technical Electives include courses in CIT, MCS, or SCS that address problems at the society-technology interface and the means of analyzing these issues. A list of qualifying Technology-Policy electives is assembled each semester and is available from the EPP Department. Example Technology-Policy electives include:

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<tr>
<td>19-211 Ethics and Policy Issues in Computing</td>
<td>9</td>
</tr>
<tr>
<td>19-365 Water Technology Innovation and Policy</td>
<td>9</td>
</tr>
<tr>
<td>19-402 Telecommunications Technology and Policy for the Internet Age</td>
<td>12</td>
</tr>
<tr>
<td>19-411 Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech</td>
<td>9</td>
</tr>
<tr>
<td>19-424 Energy and the Environment</td>
<td>9</td>
</tr>
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</table>

Students must earn a cumulative QPA of 2.0 in all courses taken for the minor. Required courses taken for a student’s primary major may not be counted toward the Technology and Policy Minor. Elective courses for a student’s primary major or courses fulfilling general education requirements may be counted, however.

Details of this program are provided in the discussion of CIT minors; see Technology and Policy Minor Description (http://coursecatalog.web.cmu.edu/carnegieinstituteoftechnology/minorsformonengineeringstudents/#technologyandpolicyminor).

**Notes on EPP Undergraduate/Graduate Level Courses**

Many courses taught by the department (19-XXX courses) are offered to undergraduate and graduate students. These “dual level” courses are offered in two formats:

- Some courses are taught under both an undergraduate and graduate number. An example is Telecommunications Technology and Policy for the Internet Age (19-402) and (19-722). In these types of courses, students who sign up under the 700-level (graduate) course number may be expected to perform the same coursework at a higher level, and/or complete additional coursework, compared to 400-level students. Undergraduates who choose to take the course under the graduate number will be also be expected to work at the higher expectation/coursework level.
- Other courses are taught under a 600 level number. An example is 19-626 Climate Science and Policy. These courses may be taken by undergraduates as a senior level course, or by graduate students as a graduate level course. As with dual number courses, graduate level students or undergraduates taking the course for graduate credit may be required to perform coursework at a higher level and/or complete additional coursework. Undergraduates who are taking a 600 level course for graduate credit should identify this fact to both the course instructor and to their EPP department advisor.

Students who have questions about the requirements of a specific EPP course may be accepted for Heinz College credit following the usual request to the master’s committee. Undergraduates who sign up under the 700-level (graduate) course number will be also be expected to work at the higher level course expectations. Students who wish to take these courses should check with their advisors.

**Faculty**

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