Department of Engineering and Public Policy

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The Department of Engineering and Public Policy (EPP) is a unique engineering department, whose overall objective is to enhance undergraduate engineering education with the perspectives and skills that enable the engineer to understand and work at the interface between technology and society. Society is largely responsible for setting the goals and framing the problems that engineers work on. However, technologies designed by engineers 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 the technology and the society in which they live in order to do their jobs responsibly and well in today's world. Engineers 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 engineering students at Carnegie Mellon University to add this important dimension to their traditional engineering education. EPP double major graduates, for the most part, will enter traditional engineering 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 EPP Double Major

The EPP department offers a unique double major B.S. degree programs with each of the five traditional engineering departments in the engineering college and with the School of Computer Science. The engineering double major leads to a fully accredited engineering degree or a computer science degree that prepares students for traditional technical careers. EPP double major engineers are not educated to be a different kind of engineer or computer scientist. Rather, their education is intended to enable them to be better, more socially responsible engineers and scientists in the traditional technical fields. The department also offers a minor in Technology and Policy for non-engineering majors.

All of the undergraduate double major programs in EPP combine the strong foundation in mathematics and physical sciences, and the development of engineering or computer science skills with a rigorous preparation in the analysis of social and political problems. The curricula include subjects which are not part of traditional technical or social science curricula, but which contain 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 industrial automation and robotics, environmental control, telecommunication and computer technologies, product safety, and energy systems. Students from several CMU colleges enroll in these projects courses exposing EPP double majors to working in truly interdisciplinary settings. Examples of past project course topics (http://www.epp.cmu.edu/ undergraduate/project_courses.html) and final reports are available.

EPP Program Educational Objectives

Society needs engineers and scientists who understand how they impact the surrounding environment and it needs policy makers with more depth of technical expertise. EPP graduates help bridge this gap. Through required courses, carefully selected electives, and project activities, double major students in Engineering and Public Policy develop the perspectives and skills that enable students to understand and work at the interface between technology and society.

Together with the objectives of the traditional technical majors, the Engineering and Public Policy undergraduate program aims to produce graduates who:

- are leaders and innovators in their professions and communities,
- value and make use of the broader perspective and analysis skills acquired through their additional major experience on Engineering and Public Policy in the workplace and beyond.

EPP Student Outcomes emphasize the added dimensions and skills the EPP undergraduate program seeks to impart. Students are expected to achieve the traditional engineering outcomes (a) through (k) in their traditional major programs. The EPP Student Outcomes are in addition to these traditional and some labeled as outcomes (l) through (p).

1. Demonstrate that engineering analysis alone is not sufficient to solve a “real world” societal need or problem.
2. Complete an analysis of a problem that involves technical, social science/behavioral, and policy dimensions and components.
3. Characterize the scale and systems level impacts of technology and public policy solutions.
4. Structure unstructured problems as part of a multidisciplinary team.
5. Recognize that they are appropriately trained for careers beyond traditional engineering.

Career Options with EPP

Students who select the EPP double major graduate with a regular accredited engineering degree or computer science degree, and thus have all of the options for traditional technical careers as their single major classmates. A large portion of our double major students pursue traditional technical careers after graduation.

The advantage of the double 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 CS position. Firms contact the EPP department every year to recruit EPP graduates because of their satisfaction with the knowledge and skills acquired by the EPP graduates.

The double 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 an engineering discipline, 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 double majors.

Other faculty affiliated with the undergraduate programs in EPP are:
- Civil Engineering: Peter Adams, Scott Matthews, Mitch Small
- Chemical Engineering: Meagan Mauter
- Computer Science: Lorrie Cranor
- Electrical and Computer Engineering: Marija Ilic, Marvin Sirbu
- Engineering and Public Policy: Ines Azevedo, Liz Casman, Erica Fuchs, Paulina Jaramillo, Deanna Matthews, Jon Peña
- Mechanical Engineering: Jeremy Michalek, Edward Rubin
- Material Science and Engineering: Jay Whitacre
- Social and Decision Sciences: Paul Fischbeck, Baruch Fischhoff
### Additional Major Curricula

**Note:** Students in the Class of 2016 and earlier should refer to the Course Catalog for the year they enrolled for EPP degree requirements; however, students in the Class of 2016 may elect to complete the requirements as listed here.

Bachelor of Science in an Engineering Field/Computer Science and Engineering and Public Policy

The EPP additional major curriculum consists of two sets of core courses: one set for the disciplinary major (Chemical Engineering, Civil Engineering, Electrical and Computer Engineering, Materials Science and Engineering, Mechanical Engineering, and Computer Science) and the second set for the interdisciplinary EPP major. The student is referred to the relevant sections of this catalog for the core courses in the disciplinary major. The student simultaneously satisfies all requirements for the undergraduate degree in a traditional engineering department or computer science, and all requirements for the undergraduate degree in Engineering and Public Policy. The EPP additional major is designed to be completed with the traditional engineering and computer science degree in the standard four-year time frame. However, additional units or course work may be required.

**Course Requirements**

The course requirements for the EPP double major fall into four categories: introductory courses, core area courses, technology-policy electives, and capstone courses. The courses are listed here and additional descriptions and requirements are provided below.

**Introductory Courses**
- 19-101 Introduction to Engineering and Public Policy
- 19-201 EPP Sophomore Seminar

**Core Area Courses**
- 73-100 Principles of Economics
- 36-220 Engineering Statistics and Quality Control*  
  Decision Science elective - one of the following, or other approved course:
  - 19-301 Decision Making Methods for EPP
  - 88-223 Decision Analysis and Decision Support Systems
  - 88-302 Behavioral Decision Making
- EPP Writing and Communications - one of the following, or other approved course:
  - 15-221 Technical Communication for Computer Scientists
  - 19-325 Writing for Policy
  - 76-270 Writing for the Professions
  - 76-271 Introduction to Professional and Technical Writing

**Technology-Policy Electives**

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

**Capstone Courses**
- 19-351 Applied Methods for Technology-Policy Analysis
- 19-451 or 19-452 EPP Projects (taken twice)
  
  *ECE and CS students may take 36-226 Introduction to Statistical Inference instead of 36-220.

The minimum number of units to complete the traditional major plus EPP double major is listed below. In some cases, additional units beyond those required for the traditional major alone are required, or elective choices may result in additional units being taken.

<table>
<thead>
<tr>
<th>Field</th>
<th>Single Major Units</th>
<th>Double Major with EPP Units</th>
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<tbody>
<tr>
<td>Chemical Engineering</td>
<td>386</td>
<td>390</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>379</td>
<td>379</td>
</tr>
<tr>
<td>Electrical and Computer Engineering</td>
<td>379</td>
<td>379</td>
</tr>
<tr>
<td>Materials Science and Engineering</td>
<td>379</td>
<td>383</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>382</td>
<td>386</td>
</tr>
<tr>
<td>Computer Science</td>
<td>360</td>
<td>360</td>
</tr>
</tbody>
</table>

**Introductory Courses**

The two introductory courses prepare students for the double 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, or as a Humanities and Arts course for CS 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**

The four core area courses provide the foundational skills in the social sciences that are needed for robust analysis of policy problems. 73-100, 36-220, the EPP Decision Science elective, and the EPP Writing and Communications elective should be completed no later than Fall semester junior year.

73-100 Principles of Economics should be taken as a CIT First Year General Education course or as a SCS Humanities and Arts course. AP credit for 73-100 is accepted, but then students are encouraged to take 73-230 Intermediate Microeconomics.

36-220 Engineering Statistics and Quality Control is required for all CE, ME, and MSE students in their traditional majors. ChE students will substitute 36-220 for 03-232 Biochemistry I. ECE students will take 36-220 or 36-226 as a Math/Science elective. CS students will take 36-220 or 36-226 as a Free Elective. Students should complete the statistics requirement by the end of sophomore year. 36-220 is a prerequisite for the Decision Science elective.

The EPP Writing and Communications course stresses communication of technical content. This course fulfills the CIT General Education Writing and Expressions requirement.

The EPP Decision Science elective fulfills either the CIT General Education Social Analysis and Decision Making requirement or a CIT General Education free elective, of CS Humanities and Arts elective.

**EPP Technology-Policy Electives**

EPP Technology-Policy Electives include courses that generally belong to two categories. These 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) forensic engineering, (4) urban engineering, (5) information and communication technology, and (6) product engineering and design, among others. These electives also include courses that teach methods or background vital to classes of important problems at the technology-society interface. Examples include mathematics courses related to optimization, estimation, and related topics. Courses in other topic areas may also be included as determined from year to year.

The majority of 19-xxx EPP departmental courses are considered Technology-Policy Electives. Exceptions will be identified when the courses are offered. 19-301 and 19-351 are required courses for the EPP double major and may not be used as EPP Technology-Policy 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 engineering or computer science course from their traditional major for these elective units. Students may use an elective engineering or computer science course from their traditional major 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., 19-421 Global Competitiveness: Firms, Nations and Technological Change is an I&I course), otherwise students use Free Elective units to complete this requirement.

**Capstone Courses**

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 19-451/19-452 EPP Projects. The course fulfills CIT General Education free elective units.

19-451/19-452 EPP Projects are taken twice by all students. 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 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 double major requirements

Students should follow the suggested curriculum timelines for completing the math, science, and engineering/computer science course requirements of the traditional major with the exception of 36-220 which should be taken as early as possible and no later then the end of sophomore year. These requirements are listed in the Undergraduate Catalog for the various departments.

EPP majors in CIT must complete all requirements for the CIT General Education curriculum. EPP majors in CS must complete all requirements for the CS Humanities and Arts curriculum. All students must complete 76-101 Interpretation and Argument. Some courses as noted above may be used to fulfill these non-technical requirements. Courses to fulfill remaining CIT General Education or CS Humanities and Arts requirements must be selected from the lists maintained by the CIT and SCS Dean’s Offices. Students must submit a plan during their first-semester as an EPP student (usually Fall sophomore year) for these courses demonstrating their relevance to EPP.

In addition to the graduation requirement of an overall minimum QPA of 2.0 (excluding the first year) as required by CIT or SCS, students must meet any minimum QPA requirements of their traditional departments (usually a QPA of 2.0 in required departmental courses), and a minimum QPA of 2.0 in all courses required for the EPP major.

A MSE/EPP double major may choose the Industrial Internship Option (IAO) which is a MSE program in cooperative education. Just as in the MSE single major IAO option, the MSE/EPP IAO option provides the students with an opportunity to supplement the academic program with relevant work experience in metallurgy and materials science as well as in the public policy area. Students are also able to complete the EPP program in an accelerated timeline so as to also complete integrated Masters programs.

Side-by-side curriculum charts (http://www.epp.cmu.edu/undergraduate/curriculumcharts.php) of the curricula for the traditional majors alone versus the traditional majors with the EPP double 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>
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<tbody>
<tr>
<td>19-101 Introduction to Engineering</td>
<td>First-year Spring</td>
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<tr>
<td>and Public Policy</td>
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<tr>
<td>73-100 Principles of Economics</td>
<td>First-year Fall or Spring</td>
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<tr>
<td>19-201 EPP Sophomore Seminar</td>
<td>Sophomore Fall</td>
</tr>
<tr>
<td>36-220 Engineering Statistics and</td>
<td>Sophomore Fall or Spring</td>
</tr>
<tr>
<td>Quality Control</td>
<td></td>
</tr>
<tr>
<td>EPP Writing and Communications</td>
<td>Sophomore Fall or Spring</td>
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<tr>
<td>Elective</td>
<td></td>
</tr>
<tr>
<td>EPP Decision Science Elective</td>
<td>Junior Fall</td>
</tr>
<tr>
<td>19-351 Applied Methods for</td>
<td>Junior Spring</td>
</tr>
<tr>
<td>Technology-Policy Analysis</td>
<td></td>
</tr>
<tr>
<td>3 EPP Technology-Policy Electives</td>
<td>Junior and/or Senior year</td>
</tr>
<tr>
<td>19-451/19-452 EPP Projects</td>
<td>Senior Fall and Spring</td>
</tr>
</tbody>
</table>

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

Students affiliated with the department 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 double 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 in CIT and the MS in EPP. The primary concern for scheduling and completing this integrated program is completing the core courses in the EPP graduate program, as some of these courses are taught every other academic year only. 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.

Minor in Technology and Policy

The department also offers a minor in Technology and Policy to non-CIT majors. This minor allows non-technical students to sample the EPP requirements and develop exposure and awareness to issues at the interface of science, technology, and society. Details of this program are provided in the discussion of CIT minors; see Technology and Policy Minor Description (http://coursescatalog.web.cmu.edu/previous/2013-2014/carnegieinstituteoftechnology/minorsformonengineeringstudents/#technologyandpolicyminor).

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 double 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 double 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 8 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 curriculums; (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 freshman or 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.

EPP Undergraduate/Graduate Level Courses

Many courses taught by the department (19-XXX) 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 19-402 Telecommunications, Technology Policy & Management. 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 19-4XX 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 19-688 Innovation for Energy and the Environment. 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 400/700, or 600 level course, should contact the course instructor.

Other departments may have different policies regarding courses offered under both an undergraduate and graduate number, and courses offered under numbers other than the 100, 200, 300, 400, or 700 levels. Students who wish to take these courses should check with those departments for their specific policies.

Faculty

PETER ADAMS, Professor of Civil and Environmental Engineering / Engineering and Public Policy – Ph.D., Caltech; Carnegie Mellon, 2001–.

JAY APT, Professor of Technology of The Tepper School of Business / Engineering and Public Policy; Director, Carnegie Mellon Electricity Industry Center – Ph.D., MIT; Carnegie Mellon, 2000–.
Emeriti Faculty

TUNG AU, University Professor of Civil and Environmental Engineering / Engineering and Public Policy, Emeritus – Ph.D., University of Illinois; Carnegie Mellon, 1957–.
JAMES GOODBY, Distinguished Service Professor, Emeritus – A.B., Harvard; Carnegie Mellon, 1989–.

FRANCIS MCMICHAEL, Walter J. Blenko, Senior Professor of Environmental Engineering; Professor of Civil and Environmental Engineering / Engineering and Public Policy, Emeritus – Ph.D., California Institute of Technology; Carnegie Mellon, 1967–.

BENOÎT MOREL, Associate Teaching Professor of Engineering and Public Policy / Physics, Emeritus – Ph.D., University of Geneva; Carnegie Mellon, 1987–.

INDIRA NAIR, Former Vice Provost for Education; Professor of Engineering and Public Policy, Emeritus – Ph.D., Northwestern University; Carnegie Mellon, 1978–.

HENRY R. PIEHLER, Professor of Materials Science and Engineering / Engineering and Public Policy / Biomedical Engineering, Emeritus – Sc.D., MIT; Carnegie Mellon, 1967–.

SAROSH TALUKDAR, Professor of Electrical and Computer Engineering / Engineering and Public Policy, Emeritus – Ph.D., Purdue University; Carnegie Mellon, 1974–.

ROBERT M. WHITE, University Professor of Electrical and Computer Engineering / Engineering and Public Policy, Emeritus – Ph.D., Stanford University; Carnegie Mellon, 1993–.