Department of Engineering and Public Policy

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Location: Wean Hall 4101
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. 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. Our undergraduate programs aim to educate young scholars to be interdisciplinary problem solvers.

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 interdisciplinary dimension to their traditional engineering or science education. Our 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. Our program has a long history of 50+ years producing graduates with these critical skills, with alumni serving in all areas of industry and government.

Overview of Our Undergraduate Programs

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, telecommunication 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 situations. Examples of past project course topics (http://www.cmu.edu/epp/prospective/undergraduate/epp-project-courses/) and final reports are available.

Additional Major in Engineering and Public Policy

The EPP department offers an additional major in Engineering and Public Policy (EPP) for students completing an undergraduate degree in engineering from any 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 completing an undergraduate B.S. degree outside of the engineering college. 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. 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.

Minor in Information Security, Privacy and Policy

The department offers a minor in Information Security, Privacy and Policy for all majors in partnership with the School of Computer Science. The Information Security, Privacy and Policy minor offers students an understanding of how to identify potential security and privacy risks and relevant legal and policy issues; a working understanding of security topics as they pertain to design, development and management of new information technologies.

Career Options with OUR Additional Majors

Students who select one of the our 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.

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. In addition, the additional major also opens up options for careers in policy analysis in federal, state, and local government or in public policy consulting firms. Alumni pursue careers in a range of companies to deal with issues like government regulation of technological systems, climate change impacts, product liability and safety, environmental control, telecommunications policy, energy systems, financial investment, 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, Destenie Nock
- Chemical Engineering: Peter Adams, Neil Donahue
- Economics/Business: Nicholas Muller, Marvin Sirbu, Phillip Yu
- Electrical and Computer Engineering: Jon Peha, Ramteem Sioshansi, Marvin Sirbu
- Engineering and Public Policy: Doron Cohen, Erica Fuchs, Paulina Jaramillo, Valerie Karplus, Deanna Matthews, Granger Morgan
- Institute for Strategy and Technology: Baruch Fischhoff
- Mechanical Engineering: Jeremy Michalek, Kate Whitefoot
- Material Science and Engineering: Jay Whitacre
- Software, Systems, and Society Department: Lorrie Cranor, Nicolas Christin, Sarah Scheffler

EPP Program Educational Objectives

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

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.

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.

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 engineering major, and general education courses. The student should refer to the relevant sections of this catalog for the required courses in the traditional engineering major. The EPP additional major is designed to be completed with a traditional engineering major in the standard eight-semester time frame. However, additional units or course work may be required. Some courses for the EPP additional major may also satisfy requirements for traditional engineering courses or for general education courses.

Overview

Course		Units
19-101	Introduction to Engineering and Public Policy	12
19-201	Professional Issues in Engineering, Science, Technology and Public Policy	1
73-102	Principles of Microeconomics	9
36-220	Engineering Statistics and Quality Control	9
(or other approved statistics course)		
19-301	Decision Making Methods for Engineers and Scientists	9
or 19-469	Behavior, Decision and Policy	
or 84-369	Decision Science for International Relations	
or 88-223	Decision Analysis	
(or other approved decision science course)		
76-270	Writing for the Professions	9
(or other approved writing course)		
19-351	Applied Methods for Technology-Policy Analysis	9
19-451	EPP Projects I	12
19-452	EPP Projects II	12
Three EPP Technology-Policy Electives		min. 24

Introductory Courses

		Units
19-101	Introduction to Engineering and Public Policy	12
19-201	Professional Issues in Engineering, Science, Technology and Public Policy	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 for engineering students. 19-201 Professional Issues in Engineering, Science, Technology and Public Policy 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
EPP Statistics elective - one of the following, or other approved course:		
36-220	Engineering Statistics and Quality Control	9
EPP Decision Science elective - one of the following, or other approved course (9 units minimum):		
19-301	Decision Making Methods for Engineers and Scientists	9
19-469	Behavior, Decision and Policy	9
84-369	Decision Science for International Relations	9
88-223	Decision Analysis	12
EPP Writing and Communications elective - one of the following, or other approved course		
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 fulfills a CIT General Education course. Students who receive a pre-requisite waiver for 73-102 may take a higher-level economics course as a substitute with approval.

CivE, EnvE, MechE, and MSE students will complete the statistics elective as part of their traditional engineering majors. ChemE students will substitute the statistics elective for the Advanced Chemistry Elective. ECE students, who have a required course in probability for their traditional engineering major are encouraged to take 36-226 Introduction to Statistical Inference to fulfill the EPP statistics requirement. 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 CIT General Education Social Analysis and Decision Making requirement or a CIT General Education free elective. The EPP Writing and Communications course fulfills the CIT 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.

19-211	Ethics and Policy Issues in Computing	9
19-303	Cryptocurrencies, Blockchains and Applications	Var.
19-403	Policies of Wireless Systems	12
19-411	Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech	9
19-425	Sustainable Energy for the Developing World	9
19-429	Climate Change Science and Solutions	9
19-433	Data Science for Technology, Innovation and Policy	9
19-608	Privacy Policy, Law, and Technology	12

19-668	Electric Vehicles: Technology, Economics, Environment and Policy	12

The majority of 19-xxx EPP departmental courses are considered EPP Technology-Policy Electives. Exceptions will be identified when the courses are offered. Courses that are required or used for core area courses for the additional major can not be used as electives. Courses from other departments also are acceptable as electives with approval. 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 19-550 Undergraduate Research may be used with approval. Students may not use a required course from their traditional engineering 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

		Units
19-351	Applied Methods for Technology-Policy Analysis	9
19-451	EPP Projects I	12
19-452	EPP Projects II	12

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 EPP Projects sequence. 19-351 may be completed as a co-requisite of 19-451 EPP Projects I. The course fulfills CIT General Education elective units.

19-451 EPP Projects I and 19-452 EPP Projects II 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. 19-452 EPP Projects II serves as the capstone engineering design course experience for additional majors.

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 the statistics elective which should be taken as early as possible and no later then the end of sophomore year.

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 advisors to determine the best sequence of courses given the varied requirements in the traditional engineering majors.

Course	Semester
19-101 Introduction to Engineering and Public Policy	**First-year Spring**
73-102 Principles of Mircoeconomics	**First-year Fall or Spring**
19-201 Professional Issues in Engineering, Science, Technology and Policy	**Sophomore Fall**
EPP Statistics Elective	**Sophomore Fall or Spring**
EPP Writing and Communications Elective	**Sophomore Fall or Spring**
EPP Decision Science Elective	**Junior Fall**
19-351 Applied Methods for Technology-Policy Analysis	**Junior Spring**
3 EPP Technology-Policy Electives	**Junior and/or Senior year**
19-451 / 19-452 EPP Projects I and II	**Senior Fall and Spring**

Course Requirements for the Additional Major in STPP

Minimum units required for additional major	106

Students pursuing an additional major in STPP must complete three sets of requirements: courses for the STPP 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 STPP additional major is designed to be completed with a traditional disciplinary major in the standard eight-semester time frame. However, additional units or course work may be required. Some courses for the STPP additional major may also satisfy requirements for traditional disciplinary majors or for general education courses.

Introductory Courses

		Units
19-101	Introduction to Engineering and Public Policy	12
19-201	Professional Issues in Engineering, Science, Technology and Public Policy	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 qualify as a general education course in some majors. 19-201 Professional Issues in Engineering, Science, Technology and Public Policy 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
Statistics course — one of the following:		
36-220	Engineering Statistics and Quality Control	9
36-226	Introduction to Statistical Inference	9
or other approved statistics course		
STPP Decision Science course — one of the following:		
19-301	Decision Making Methods for Engineers and Scientists	9
19-469	Behavior, Decision and Policy	9
84-369	Decision Science for International Relations	9
88-223	Decision Analysis	12
88-302	Behavioral Decision Making	9
or other approved decision science course		
STPP Writing and Communications course — one of the following:		
76-270	Writing for the Professions	9
76-271	Introduction to Professional and Technical Writing	9
or other approved writing and communications course		

The four core area courses provide the foundational skills in the social sciences that are needed for robust analysis of policy problems. For students in SCS and MCS, the economics, decision science, and writing course selections may qualify as general education courses, and the statistics elective may qualify for a math/science requirement. For students in DC and CFA, some core area requirements may be fulfilled by traditional program requirements or general education courses. Students should consult with their advisors in both programs to assure that courses are meeting requirements and providing appropriate depth of content. Students who receive a pre-requisite waiver for 73-102 may complete a higher-level economics course as a substitute with approval.

Technology-Policy Electives

3 courses	**24 minimum units**

STPP Technology-Policy Electives include courses that belong to three categories. First, STPP Technology-Policy Electives include courses that synthesize technical 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 development and design, among others. Second, STPP 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, STPP Technology-Policy Electives include courses that provide technical background for policy relevant issues. These courses are fundamental for understanding our current technical systems and how proposed changes can be implemented. Examples include courses on electricity systems, telecommunication systems, engine design, or atmospheric systems. A sample of courses for STPP Technology-Policy Electives is below, a full list of approved courses is available from the department.

19-211	Ethics and Policy Issues in Computing	9
19-303	Cryptocurrencies, Blockchains and Applications	Var.
19-403	Policies of Wireless Systems	12
19-411	Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech	9
19-421	Emerging Energy Policies	9
19-425	Sustainable Energy for the Developing World	9
19-429	Climate Change Science and Solutions	9
19-433	Data Science for Technology, Innovation and Policy	9
19-608	Privacy Policy, Law, and Technology	12
19-668	Electric Vehicles: Technology, Economics, Environment and Policy	12

The majority of 19-xxx EPP departmental courses are considered STPP Technology-Policy Electives. Exceptions will be identified when the courses are offered. Courses that are required or used for core area courses for the additional major can not be used as electives. Courses from other departments also are acceptable as electives with approval. Students should work with their advisors to define areas of concentration or a selection of breadth courses for the STPP Technology-Policy Electives.

Students are required to take at least three STPP 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 19-550 Undergraduate 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 STPP Technology-Policy elective, but the units for the course will not be double-counted toward units required for their degree. Some STPP Technology-Policy elective courses may fulfill general education requirements for traditional major programs.

Capstone Courses

19-351	Applied Methods for Technology-Policy Analysis	9
19-451	EPP Projects I	12
19-452	EPP Projects II	12

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 STPP additional major.

19-351 Applied Methods for Technology-Policy Analysis is a preparatory course for the EPP Projects sequence. 19-351 may be completed as a co-requisite of 19-451 EPP Projects I.

19-451 EPP Projects I and 19-452 EPP Projects II 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 the EPP and STPP programs, 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. These capstone courses may qualify as capstone experience courses or general education courses in some major programs.

Notes on STPP additional major requirements

Students should follow the suggested curriculum timelines for completing the course requirements of their primary major program where necessary and will work with both their primary program advisor and the STPP advisor to assure that requirements for both degrees are met.

Students must complete the minimum number of units as required by their primary major for graduation. In some cases, students completing the STPP additional major may need to complete additional units to meet all requirements for the primary major and STPP 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 primary major, students must earn a minimum QPA of 2.0 in all courses required for the STPP additional major.

Integrated B.S./M.S. Programs

B.S. integrated with M.S. in Engineering and Public Policy

CMU undergraduate students, regardless of whether they complete an undergraduate additional major in EPP or STPP or not, may plan a course of study that leads to completing both their undergraduate B.S. degree and an MS in Engineering and Public Policy. This course of study will ordinarily require two additional semesters of study beyond that required for an undergraduate degree, although advanced placement or other study may reduce this time. Some coursework towards the MS may 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 should contact their advisor for details on the application process and course requirements. See the EPP website for more information about the MS in EPP program requirements (https://www.cmu.edu/epp/prospective/ms-in-epp/) including curriculum.

Minors in Engineering and Public Policy

MINOR IN TECHNOLOGY AND POLICY

The department offers a minor in Technology and Policy. This minor allows students 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 similar level economics course) and statistics (36-202 Methods for Statistics & Data Science or similar level statistics course) in order to pursue the Technology and Policy Minor.

Course Requirements		Units
19-101	Introduction to Engineering and Public Policy	12
19-301	Decision Making Methods for Engineers and Scientists (or other approved Decision Science course)	9
or 19-351	Applied Methods for Technology-Policy Analysis	
19-451	EPP Projects I	12
xx-xxx	Two EPP Technology-Policy Electives	18

EPP Technical Electives include courses that address problems at the society-technology interface and the means of analyzing these issues. A list of qualifying Technology-Policy electives is available from the EPP Department. Example Technology-Policy electives include:

19-211	Ethics and Policy Issues in Computing	9
19-303	Cryptocurrencies, Blockchains and Applications	Var.
19-403	Policies of Wireless Systems	12

19-411	Science and Innovation Leadership for the 21st Century: Firms, Nations, and Tech	9
19-425	Sustainable Energy for the Developing World	9
19-429	Climate Change Science and Solutions	9
19-433	Data Science for Technology, Innovation and Policy	9
19-534	Usable Privacy and Security	9

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/schools-colleges/collegeofengineering/minorsfornonengineeringstudents/#technologyandpolicyminor).

MINOR IN INFORMATION SECURITY, PRIVACY AND POLICY

Lujo Bauer, Director

Interdisciplinary minor offered by both CIT and SCS

There is a growing demand for security and privacy experts, and increasing interest among CMU undergraduates in taking security and privacy courses. Security and privacy expertise is an asset in a variety of careers outside, not just in computer science, but also in areas that include business, management, and law. In addition, the policy side of security and privacy is becoming increasingly important and employers are interested in hiring people with an understanding of relevant policy issues, especially in the privacy and security area.

This minor is for undergraduate students across the university who are interested in policy issues related to security and privacy, including those who are planning careers in security/privacy as well as those who plan to focus their careers in other areas. The curriculum has been designed to accommodate students from any major as long as they have taken at least one introductory-level college programming course (such as 15-110 or 15-112).

After completing this minor, students will have a good understanding of how to identify potential security and privacy risks and relevant legal and policy issues; a working understanding of security topics such as cryptography, authentication, and Internet security protocols; as well as broad knowledge of several security- and privacy-related areas as they pertain to the design, development, deployment and management of technologies in a variety of practical contexts (e.g., Web, mobile, Internet of Things, social media, crypto currencies).

Admission

Students are not required to apply to enroll in this minor to start the required courses. However, they are encouraged to consult with the minor director on their elective course selection. In addition, students doing the independent study option must get approval from the minor director prior to enrolling in their independent study course. Finally, students must contact the minor director to certify their completion of the minor.

Curriculum

Students are required to take five courses to complete this minor with a minimum of 48 units.

INTRODUCTORY SECURITY COURSE

17-331	Information Security, Privacy, and Policy	12

Students who have taken 15-213 Introduction to Computer Systems may substitute 15-330 Introduction to Computer Security/18-330 Introduction to Computer Security

PRIVACY AND POLICY COURSE

17-333	Privacy Policy, Law, and Technology	9

Students may substitute 12-unit version of this course: 19-608, 17-733, or 95-818.

PRIVACY ELECTIVES

Complete a minimum of 9 units:		Units
19-534/17-334/05-436	Usable Privacy and Security	9
19-602/17-702	Current Topics In Privacy Seminar	3
17-731	Foundations of Privacy	12

TECHNOLOGY AND POLICY ELECTIVES

Complete a minimum of 9 units:		Units
19-211	Ethics and Policy Issues in Computing	9
17-562	Law of Computer Technology	9
19-101	Introduction to Engineering and Public Policy	12
19-402	Telecommunications Technology and Policy for the Internet Age	12
19-403	Policies of Wireless Systems	12
19-639	Policies of the Internet	12
84-387	Remote Systems and the Cyber Domain in Conflict	9

Crosslisted courses are also allowed.

ADDITIONAL APPROVED ELECTIVE

Students must complete an additional elective of 9 units or more. Students may choose an additional privacy elective or technology policy elective from the list above, or the one of the following security electives:

15-316	Software Foundations of Security and Privacy	9
15-356	Introduction to Cryptography	12
19/17-303	Cryptocurrencies, Blockchains and Applications	Var.
19-534/17-334	Usable Privacy and Security	9
18-334	Network Security	12
18-335	Secure Software Systems	12
18-435	Foundations of Blockchains	12

*Course 18-733 Applied Cryptography is also an approved security elective.

Students who have the necessary prerequisites may choose any approved elective from the SCS or ECE security and privacy undergraduate concentration. Check with the minor program director to determine which category of elective each course will fulfill.

Students should be careful to choose electives for which they have appropriate prerequisites. New elective options are expected as more courses are offered. Students may petition to count a course not on this list as an elective. Students should request permission *before* taking a course that is not on this list. Students may not count multiple electives that overlap substantially.

Optional Project: Subject to approval by the minor director, students may optionally count towards one of the elective requirements 9 units of an independent study or research project course in the security or privacy area, under the supervision of a faculty member in any department. In order to receive credit towards the minor, students must submit a brief project proposal to their project advisor and to the minor director and have it approved prior to conducting the project. Depending on the topic of the project, the minor director may approve credits counting towards privacy electives, technology policy electives, security electives, or some combination of these. Students may work individually, with other undergraduates, or as part of project teams with graduate students or research staff. Students involved in a group project must identify specific project components for which they are responsible. In addition, they must submit a final project report to their project advisor and the minor director that includes a literature review and describes the work they completed. Students working on a group project must each submit their own final report, which should also situate their contribution in the context of the larger project. Note, students are expected to work approximately 1 hour per week for each unit of project in which they are enrolled (e.g. 9 units = 9 hours/week of project work).

Double Counting: At most 2 of the courses used to fulfill the minor requirements may be counted towards any other undergraduate major or minor program. This rule does not apply to courses counted for general education requirements.

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 19-403 Policies of Wireless Systems, also offered as 19-713. 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 19-668 Electric Vehicles: Technology, Economics, Environment 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 400/700, or 600 level course, should contact the course instructor. Some courses have pre-requisites which may be waived for students given prior background.

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