

Engineering and Public Policy, Additional Major

Additional Major in Engineering and Public Policy

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.

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 Engineering and Public Policy (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.

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

EPP Economics elective - one of the following, or other approved course:

73-102	Principles of Microeconomics	9
84-110	The Economics of Politics and Technology	9

EPP Statistics elective - one of the following, or other approved course:

36-220	Engineering Statistics and Quality Control	9
36-226	Introduction to Statistical Inference	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
19-488	Special Topics: Designing for Human Behavior: Incentives, Information & 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
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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. Other courses with approval.

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
19-416	Responsible AI and AI Governance: Identifying and Mitigating Risks in the Design	Var.
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 than 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 (<https://epp.engineering.cmu.edu/education/undergraduate/additional-major-epp.html>) 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
EPP Economics Elective	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