Carnegie Mellon University
Heinz College
INFORMATION SYSTEMS • PUBLIC POLICY • MANAGEMENT

Student Handbook | **2019-2020**

Master of Science in Public Policy and Management
Two Year Track
Three Semester Track
Data Analytics Track
Global Track

Contents

HEINZ COLLEGE OF INFORMATION SYSTEMS AND PUBLIC POLICY
MASTER OF SCIENCE IN PUBLIC POLICY AND MANAGEMENT
POLICIES AND GUIDELINES

1 INTRODUCTION

This handbook provides specific information on the curriculum and program requirements for the Master of Science in Public Policy and Management Program. The Heinz College also publishes a separate handbook which details College-wide policies and procedures pertaining to educational planning, program committee, teaching, scheduling and course credit, performance standards, academic standing, ethics and discipline, student privacy rights and major forms and deadlines. Students should familiarize themselves with both handbooks as they include information that is critical for your success. Both handbooks can be obtained through your program director and via the Heinz College website at: https://www.heinz.cmu.edu/current-students/

2 MISSION STATEMENT

The Heinz College educates men and women of intelligent action. Its Master of Science in Public Policy and Management prepares ethical leaders who analyze and implement policy; ground decisions in scientific evidence; create, transform, and manage organizations; and develop innovative solutions to important societal issues around the world.

We achieve that end through curricular and co-curricular activities that stress problem-solving and team-based learning within a diverse community of individuals who are committed to serving the public interest.

3 CURRICULUM

You will complete the MSPPM (two-year, MS-Global, MS-Data Analytics tracks) program in four consecutive semesters, excluding summer semester. The MSPPM curriculum is structured with a set of Common Core courses, a set of advanced course requirements, and free electives. In order to successfully complete the MSPPM program, you must complete the following:

- 198 units of course credit;
- All common core courses (unless you exempt them);
- Advanced coursework;
- Internship between the first and second year
- All other standards for graduation, including meeting minimum grade point averages.

You will complete the MSPPM three-semester program in three consecutive semesters, excluding summer semester. The MSPPM curriculum is structured with a set of common core courses, a set of advanced course requirements, and free electives. In order to successfully complete the MSPPM three-semester program, you must complete the following:

- 168 units of course credit;
- All Common Core courses (unless you exempt them);
- Advanced Coursework;
- All other standards for graduation, including meeting minimum grade point averages.

3.1 MSPPM Requirements

You must complete the common core requirements and all other requirements listed below by track in order to graduate. You must take common core courses in the sequence shown below for each track, unless you obtain permission in advance from the MSPPM Program Director or Associate Dean.

3.2 MSPPM Two-Year Track Requirements

Fall Semester		**Units**
90-710 90-709	Applied Economic Analysis **or** Intermediate Economic Analysis	12
90-707 90-711 90-777	Statistical Reasoning **or** Statistical Reasoning with R **or** Intermediate Statistical Methods (6 units)	12
94-701 90-717	Business English **or** Writing for Public Policy	6
90-728	Introduction to Database Management	6
94-700	Organizational Design & Implementation	6
	Electives	12
	semester units	**54**
Spring Semester		
90-713 90-714	Policy & Politics: An International Perspective **or** Policy & Politics in American Political Institutions	12
90-718	Strategic Presentation Skills (mini 3 or mini 4)	6
90-722	Management Science I (mini 3)	6
90-760	Management Science II (mini 4)	6
90-723	Financial Statements and Analysis for Companies (mini 3)	6
	Financial Analysis (your choice from numerous courses) (Mini 4): Financial Analysis of Non-Profits: 90-744; Management Accounting: 90-725; Public Financial Management: 90-731; Principles of Finance: 95-716 Advanced Financial Management Healthcare: 90-831	6
	Electives	6
	semester units	**48**
94-900	**Summer Internship (Required)**	0

Fall or Spring		
	Additional Policy (your choice from numerous courses)	12
	Additional Methods (your choice from numerous courses)	12
	Additional Management (your choice from numerous courses)	6
	Additional Informational Technology Requirement (your choice from numerous courses)	6
	Electives: more if exempt from core courses	48
	Systems Synthesis ***(fall or spring semester of second year)***	12
	Total Units	**198**

3.3 MSPPM Three-Semester Track Requirements

Fall Semester		**Units**
90-710 90-709	Applied Economic Analysis **or** Intermediate Economic Analysis	12
90-707 90-711 90-777	Statistical Reasoning **or** Statistical Reasoning with R **or** Intermediate Statistical Methods (6 units)	12
94-701 90-717	Business English **or** Writing for Public Policy	6
90-728	Introduction to Database Management	6
94-700	Organizational Design & Implementation	6
	Electives	18
	semester units	**60**
Spring Semester		
90-713 90-714	Policy & Politics: An International Perspective **or** Policy & Politics in American Political Institutions	12
90-718	Strategic Presentation Skills (mini 3 or mini 4)	6
90-722	Management Science I (mini 3)	6
90-760	Management Science II (mini 4)	6
90-723	Financial Statements and Analysis for Companies (mini 3)	6
	Financial Analysis (your choice from numerous courses) (Mini 4): Financial Analysis of Non-Profits: 90-744; Management Accounting: 90-725; Public Financial Management: 90-731; Principles of Finance: 95-716 Advanced Financial Management Healthcare: 90-831	6
	Electives	12
	semester units	**54**
	Summer Internship (Optional)	
Fall		
	Additional Policy (your choice from numerous courses)	12
	Additional Methods (your choice from numerous courses)	12
	Additional Management (your choice from numerous courses)	6

	Additional Informational Technology Requirement (your choice from numerous courses)	6
	Electives: more if exempt from core courses	6
	Systems Synthesis (final semester)	12
	Total Units	**168**

3.4 MSPPM-Data Analytics Track Requirements

Course No.	**Course**	**Units**
Fall Semester 1st Year		
90-710	Applied Economic Analysis **or** 90-709 Intermediate Economic Analysis	12
90-717	Writing for Public Policy **or** 94-701 Business English	6
90-777	Intermediate Statistical Methods	6
90-812	Introduction to Programming with Python (mini 1) **or** 95-888 Data Focused Python (only with permission of advisor)	6
94-842	Programming R for Analytics (mini 2)	6
90-838	Database Management for Policy Analytics	12
90-718	Strategic Presentation Skills	6
	semester units	**54**
Spring Semester 1st year		
90-723	Financial Statements and Analysis for Companies (mini 3)	6
9x-xxx	Financial Analysis (your choice from numerous courses): Financial Analysis of Non-Profits: 90-744; Management Accounting: 90-725; Public Financial Management: 90-731; Principles of Finance: 95-716 Advanced Financial Management Healthcare: 90-831	6
90-713	Policy and Politics: An International Perspective **or** 90-714 Policy and Politics in American Political Institutions	12
94-834	Applied Econometrics I (mini 3)	6
94-835	Applied Econometrics II (mini 4)	6
90-722	Management Science I (mini 3)	6
90-760	Management Science II (mini 4)	6
95-791	Data Mining	6
	Semester units	**54**
Summer Internship Required		
Fall and Spring Semester 2nd Year		
94-700	Organizational Design & Implementation (Fall)	6
94-867	Decision Analytics for Business and Policy (Spring) (Fall for F19 starts)	12
9x-xxx	30 units from across these three content bins with at least 6 from each: Data Mining/Machine Learning Statistics and Modeling of Uncertainty Computer Programming and Information Systems	30
9x-xxx	6 units from the content bin Decision Frameworks and Policy Methods	6

90-739	Systems Synthesis Project	12
9x-xxx	Electives	24
	Total Units	**198**

Content Area Courses for the MSPPM-Data Analytics program

Below is the current set of Heinz faculty approved courses students can choose from to satisfy the content area requirement in the MSPPM-DA program. Of the 36 required units, 30 units must come from across the three content areas, with at least 6 from each, of Data Mining/Machine Learning, Statistics and Modeling of Uncertainty, and Computer Programming and Information Systems. The remaining 6 units must come from the Decision Frameworks and Policy Methods content area. The specific distribution across the four areas for each student must be discussed with, and approved by, the student's academic advisor.

Data Mining/Machine Learning

94-775 Unstructured Data Analytics for Policy, 6 units
94-832 Business Intelligence & Data Mining with SAS, 6 units
94-887 Applied Analytics: The Machine Learning Pipeline, 12 units
94-889 Machine Learning for Public Policy Lab, 12 units
95-816 Advanced Business Intelligence with SAS, 6 units
95-885 Data Science and Big Data, 12 units

Statistics and Modeling of Uncertainty

90-906 PhD Econometrics I, 12 units
90-907 Econometric Theory and Methods, 12 units
94-827 SAS for Public Policy, 6 units
94-830 Analysis of Survey Data, 6 units
94-833 Decision Analysis and Multi-criteria Decision Making, 6 units
95-819 A/B Testing, Design and Analysis, 6 units
95-866 Advanced Business Analytics, 6 units
95-868 Exploring and Visualizing Data, 6 units

Computer Programming and Information Systems

90-753 Advanced Geographical Information Systems, 6 units
94-706 Healthcare Information Systems, 12 units
94-802 Geographic Information Systems OR 90-834 Healthcare Geographic Information Systems, 12 units (*94-802 and 90-834 are substitutes; only one of the two should be taken)*
94-880 R Shiny for Operations Management, 6 units
95-736 Advanced Relational Database, 6 units
95-737 NoSQL Database Management, 6 units
95-752 Introduction to Information Security, 12 units
95-797 Data Warehousing, 6 units
95-799 Linus and Open Source, 6 units
95-869 Big Data and Large-Scale Computing, 6 units

Computer Programming and Information Systems - continued

*90-819 Intermediate Programming with Python

*If a student is conditionally exempt from 90-812 Intro to Programming contingent on completion of 90-819, the course *may not* be double-counted toward the content requirement.

^95-888 Data Focused Python

^If a student is conditionally exempt from 90-812 Intro to Programming contingent on completion of 95-888, the course *may not* be double-counted toward the content requirement.

Decision Frameworks and Policy Methods

90-730 Methods of Policy Analysis, 12 units
90-745 Methods of Policy Analysis: International Policy, 12 units
90-747 Cost Benefit Analysis, 6 units
90-769 Critical AI Studies for Public Policy, 6 units
90-822 Critical Analysis of Policy Research, 6 units
90-823 Program Evaluation, 12 units
90-860 Policy in a Global Economy, 12 units
90-882 Behavioral Economics in Public Policy, 12 units
94-774 Business Process Modeling, 6 units
94-845 Smart Cities: Growth and Intelligent Transportation Systems, 6 units
94-866 Design Thinking, 6 units
94-878 AI, Society and Humanity, 12 units
94-881 Managing Analytic Projects, 6 units
95-824 Policies of Wireless Systems, 12 units

3.5 MS-Global Track Requirements

Fall (Australia)		**Units**
90-705	Policy Analysis I	12
90-707	Statistical Reasoning	12
91-820	Strategic Planning	12
94-702	Professional Writing	6
90-728	Introduction to Database Management	6
	semester units	**48**
Spring (Australia)		
90-710	Applied Economic Analysis	12
90-724	Financial Analysis	12
94-700	Organizational Design & Implementation	6
94-718	Strategic Presentation Skills	6
94-728	Business Intelligence and Analytics	6
95-760	Decision Making Under Uncertainty	6
	semester units	**48**
94-900	**Summer Internship (Required)**	0

Fall or Spring (Pittsburgh)		
90-747	Cost Benefit Analysis (spring only)	6
	Additional Policy (your choice from numerous courses)	12
	Additional Methods (your choice from numerous courses)	12
	Additional Management (your choice from numerous courses)	6
xx-xxx	Electives: *more if exempt from core courses*	48
90-7xx	Systems Synthesis (fall or spring semester of second year)	12
	Total Units	**198**

3.6 Information Technology Core Requirement

All MSPPM students except for MS-DA students must take 90-728, Introduction to Database Management plus at least six units from the courses listed below. Students may take additional courses from the lists as advanced policy or methods courses where cross-listed, but students may not use any course to satisfy both an information technology core requirement and an advanced course requirement.

Information technology courses that meet the core requirement are listed in four categories:

- ***Analytics***—courses at the intersection of data analysis and information technology. There is very high demand for graduates who have analytical skills including a statistical package such as SAS or other advanced statistical software.
- ***Applications***—courses about using or analyzing information technology in organizations and a variety of settings. These courses apply information technology to various industries and functional areas of organizations.
- ***Strategy***—courses on approaches to using information technology as a comparative advantage or to advance the missions of organizations. These courses address the advantages as well as threats to strategic uses of information technology.
- ***Systems***—courses on or supporting designing, building, and implementing information systems. These courses have material at the foundation of information systems and provide comparative advantages for graduates.

Analytics

No.	Course Title	Units	Prerequisites	Sem.
94-827	SAS for Policy Analysis	6	90-711 Statistical Reasoning with R or 90-707 or 90-777	Spring
94-830	Analysis of Sample Survey Data	6		Spring
94-832	Business Intelligence & Data Mining SAS	6	No official prerequisite, preferably some knowledge in statistics, economics and database	Fall Spring
94-842	Programming R for Analytics	6	90-711 Statistical Reasoning with R or 90-707 or 90-777	Fall Spring

95-791	Data Mining	6	90-711 Statistical Reasoning with R or 90-707 or 90-777 and 94-842 is highly recommended	Fall Spring
95-868	Exploring and Visualizing Data	6	90-711 Statistical Reasoning with R or 90-707 or 90-777	Spring

Applications

No.	Course Title	Units	Prerequisites	Sem.
90-753	Advanced Geographical Information System	6	90-834 or 94-706	
90-812	Introduction to Programming with Python	6		Fall Spring
90-834	Health Care Geographical Information Systems	12	90-728 Database Management	Spring
94-706	Health Care Information Systems	12		Spring
94-823	Measuring Social	12		Fall Spring
95-732	Marketing Digital Media	6		Spring
95-818	Privacy Policy, Technology, and Law	12		Fall
95-821	Product Management in Information Technology	6		Spring
95-891	Introduction to AI	12	90-711 Statistical Reasoning with R or 90-707 or 90-777	Spring Fall

Strategy

No.	Course Title	Units	Prerequisites	Sem.
94-806	Privacy in the Digital Age	6		Fall Spring
95-743	Cybersecurity Policy and Governance II	6	95-744 Cybersecurity Policy and Governance I	Fall
95-744	Cybersecurity Policy and Governance I	6		Spring Fall
95-752	Introduction to Information Security Management	12		Fall

95-775	IT Business Leadership	6		Fall
95-794	Tech Startup: Market Discovery	6		Fall

Systems

No.	Course Title	Units	Prerequisites	Sem.
90-782	Multimedia	12		Fall Spring
90-801	Media & Communication Design I	6		Fall Spring
94-774	Business Process Modeling	6		Fall Spring
94-802	Geographic Information Systems	12	90-728 Database Management	Fall Spring
94-881	Managing Analytic Projects	6	Students should have completed a statistics course. Ability to use at least one analysis environment (e.g. Python, R, or SAS) required. Experience with advanced analytics (data science, artificial intelligence) highly desirable	Fall & Spring
95-703	Database Management	12		Fall
95-797	Data Warehousing	6	95-703 Database Management	Fall Spring
95-808	IT Project Management	6		Fall Spring

3.7 Advanced Coursework

The coursework beyond the core can be characterized as structured choice. Students are required take each of the following: advanced methods courses (12 units), advanced policy courses (12 units), and advanced management course (6 units).

3.7.1 Advanced Policy Topics (12 units)

Advanced Policy Topics courses are designed to provide you with an opportunity to explore the substantive aspects of policy making within the context of several policy areas. The complete list of Advanced Policy Topics is available below:

Course Number	Title	Semester	Units
90703	Gender, Race, Politics & Social Movements	Spring	12
90704	Poverty, Inequality and Social Policies: An International Comparison	Fall	12
90730	Methods of Policy Analysis	Fall	12
90745	Methods of Policy Analysis - The Future of Work	Spring	12

90734	Urban Policy	Spring	6
90736	Public Finance	Fall	12
90743	Urban and Regional Economic Development	Spring	12
90752	The Rise of East Asian Economies	Fall	12
90763	Human Rights Conflicts & Development	Fall	12
90765	Cities, Technology and the Environment	Spring	6
90789	Resilient & Sustainable Communities	Spring	12
90798	Systems Thinking for Environmental Policy & Planning	Fall	12
90808	Energy Policy	Fall	6
90822	Critical Analysis of Policy Research	Fall	6
90842	Public Policy Implementation	Spring	6
90860	Policy in a Global Economy	Fall	12
90882	Behavioral Economics in Public Policy	Fall	12
90894	Policy Topics I: Federal Budget Policy	Fall	6
94806	Privacy in Digital Age	Fall	6

3.7.2 Advanced Methods Courses (12 units)

Advanced Methods courses deepen your understanding of both the tools and topics of policy analysis and management. Many of these courses count toward your concentration area. The complete list of Advanced Methods courses is available below:

Course Number	Title	Semester	Units
90730	Methods of Policy Analysis	Fall	12
90745	Methods of Policy Analysis - The Future of Work	Spring	12
90747	Cost Benefit Analysis	Spring	6
90774	Public Expenditure Analysis	Spring	12
90823	Program Evaluation	Fall & Spring	12
90906	PhD Econometrics I	Fall	12
90908	PhD Microeconomics	Fall	12
94827	SAS for Public Policy	Spring	6
94830	Analysis of Survey Data	Spring	6
94834	Applied Econometrics I	Fall & Spring	6
94835	Applied Econometrics II	Spring	6
94842	Programming R for Analytics	Fall & Spring	6
94867	Decision Analytics for Business and Policy	Spring	12

3.7.3 Advanced Management Courses (6 units)

Additional Management courses are designed to equip you to lead and manage organizations in the public interest.

Course Number	Title	Semester	Units
90737	Budget Management Control System	Fall	12
91809	Organizational Change	Spring	6
94800	Negotiation	Fall & Spring	6
94808	Management Consulting	Fall & Spring	12
94811	Strategy Development	Fall & Spring	6
94813	Project Management	Fall & Spring	6
94814	Evidence-Based Management	Fall	6
94854	Developing as a Leader	Fall & Spring	6

4 PROJECT COURSEWORK

In addition, you must take a minimum of 12 units of a project course. To fulfill this requirement, you can elect to take either of the following:

- one semester of 90-739, System Synthesis or
- one semester of 90-719, Physical Technical Systems
- other project courses offered by the School on an occasional basis.

Physical Technical Systems projects are run jointly with the Department of Engineering and Public Policy and with the Department of Social and Decision Sciences.

Most project courses are organized around significant public interest or management problems, the solution to which requires a mix of technological, economic, social and political skills. Most project courses are sponsored by a public or not-for-profit agency or have a project advisory committee of people from a range of agencies interested in the project's outcome. As opposed to the traditional classroom setting, project courses are organized as an exercise in group problem solving. Students are divided into teams guided by faculty from the Heinz College and other colleges and departments in the university.

There are two separate project courses: Systems Synthesis and Physical/Technical Systems. Each last for one semester. You must take either one Physical/Technical course or one System Synthesis Project to fulfill graduation requirements. Occasionally, other types of project courses will be offered with which students may satisfy this requirement. The Systems Synthesis project must be completed during the student's final semester.

4.1 Systems Synthesis

Systems Synthesis projects allow students to apply the diverse skills developed in the classroom to a "real world" problem with a "real world client" in the design of a specific functioning public or non-profit sector system. The term "system" refers to the fact that the particular entity studied has an identifiable objective or function and consists of several interacting components, and the word "synthesis" refers to the fact that the desired output is an integrated design, drawing on multiple disciplines, for improved operation of that system.

In a Systems Synthesis project, you will work in a group to structure a problem, do appropriate analysis using quantitative and analytical tools, generate recommendations to solve or ameliorate the problem, and present the analysis and recommendations to the client in both written and oral form. Increasingly, the written form consists of websites with summaries for stakeholders as well as downloadable materials such as reports. The experience will be designed to sharpen your problem-solving skills and skills in working effectively in groups.

The Systems Synthesis Project Course Guide provides more detailed information. It is distributed at the start of your systems project.

4.2 Organization of Systems Synthesis Projects

Projects must be supervised by at least one faculty member who maintains relations with the client, directs and critiques the students' work, coaches them for their presentations, coordinates relationships with a Project Advisory Committee, and grades the students on their contributions to the projects as

well as grading the overall projects.

Systems Synthesis projects involve both oral and written work. Generally, each project should make at least one oral presentation to the client per semester; this presentation is open to the public and is advertised accordingly. Each student should participate in at least one oral presentation to the client. In addition, groups must produce an interim report and a final report. Each student should write a significant and identifiable section of the report and perform some nontrivial analysis, even if these efforts have to be improved upon by other members of the group before being included in a report to the client. The written report is expected to be of high quality but also produced on time. Each group must submit an electronic copy of the final report to the Associate Dean's Office.

4.3 Development of Systems Synthesis Projects

In the spring semester, the Program Director announces the request for Systems Synthesis project proposals. Typically, proposals are generated by faculty and by organizations external to the School of Public Policy and Management. In recent years, some successful proposals have come from students with an interest in a particular problem. The MSPPM Program Director, Associate Dean, and other faculty designated by the Dean are available to assist students who are interested in developing their own proposals. If you are interested in organizing a project, you must submit a proposal to the MSPPM Program Director including as many of the following items as possible:

- a brief description of the system to be studied,
- the system client if identified,
- the kinds of alternative improvements to be considered,
- the types of data that would be used in such an analysis and how you intend to gather that data,
- the analytical approaches you anticipate you will use in the study,
- the feasibility of completing the project in one semester, and
- the name(s) of proposed faculty advisors.

It is certainly not necessary to have all of the aspects of a project listed above in place to submit a proposal. If you need assistance with any aspect of developing a project, contact the MSPPM Program Director. The most critical factors are a well-defined project idea, significant interest from students, the feasibility of completing the project, and the ability of the Associate Dean to assign a faculty member to supervise the project. The latter depends a great deal on the needs for individual faculty to teach other courses in the curriculum.

Projects proposed by students will be subject to review by the faculty for feasibility and suitability as a systems project.

4.4 Assignment of Students to Projects

Student preference is an important consideration. The Committee tries to consider the link between the skills of the student and the nature of the tasks in the Systems courses.

4.5 Grading of Systems Synthesis Projects

You will receive a Systems Synthesis grade based on your individual and group performance. In any group project there is an inherent tension between rewarding individual and group performance. This tension is in part by design, as it reflects some of the realities of group staff work in public and private organizations. Grades in Systems Synthesis courses are a combination of individual and group

considerations. It is generally desirable that students perform multiple roles in projects, and it is recommended that faculty and student evaluations consider these various contributions.

4.6 Physical/Technical Systems Projects

Topics for these projects are determined jointly by the Department of Engineering and Public Policy, the Department of Social and Decision Sciences, and the Heinz College. Physical/Technical Systems Projects allow you to work with engineering faculty and students to approach technology-oriented policy issues. In these projects, you will learn how to structure a diffuse problem, how to take an unfamiliar problem and gain enough mastery to make recommendations about policy issues, and how to make formal presentations to panels of experts from outside the academic community.

5 INDEPENDENT STUDIES AND WORKING PAPER OPTION FOR STUDENT RESEARCH

The MSPPM program does not have a thesis option for students interested in doing research. Instead of a thesis, the program requires the Systems Synthesis group project as the appropriate capstone experience for professional master's degree students. All MSPPM students must complete a Systems Synthesis project without exception.

Nevertheless, each year there is a small number of students who wish to conduct individual research projects; for example, because they wish to work in a "think tank" or pursue a PhD degree. For such students we recommend taking one or two elective independent studies courses with a faculty member and with the goal of publishing a working paper on the Heinz College website jointly with the faculty member (see http://www.heinz.cmu.edu/faculty-and-research/research/working-papers/index.aspx).

A working paper is a focused research product of journal length (25 to 35 double-spaced pages) that represents good progress on a research topic, publishable in an academic journal. In contrast, a thesis is a longer and more expansive work generally on the order of 100 or more pages in length. The merits of a working paper are many: (1) it is published and accessible from the Heinz website; (2) it is feasible to complete and graduate on time (whereas, there is no guarantee of finishing a thesis on time); (3) it is a strong basis upon which faculty members can write recommendation letters and which students can include in work or PhD applications; and (4) it represents the "coin of the realm" for researchers which is the refereed journal article.

We recommend that students take a first independent studies course in the Fall of the second year of the program with the intention of finishing by the end of that semester. Quite often, however, research projects take longer than expected to complete, or additional features are discovered which are desirable to pursue. If necessary or desirable, then students can petition for a second independent studies course to finish up in Spring Semester.

6 CONCENTRATION AREAS

As an MSPPM student, you are recommended—but not required—to declare a concentration. Depth in some field or application area is useful both for getting a first job and excelling at it. We provide coherent offerings of courses in eleven defined concentration areas that many students find appealing. Some MSPPM students design their own concentrations, and if you believe you have a compelling educational interest in selecting courses that do not comprise a defined concentration, you are free to

pursue that vision. In addition, while not a concentration, we offer a Pre-PhD option for the occasional student who wishes to pursue a PhD after completing the MSPPM.

Defined Concentrations
The Heinz College provides descriptions and lists of courses within the following ten defined concentrations:

- Cyber Security and Management
- Energy Systems and Public Policy
- Environmental Policy
- Health Policy
- International Trade and Development
- Management
- Policy Analysis
- Public and Non-Profit Finance
- Smart Communities
- Social Innovation and Entrepreneurship
- Urban and Regional Economic Development

Concentrations require a minimum of 48 units of courses from provided lists. It is important to note that all of the courses listed are not offered in every academic year. It is also possible that the semester in which a course is offered may change from year to year and additional courses may be offered. You should consult with your advisor for courses that best match your academic and career interests. In addition, consult current course schedules for updated information.

Concentration courses can also count towards the advanced coursework requirements.

Submit the online form to declare a concentration if you are interested in pursuing a concentration.

6.1 Cyber Security Policy and Management Concentration

Goal
Cyber threats to public, private, and non-profit sectors continue to increase with the potential to cause wide-spread disruption to the health and safety of citizens, economic growth and stability, and national security. People, processes, technologies, and *policies* are key ingredients in building a usable and durable approach to addressing the cyber challenge. Cyber security policy is the cornerstone of developing productive public-private partnerships, necessary for sharing vital threat information, coordinating responses to threats, and fortifying defenses. The Cyber Security Policy and Management concentration provides students with a core understanding of the cyber challenge and explores the ways in which policy enhances the effectiveness of traditional approaches to managing cyber threat. There is very large unmet demand for cyber security policy analysts and managers in all sectors of employment.

Faculty Leader

If you have questions about this concentration, **Randy Trzeciak** (randallt@andrew.cmu.edu). Further information on public policy and management careers in the cyber security profession is available from the National Initiative for Cybersecurity Careers and Studies (http://niccs.uscert.gov/training/tc/framework).

Curriculum

There are three foundational courses. To gain a substantial and broad understanding of cyber security as it relates to information assets, networks, and the use of the Internet students will take 95-752 Introduction to Information Security Management. To understand the policy aspects of cyber security, students will take 95-744 Information Security Policy and Governance I and 95-743 Information Security Policy and Governance II, which broadly explores the policymakers and relevant policies that guide and govern cyber security in both government and private industry, such as the newly-published National Institutes of Standards and Technology (NIST) Cyber Security Framework. Students in 95-744 and 743 will also study well-known cases of cyber intrusion and disruption and explore the policy considerations that would have limited or mitigated disruptive outcomes.

Additional concentration courses allow students to further enhance their technical understanding of cyber security (for example, 95-748 Software and Security or 95-758 Network and Internet Security) or to develop specific expertise in critical policy areas such as privacy (94-806 Privacy in the Digital Age). While computer programming is not a prerequisite for this concentration, some cyber-security concentration courses such as 95-748 Software and Security may involve exposure to minor coding or script development concepts. Prior programming experience is not necessary to enroll in these courses but if you are interested in building knowledge, skills, and abilities with a programming language consider taking 90-812 Introduction to Programming with Python.

To obtain the concentration in Cyber Security Policy and Management, students are recommended to take at least 48 units of coursework, including 24 units of foundational courses, as follows.

Foundation Courses:			
95-752	Introduction to Information Security Management	Fall	12 units
95-743	Cybersecurity Policy and Governance II	Fall	6 units
95-744	Cybersecurity Policy and Governance I	Fall	6 units

Additional Concentration Courses (Heinz):			
94-806	Privacy in the Digital Age	Fall	6 units
95-755	Information Security Risk Management I	Spring	6 units
95-757	Information Security Policy & Management	Spring	6 units
95-758	Network and Internet Security	Spring/Fall	12 units
95-759	Malicious Code Analysis	Spring	6 units
95-748	Software and Security	Spring/Fall	6 units

95-749	Cryptography	Spring	6 units
95-723	Managing Disruptive Technologies	Spring/Fall	6 units
95-810	Blockchain Fundamentals	Fall/Spring	6 units
95-818	Privacy Policy, Technology, and Law	Fall	12 units
95-824	Policies of Wireless Systems	Fall	12 units
95-855	Network Traffic Analysis	Fall	6 units
95-878	Engineering Privacy in Software	Spring	12 units

Additional Concentration Courses (Information Networking Institute):			
14-761	Applied Information Assurance	Fall/Spring	12 units
14-809	Introduction to Cyber Intelligence	Fall	12 units
14-823	Network Forensics	Fall	12 units
14-829	Mobile Security	Fall	12 units
14-735	Secure Coding	Spring	12 units
14-814	Wireless Network Security	Spring	12 units
14-819	Introduction to Software Reverse Engineering	Spring	12 units
14-822	Host Based Forensics	Spring	12 units

6.2 Energy Systems and Public Policy Concentration

Goal

This Master of Science in Public Policy and Management (MSPPM) concentration is for students who have a science or engineering background and who seek a career in energy policy and management. The program is designed to prepare graduates for leadership positions in one of the many energy-related job markets where public policy and management skills are valued. These include opportunities in government, non-profits, consulting firms, traditional utility companies and energy suppliers, and alternative and renewable energy companies. Unique to this concentration are in-depth public policy and management knowledge, decision frameworks, and data analytic skill-bases with sufficient science and engineering background to effectively guide design, adoption, implementation, and management of innovative energy policies.

This concentration is a partnership between the School of Public Policy and Management at the Heinz College and the Engineering College's Energy Science, Technology and Policy (EST&P) master's degree program (http://www.cmu.edu/engineering/estp/index.html). EST&P is an interdisciplinary engineering degree "…based in engineering, aligned with new discoveries in science, attuned to sustainability and the environment, and informed by a broader perspective in economics and public policy." The students in this new energy policy and management concentration will benefit from the research and experiential opportunities made possible by the University's Wilton E. Scott Institute for Energy Innovation (http://www.cmu.edu/energy/) and its mission of, "…developing and demonstrating the technologies, systems and policies needed to make the transition to a sustainable energy future…[including] an understanding of the intersection of energy and public policy…."

Faculty Leader

If you have questions about this concentration, contact Karen Clay (kclay@andrew.cmu.edu),

Curriculum

The concentration consists of a minimum of 48 units of coursework, with of 24 units of foundation classes and 24 units of additional concentration coursework. Foundation courses for the concentration, listed below, are the energy core courses of the EST&P program https://www.cmu.edu/engineering/estp/degree-programs/index.html and cover energy supply, demand, storage, utilization, policy, sustainability, and the environment. Additional concentration coursework, selected by the student in consultation with his/her academic advisor, can be drawn from a list of Heinz College courses, Tepper School of Business courses, and courses in the Engineering College's six departments (Chemical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Engineering and Public Policy, Materials Science and Engineering, and Mechanical Engineering).

Foundation Courses (to be taken by all students in the concentration):			
39-610	Energy Conversion and Supply	Fall	6 units
39-613	Energy Transport and Storage	Fall	6 units
39-611	Energy Demand and Utilization	Spring	6 units

Additional Concentration Courses (Heinz College):			
90-747	Cost Benefit Analysis	Spring	6 units
90-808	Energy Policy	Spring	6 units
90-789	Resilient & Sustainable Communities	Spring	12 units
90-730	Methods of Policy Analysis	Fall	12 units
90-842	Public Policy Implementation	Spring	6 units
90-860	Policy in a Global Economy	Fall	12 units
94-854	Developing as a Leader	Spring Fall	6 units

Additional Concentration Courses (Tepper School) *:			
45-928	Energy Finance	Spring	6 units
45-964	Real options	Fall	6 units
45-823	Options	Fall	6 units
45-863	Risk Analytics	Fall	6 units
45-875	Government and Business	Fall	6 units
45-912	Business Forecasting with Time Series Models	Spring	6 units
45-960	Sustainable Operations	Spring	6 units

*Note that Heinz College students in the Energy Systems and Public Policy concentration do not have priority for registering in Tepper School courses.

Additional Concentration Courses (Engineering College, see EST&P disciplinary concentration courses https://www.cmu.edu/engineering/estp/degree-programs/index.html

6.3 Environmental Policy Concentration

Goal

The Environmental Policy Concentration provides students interested in environmental policy and planning with concepts, knowledge, and tools in the environmental area.

Faculty contact person
If you have questions about this concentration contact Karen Clay (kclay@andrew.cmu.edu).

Curriculum
Foundation courses in the concentration provides a broad survey of the area; which covers the economics of regulation; and or, which address primary drivers of pollution. Population growth, urbanization, and energy use are primary drivers of environmental pollution so policy makers need a grounding in these areas. Global warming occupies center stage and sustainability is critical. Of course, there is a technical side to the environmental area, so students benefit by taking at least one course with engineers.

Students interested in the Environmental Policy Concentration are recommended to complete at least 48 units of coursework from the lists below

Foundation Course:			
90-798	Systems Thinking for Environmental Policy & Planning	Fall	12 units

Additional Concentration Courses:			
90-808	Energy Policy	Spring	6 units
90-789	Resilient & Sustainable Communities	Spring	12 units
90-765	Cities, Technology & the Environment	Spring	6 units
90-813	Environmental Politics and Policy	Spring	6 units
12-712	Introduction to Sustainability Engineering (Civil and Environmental Engineering, has limited freshman calculus)	Fall	12 units
19-424	Energy & the Environment	Fall	9 units

6.4 Health Policy Concentration

Goal
The Health Policy enhances students' education by teaching them how to think strategically about the economic, political, and financial environment in which health care is delivered and equipping them with the technical and analytic tools needed to develop and analyze health policy.

Faculty Leader
If you have questions about this concentration contact **Professor Laura Synnott** (synnott@andrew.cmu.edu).

Curriculum

In order to provide students with fundamental knowledge in areas unique to the health care, students are recommended to take at least 48 units of coursework from the following foundation and additional concentration course lists. While students can take any combination of foundation and additional concentration courses, it is recommended that students, particularly those without prior health care industry experience, prioritize the foundation courses.

Foundation Courses:			
90-836	Health Systems	Fall	6 units
90-833	Population Health	Spring	6 units
90-861	Health Policy	Spring	6 units
94-705	Health Economics	Fall	12 units

Additional Concentration Courses:			
90-721	Health Care Management*	Fall/Spring	6 units
90-831	Advanced Financial Management of Health Care	Spring	6 units
90-834	Health Care Geographical Information Systems	Spring	12 units
94-706	Health Care Information Systems	Spring	12 units
90-832	Health Law	Spring	6 units

*Students registering for 90-721 must either be concurrently registered for or have completed 90-836

6.5 International Trade and Development Concentration

Goal

Globalization is one of the most critical social forces of the past half-century. Globalization has radically reshaped the domains of economics, business, finance, and global politics, and it will continue to do so throughout the working lives of current and future Heinz students. The International Trade and Development Concentration provides students interested in international economics, economic development, and international relations with the analytical frameworks and conceptual tools they need to understand the current public policy debates in this area. Those tools include:

a. The main analytic methods and approaches used in international relations.
b. The foundational economic models used to understand the contemporary global trading system, international financial markets, and the operation of multinational enterprises.
c. The analytical tools and frameworks needed to understand the rise of Asia as a major center of the global economy.
d. Human rights, conflict and development problems affecting selected Latin American, African and Asian countries
e. Comparative approach to poverty, social policy and inequality
f. Trade relations with a special focus on Asia and the U.S.
g. Economics of development

These courses and tools are essential for students who wish to become effective policy makers, analysts and managers in international organizations, and in the public and private sectors both in the U.S. and in other countries.

Faculty leaders

The International Trade and Development Concentration is jointly led by **Professors Lee Branstetter (branstet@cmu.edu) and Silvia Borzutzky (sb6n@andrew.cmu.edu).** Interested students are encouraged to approach either faculty member with questions about the concentration, its courses, courses outside of Heinz College, or further resources for international study and research at Carnegie Mellon.

The International Trade and Development concentration provides students with a menu of courses offered by the Heinz College that explore the phenomena of globalization, international development, international policy, and trade issues in depth and from multiple perspectives. All students are strongly encouraged to take the core course, 90-713 Policy and Politics an International Perspective, and the concentration foundation course, 90-860 Policy in a Global Economy. These courses provide students with the frameworks essential to understand economic globalization and the political issues that shape its evolution on the other.

Interested students are also given the option of enrolling in international courses outside the Heinz College. Students interested in such courses should seek the advice and consent of the concentration director prior to enrollment. This faculty member can help guide students to outside courses that meet the Heinz College's standards of quality and rigor.

Foundation Course:			
90-860	Policy in a Global Economy	Fall	12 units

Additional Concentration Courses:			
90-703	Gender, Race, Politics & Social Movements.	Fall	12 units
90-763	Human Rights, Conflicts, and Development	Fall	12 units
90-704	Poverty, Inequality, and Social Policies: An International Comparison	Fall	12 units
90-752	Rise of the Asian Economies	Fall	12 units
90-822	Critical Analysis of Policy Research	Fall	6 units
94-859	International Crisis Negotiation Exercise	Spring	3 units
90-745	Methods of Policy Analysis: The Future of Work	Spring	12 units

6.6 Management Concentration

Goal

This concentration is designed to ensure that students achieve a thorough understanding of management, planning, human resources, managerial decision-making, and organizational analysis and development within organizations that pursue the public interest.

Faculty Leader

If you have questions about this concentration contact Professor **David Krackhardt** (krack@cmu.edu).

Curriculum

Students in the Management Concentration are recommended to complete at least 48 units of coursework from the following foundation and additional courses.

Foundation Courses:			
94-814	Evidence-Based Management	Fall	6 units
94-854	Developing as a Leader	Fall/Spring	6 units

Additional Concentration Courses:			
94-800	Negotiation	Fall/Spring	6 units
91-809	Organizational Change	Spring	6 units
94-808	Management Consulting	Fall/Spring	12 units
94-803	Consulting Lab	Fall/Spring	6 units
94-801	Acting for Management	Fall/Spring	6 units
90-825	Innovation Management in Practice	Fall	3-4,6 units
94-811	Strategy Development	Fall	6 units
94-813	Project Management	Fall/Spring	6 units

6.7 Policy Analysis Concentration

Goal

The Policy Analysis Concentration prepares students to understand and solve policy problems of importance to the public and not-for-profit sectors.

Faculty Leader

If you have questions about this concentration contact Professor **Amelia Haviland** (amelia@andrew.cmu.edu).

Curriculum

A policy analyst is a generalist who works on series of high-level projects. The projects and fields vary over time but the underlying analytical framework, methods, and tools apply universally. Thus, the Policy Analysis concentration includes several analytical courses and a variety of substantive policy area courses.

Foundation analytical courses that all students in the concentration are recommended to take are 90-747 Cost-Benefit Analysis, which provides an evaluative framework; two alternate empirical methods courses, 90-823 Program Evaluation, which addresses the collection of evidence on program performance and 94-834 Applied Econometrics I and II, which provide statistical methods for estimating relationships from non-experimental data; and a policy analysis framework course, 90-730 Methods of Policy Analysis. Students may focus on one substantive policy area, but it is recommended that students take courses in widely different areas to gain experience in analyzing a range of policy problems.

Students in the Policy Analysis Concentration are recommended to complete at least 48 units of coursework from the following lists:

Foundation Courses:			
90-747	Cost Benefit Analysis	Spring	6 units
90-823	Program Evaluation*	Spring	12 units
94-834 & 94-835	Applied Econometrics I and II*	Fall/Spring	6 units 6 units
90-730	Methods of Policy Analysis	Fall	12 units

*You only need to take one of these two alternate foundation courses, but it is worthwhile to take both.

Additional Concentration Courses:			
90-798	Systems Thinking for Environmental Policy & Planning	Fall	12 units
90-822	Critical Analysis of Policy Research	Fall	6 units
90-842	Public Policy Implementation	Spring	6 units
90-861	Health Policy	Fall	6 units
90-704	Poverty, Inequality and Social Policies: An International Comparison	Fall	12 units
94-831	Design Center: Design Thinking for Social Innovation	Fall	12 units
90-860	Policy in a Global Economy	Fall	12 units
90-734	Urban Policy	Spring	6 units
94-859	International Crisis Negotiation Exercise	Spring	3 units

6.8 Public and Non-Profit Finance

Goal

The courses in the Public and Non-Profit Finance concentration are designed to give students a background in the theory and practice of not-for-profit finance, either in the public (government) or not-for-profit sector.

Faculty Leader

If you have questions about this concentration contact **Professor Kathleen Smith** (ks54@andrew.cmu.edu).

Curriculum

Foundation courses that should be taken by all students in the public and non-profit finance concentration include 90-737 Budget Management Control System and 90-736 Public Finance.

Students must complete at least 48 units of coursework from the following foundation courses and additional concentration courses lists:

Foundation Courses:			
90-737	Budget Management Control System	Fall	6 units
90-736	Public Finance	Fall	12 units

Additional Concentration Courses:			
90-774	Public Expenditure Analysis	Spring	12 units
90-817	Education Finance and Policy	Spring	12 units
90-831	Advanced Financial Management of Health Care	Spring	6 units
90-747	Cost Benefit Analysis	Spring	6 units
94-834	Applied Econometrics I	Fall/Spring	6 units
90-823	Program Evaluation	Spring	12 units

6.9 Smart Communities

Goal:

Advanced information and communication system technologies joined with powerful data analytic tools have become central to the management and making of public policy for cities and urban regions. The Heinz College's Smart Communities concentration of the Master Science in Public Policy and Management program integrates technology, social science, and management skills in the key areas driving the future of cities and urban regions in the United States and around the world.

Cities and communities are facing challenges and opportunities in infrastructure, transportation, sustainability, and workforce development. Cities are seeking ways to increase government efficiency and transparency, pursue equity, and increase quality of life in the face of limited governmental resources. Advancements in computing, information communication technologies, and information systems are increasingly playing a role in generating smart city solutions. Autonomous vehicles, sensors, and the internet of things are disrupting business as usual. Cities around the world are growing in size and evolving into connected and technologically-enabled societies. The use of technology can facilitate work with impact. However, technology alone cannot solve these problems. Students pursing this concentration will gain multidisciplinary skills in policy, analytics, information systems, privacy, ethics, and civil infrastructure to tackle complex problems.

One of the educational hallmarks of Carnegie Mellon University is the joint engagement of multiple departments and colleges in degree offerings. This concentration offers courses from across Carnegie Mellon University, such as the internationally prominent Engineering College, School of Computer Science, and the Dietrich College of Humanities and Social Sciences.

It draws on the Heinz College's strengths in information technology management (rated #1 nationally by U.S. News and World Report). It also draws on major multidisciplinary research centers at Heinz College including Traffic21, Metro21, and national US Department of Transportation Research Centers in both mobility and safety, as well as Carnegie Mellon's Software Engineering Institute, the country's largest government-funded center in software engineering and cybersecurity.

Faculty Leader:

If you have questions about this concentration contact Professor Sean Qian: seanqian@cmu.edu.

Curriculum:

To obtain the concentration in Smart Communities, students are required to complete at least 48 units from the coursework. Students are required to complete 30 units of foundational courses and 24 units of additional concentration courses.

Foundation Courses *All the courses listed below are required for the concentration*				
Course	Title	Dept.	Sem.	Units
90-789 90-807	Resilient & Sustainable Communities OR Planning by Design: Campuses, Waterfronts, Districts, and Cities	HNZ CFA	Spring Spring	12 12

94-845	Smart Cities: Growth and Intelligent Transportation Systems	HNZ	Fall	6
95-818	Privacy, Policy, Technology, and Law	SCS	Fall	12

Additional Concentration Courses *Select 18 units from the courses listed below.*				
12-706	Civil Systems Investment Planning and Pricing	CEE	Fall	12
12-709	Data Analytics for Engineered Systems	CEE	Fall	12
12-749	Climate Change Adaptation	CEE	Fall	6
12-750	Infrastructure Management	CEE	Spring	12
12-761	Sensing and Data Mining for Smart Structures and Systems	CEE	Spring	12
19-722	Telecommunications Technology and Policy for the Internet Age *(pre-requisite, knowledge of microeconomics)*	EPP	Spring	12
39-611	Energy Demand and Utilization	CIT	Fall	6
39-612	Energy Policy and Economics	CIT	Spring	6
48-712	Issues of Global Urbanization	SoA	Spring	
48-xxx	Urban Ecology	SoA	Spring	
90-734	Urban Policy	HNZ	Spring	6
90-765	Cities, Technology, and the Environment	HNZ	Spring	6
90-766	Intermediate Database Design and SQL *(pre-requisite 90-728 Database Management)*	HNZ	Fall	6
90-783	Policy Innovation Lab	HNZ	Spring	6
90-812	Introduction to Programming with Python	HNZ	Fall/Spring	6
94-802	Geographic Information Systems	HNZ	Fall/Spring	12
94-831	Design Center: Design Thinking for Social Innovation	CFA	Fall	12
94-878	AI, Society and Humanity	H&SS	Fall	12
95-733	Internet of Things *(pre-requisite, computer programming language such as Java, Python, or JavaScript)*	HNZ	Fall/Spring	6
95-744	Cybersecurity Policy and Governance I	HNZ	Fall	6
95-791	Data Mining *(pre-requisite 94-842 Programming R)*	HNZ	Fall/Spring	6
95-824	Policies of Wireless Systems	EPP	Fall	12

6.10 Social Innovation and Entrepreneurship Concentration

Goal

The Social Innovation and Entrepreneurship Concentration provides students with the knowledge and fundamental tools to develop new ventures or assist existing organizations in all sectors to spearhead innovative ventures in the public interest that are more scalable and financially sustainable. This

concentration addresses issues relevant to serving the public interest via entrepreneurship in public, non-profit and for-profit institutions worldwide.

Faculty Leader

If you have questions about this concentration contact **Professor Tim Zak** (**tjzak@andrew.cmu.edu**).

Curriculum

The courses within the Social Innovation Concentration provide students with knowledge and depth in new venture development, human centered design, finance, management, organizational analysis, and change for public good. The foundation courses provide students with a comprehensive introduction to the field as well as opportunities to gain practical skills required for success. Students interested in this concentration are advised to take at least 48 units of coursework from the following list:

Concentration Courses:			
90-737	Budgeting Management Control Systems	Fall	12 units
94-831	Design Center: Design Thinking for Social Innovation	Fall	12 units
90-747	Cost Benefit Analysis	Spring	6 units
90-845	Entrepreneurship and Business Plan Development	Fall	12 units
94-800	Negotiation	Fall/Spring	6 units
94-813	Project Management	Fall/Spring	6 units
94-850	The Science of Growth	Fall	6 units
94-866	Design Thinking	Fall	6 units
08-737	Artificial Intelligence Methods for Social Good*	Spring	12 units

6.11 Urban and Regional economic Development Concentration

Goal

The Urban and Regional Economic Development Policy Concentration provides students interested in the policy and practice of economic development in the United States with concepts, knowledge, and tools needed for economic development at the local, regional, or state level. The concentration is relevant for work in foundation, state, or federal level programs intended to support economic development at the local or regional level.

Students completing this concentration will be able to demonstrate an understanding of what economic development is, the forces that lead state and local governments to pursue economic development programs and strategies, as well as demonstrate understanding of some of the types of strategies pursued. Students will also have an ability to apply one or more policy analysis or management frameworks to an economic development problem, opportunity, or decision.

Faculty Leader

If you have questions about this concentration contact **Greg Lagana (glagana@andrew.cmu.edu**).
Further information on areas of practice in economic development is available from the Heinz College

Career Center, which offers an Introduction to Economic Development brochure. Interested students are also invited to review the career profiles of Heinz alumni working in economic development at the Career Services Center.

Curriculum

Foundation courses in the concentration are 90-743 Urban and Regional Economic Development, which provides a broad survey of the area. Additional concentration courses include background/policy courses in urban settings, as well as courses related to entrepreneurship and business development, community development, real estate, and strategy. The curriculum emphasizes development in the U.S. context. Students interested in international development may want to consider the International Trade and Development concentration.

Foundation Courses:			
90-743	Urban & Regional Economic Development	Spring	12 units
90-748	Real Estate Development	Fall	6 units
90-845	Social Innovation Accelerator (Spring) Formerly named Entrepreneurship and Business Plan Dev	Spring	12 units

Additional Concentration Courses:			
94-800	Negotiation	Fall/Spring	6 units
90-734	Urban Policy	Spring	6 units
90-774	Public Expenditure Analysis	Spring	12 units
90-750	Civic Engagement as a Community Process	Fall	6 units
90-765	Cities, Technology, & the Environment	Spring	6 units
90-789	Resilient and Sustainable Communities	Spring	12 units
90-843	Unlocking the Development Finance Toolbox	Spring	3 units
94-845	Smart Cities: Growth and Intelligent Transportation	Fall	6 units
90-784	Affordable Housing and Finance	Spring	6 units
Additional Concentration Courses at the School of Architecture: By agreement, a small number of seats are set aside for Heinz students			
48-725	Real Estate Design & Development	Fall	9,12 units
90-807	Planning by Design: Campuses, Waterfronts, Districts and Cities	Spring	12 units

6.12 Pre-PhD Option

Goal

The Pre-PhD option provides students with a solid background and the foundation skills needed to prepare them for pursuing a PhD degree.

Curriculum

The Pre-PhD courses provide analytical and quantitative tools and methods through coursework in applied mathematics, statistics, econometrics, and microeconomics. Students interested in this option are recommended to take at least 48 units of coursework from the following list. Students with limited math backgrounds may choose to take additional courses from Carnegie Mellon's undergraduate math program. Please note that these are undergraduate courses and will not be counted towards your Heinz degree, but may be useful in strengthening your quantitative skills. These courses will need to be taken above and beyond the requirements for your Heinz degree. Note that all MSPPM students must take the Systems Synthesis project course and there is no thesis alternative for this requirement. Highly recommended is to take one or two independent studies to complete a research paper under the guidance of a faculty member with the result of a working paper posted in the Heinz College research papers collection online and possibly submitted for publication. Having been mentored by a faculty member and involved in research provide tremendous advantages when applying to PhD programs.

Number	Course Name	Semester	Units
94-834	Applied Econometrics I	Fall/Spring	6
94-835	Applied Econometrics II	Fall/Spring	6
90-823	Program Evaluation	Fall/Spring	12
90-907	Econometric Theory and Methods	Spring	12
90-908	PhD Microeconomics	Fall	12
21-111*	Differential Calculus	Fall/Spring	10
21-112*	Integral Calculus	Fall/Spring	10
21-120*	Differential and Integral Calculus	Fall/Spring	10
21-122 *	Integration and Approximation	Fall/ Spring	10
21-240**	Matrix Algebra with Applications	Fall/Spring	10
21-256**	Multivariate Analysis	Fall/ Spring	9
21-257**	Models and Methods for Optimization	Spring	9
21-228**	Discrete Mathematics	Fall/Spring	9
21-484**	Graph Theory	Spring	9
21-341**	Linear Algebra	Fall/Spring	9
21-355**	Principles of Real Analysis I	Fall/Spring	9
Courses will NOT count towards Heinz degree. Courses require prior approval of the Program Director.** * See Heinz College-Wide Handbook for policies pertaining to undergraduate coursework.**			

7 SUMMER INTERNSHIP

MSPPM students (except for MS3 an MS-MBA students) are required to spend the summer following their first year in the program gaining professional experience in management and analysis by working in a public agency, non-profit organization, or private firm. Your internship duties must have significant educational value.

Your internship will train you in ways significantly different from classroom instruction. By working in a professional environment, you will solidify the knowledge gained in your Heinz College coursework,

refine career interests, and establish personal networks that might lead to later career opportunities. You also can earn income, though the Heinz College does accept volunteer internships. The internship also provides the faculty with feedback about the relevance of the curriculum and the effectiveness of the teaching program.

The completion of an internship is a graduation requirement.

- Minimally, the internship requires the equivalent of 300 hours of full- time employment that has formal supervision, is professional in nature, includes work that is of importance to the organization, and has significant educational value.
- Before beginning the internship, students must complete the online "Career Services Internship Reporting Form" for approval: https://www.heinz.cmu.edu/current-students/career-services/start-your-search-now
- The internship will be verified with the students' supervisors and then approved. Students must notify their Career Advisor of any significant changes in their internships, such as length, location, hours of work, etc.
- Once the internship has been approved, students will be registered for the zero-unit internship course. Students will not receive academic credit for the internship, but it will be reflected on their transcript as a course with P/F grade. If a student plans to exempt the internship, they will need to complete the Petition for Course Exemption.
- At the end of your internship your Career Services Advisor will request that your supervisor complete an evaluation form about your internship performance. You are also required to complete an evaluation survey as well as a self-reflection statement describing how your internship fulfilled the educational goals of the program. **If you do not successfully complete an eligible internship along with your survey and self-evaluation, you will not fulfill your internship requirement necessary for graduation.**
- **F1 Visa Students:** You must apply for Curricular Practical Training (CPT) employment authorization for your summer internship. CPT authorization is required regardless of the internship being paid or unpaid. CPT is only available to F-1 students who have not graduated and who have been enrolled on a full-time basis for one full academic year (i.e. fall and spring.) If your degree program requires you to complete a summer internship, you can qualify for CPT. Processing CPT may take up to 2 weeks and you cannot begin employment until you receive authorization. Guidelines, forms and instructions can be found at the Office of International Education's website.

The summer internship for three-semester MSPPM students is optional; however, students are encouraged to seek internship opportunities.

Your internship will train you in ways significantly different from classroom instruction. By working in a professional environment, you will solidify the knowledge gained in your Heinz College coursework, refine career interests, and establish personal networks that might lead to later career opportunities. You also can earn income, though the Heinz College does accept volunteer internships. The internship also provides the faculty with feedback about the relevance of the curriculum and the effectiveness of the teaching program.

7.1 Securing an Internship

You are responsible for securing a suitable internship. The Heinz College Career Services Office provides assistance through counseling, workshops on resume preparation and interview skills, and listings of potential internships. You can make an appointment at any time to meet with the staff to discuss your situation and you are encouraged to come to workshops that cover the essential skills for finding the right internship.

7.2 Internship Standards

The faculty expects all students to satisfactorily complete an internship as an integral part of the degree program. Minimally, this requires the equivalent of 300 hours of full-time employment in a technical, managerial, or administrative position with a satisfactory evaluation by your supervisor.

Before you begin your internship, you must complete the Career Services Internship Reporting Form. You will not be permitted to graduate if you accept or begin work at an internship which does not meet Heinz College standards. Your internship will be verified with your supervisor. You must notify your Career Advisor of any significant changes in your internship, such as length, location, hours of work, etc.

Near the end of the internship, the Career Services Office will request that your supervisor complete an evaluation form about your performance during the summer. You are also required to complete an evaluation survey as well as a self-reflection statement describing how your internship fulfilled the educational goals of the program. If you do not successfully complete an eligible internship along with your survey and self-evaluation, you will not fulfill your internship requirement necessary for graduation. Based on the supervisor's evaluation and your self-reflection statement, Career Services will advise the Masters Committee if you have satisfactorily completed the internship requirement. If you do not successfully complete an eligible internship, you will have to complete one before you can graduate.

The Career Services Office encourages you to notify them of job opportunities within your internship organization which might be available for future Heinz College graduates or interns. The Office will maintain these descriptions for reference by both first and second year students.

7.3 Internship Opportunity Fund

Students who are required to complete internships and accept internships that do not qualify for funding under the Federal Work Study (FWS) program, either because the student does not have federal financial aid eligibility or because the employer and/or the job does not meet federal regulations for FWS eligibility, may apply to the Heinz College Internship Opportunity Fund (IOF) for consideration of awards to help support non-paying and low paying internships. Students are never eligible to receive both IOF and FWS funds to subsidize the same position.

The Internship Opportunity Fund (IOF) is a student-run group that holds various fundraising activities throughout the year to raise money that will be matched by the College and then redistributed to students taking low-paying or unpaid summer internships, regardless of the employer's sector. The IOF is open to students in all programs who do not qualify for FWS and that have a required summer internship component, regardless of the employer's sector. Students that actively participate in the fundraising, and that have a demonstrated financial need, will receive preference when the funds are distributed.

The number of students that can receive IOF support, and the amount of support they can receive, depends directly on the success of the fundraising effort organized by students. Students who may wish to seek support from IOF should begin working early in the year to help raise funds.

8 STATEMENT OF ASSURANCE

Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex, handicap or disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Furthermore, Carnegie Mellon University does not discriminate and is required not to discriminate in violation of federal, state, or local laws or executive orders.

Inquiries concerning the application of and compliance with this statement should be directed to the university ombudsman, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-1018.

Obtain general information about Carnegie Mellon University by calling 412-268-2000.