Data Science (Collaborative Specialization)

This section presents the requirements for programs in:

- **M.Sc. Biology with Collaborative Specialization in Data Science**
- **M.A.Sc. Biomedical Engineering with Collaborative Specialization in Data Science**
- **M.Eng. Biomedical Engineering with Collaborative Specialization in Data Science**
- **M.Sc. in Chemistry with Collaborative Specialization in Data Science**
- **Master of Cognitive Science with Collaborative Specialization in Data Science**
- **M.A. Communication with Collaborative Specialization in Data Science**
- **M.C.S. Computer Science with Collaborative Specialization in Data Science**
- **M.A. Economics with Collaborative Specialization in Data Science**
- **M.A.Sc. Electrical and Computer Engineering with Collaborative Specialization in Data Science**
- **M.Eng. Electrical and Computer Engineering with Collaborative Specialization in Data Science**
- **M.A. Geography with Collaborative Specialization in Data Science**
- **M.Sc. Geography with Collaborative Specialization in Data Science**
- **M.Sc. Health Sciences with Collaborative Specialization in Data Science**
- **M.A. History with Collaborative Specialization in Data Science**
- **M.A. International Affairs with Collaborative Specialization in Data Science**
- **M.A.Sc. Digital Media with Collaborative Specialization in Data Science**
- **M.Sc. Physics Medical Physics Stream with Collaborative Specialization in Data Science**
- **M.Sc. Physics Particle Physics Stream with Collaborative Specialization in Data Science**
- **M.A. Psychology with Collaborative Specialization in Data Science**
- **Master of Public Policy and Administration with Collaborative Specialization in Data Science**
- **M.A. Sociology with Collaborative Specialization in Data Science**

Program Requirements

Students enrolled in the Collaborative Program in Data Science must meet the requirements of their respective home units as well as those of the Collaborative Program. The requirements of the Collaborative Program do not, however, add to the number of credits students are required to accumulate by their home unit and the credit value of the degree remains the same. Consult the individual programs for detailed program requirements.

M.Sc. Biology with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in approved coursework		0.5
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 4.0 credits in:		4.0
BIOL 5909 [4.0]	M.Sc. Thesis (in the specialization, including successful oral defence)	
Total Credits		**5.0**

M.A.Sc. Biomedical Engineering with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in:		0.5
BIOM 5010 [0.5]	Introduction to Biomedical Engineering	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 1.0 credit in BIOM (BMG) courses		1.0
4. 0.5 credit in elective courses taken either at Carleton University or University of Ottawa with the approval of the OCIBME Director or Associate Director		0.5
5. 2.5 credits in:		2.5
BIOM 5909 [2.5]	M.A.Sc. Thesis (in the specialization)	
6. 0.0 credit in:		0.0
BIOM 5800 [0.0]	Biomedical Engineering Seminar	
Total Credits		**5.0**

Note: for the course work **Item 3** and **Item 4** above, one 0.5 credit data science elective course must be taken (one of BIOM 5202, BIOM 5400, BIOM 5405, COMP 5100, COMP 5101, COMP 5107, COMP 5108, COMP 5111, COMP 5112, COMP 5204, COMP 5209, COMP 5305, COMP 5306, COMP 5307, COMP 5308, COMP 5401, COMP 5703, COMP 5704, PHYS 5002, SYSC 5001, SYSC 5003, SYSC 5004, SYSC 5007, SYSC 5101, SYSC 5102, SYSC 5103, SYSC 5108, SYSC 5201, SYSC 5207, SYSC 5300, SYSC 5303, SYSC 5306, SYSC 5401, SYSC 5404, SYSC 5405, SYSC 5407, SYSC 5500, SYSC 5703, SYSC 5706).

M.Eng. Biomedical Engineering with Collaborative Specialization in Data Science (5.0 credits)

Requirements - by coursework:

1. 0.5 credit in:		0.5
BIOM 5010 [0.5]	Introduction to Biomedical Engineering	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 2.0 credits in BIOM (BMG) courses		2.0

4. 2.0 credits in elective courses at either Carleton University or University of Ottawa with the approval of the OCIBME Director or Associate Director		2.0
5. 0.0 credit in:		
BIOM 5800 [0.0]	Biomedical Engineering Seminar	
Total Credits		**5.0**

Note: for the course work Item 3 and Item 4 above, three 0.5-credit data science elective courses must be taken (three of BIOM 5400,BIOM 5405, COMP 5100, COMP 5101, COMP 5107, COMP 5108, COMP 5111, COMP 5112, COMP 5204, COMP 5209, COMP 5305,COMP 5306, COMP 5307, COMP 5308, COMP 5401,COMP 5703, COMP 5704, PHYS 5002, SYSC 5001, SYSC 5003,SYSC 5004, SYSC 5007, SYSC 5101, SYSC 5102, SYSC 5103, SYSC 5108, SYSC 5201, SYSC 5207, SYSC 5300, SYSC 5303, SYSC 5306, SYSC 5401,SYSC 5404, SYSC 5405, SYSC 5407, SYSC 5500, SYSC 5703, SYSC 5706)

Requirements - by project:

1. 0.5 credit in:		0.5
BIOM 5010 [0.5]	Introduction to Biomedical Engineering	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 1.5 credits in BIOM (BMG) courses		1.5
4. 1.0 credit in elective courses at either Carleton University or University of Ottawa with the approval of the OCIBME Director or Associate Director		1.0
5. 0.0 credit in:		
BIOM 5800 [0.0]	Biomedical Engineering Seminar	
6. 1.5 credit in:		1.5
BIOM 5900 [1.5]	Biomedical Engineering Project (in the specialization)	
Total Credits		**5.0**

Note: for the course work Item 3 and Item 4 above, three 0.5-credit data science elective courses must be taken (three of BIOM 5400,BIOM 5405, COMP 5100, COMP 5101, COMP 5107, COMP 5108, COMP 5111, COMP 5112, COMP 5204, COMP 5209, COMP 5305,COMP 5306, COMP 5307, COMP 5308, COMP 5401,COMP 5703, COMP 5704, PHYS 5002, SYSC 5001, SYSC 5003,SYSC 5004, SYSC 5007, SYSC 5101, SYSC 5102, SYSC 5103, SYSC 5108, SYSC 5201, SYSC 5207, SYSC 5300, SYSC 5303, SYSC 5306, SYSC 5401,SYSC 5404, SYSC 5405, SYSC 5407, SYSC 5500, SYSC 5703, SYSC 5706)

M.Sc. in Chemistry with Collaborative Specialization in Data Science (5.0 credits)

Requirements

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
CHEM 5810 [0.5]	Seminar I	
3. 0.5 credit in:		0.5
CHEM 5804 [0.5]	Modern Scientific Communication	
4. 0.5 credit in CHEM at the graduate level, which may include up to 0.5 credit in another discipline, with permission of the department.		0.5
5. 3.0 credits in:		3.0
CHEM 5909 [3.0]	M.Sc. Thesis (in the specialization)	
Total Credits		**5.0**

Master of Cognitive Science with Collaborative Specialization in Data Science (5.0 credits)

Requirements - Thesis pathway (5.0 credits)

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
CGSC 5100 [0.5]	Issues in Cognitive Science	
3. 0.5 credit in:		0.5
CGSC 5101 [0.5]	Experimental Methods and Statistics	
4. 1.0 credit in CGSC or other approved courses, from two different cognitive disciplines, selected in consultation with the graduate supervisor.		1.0
5. 2.5 credits in:		2.5
CGSC 5909 [2.5]	M. Cog. Thesis (The thesis must be approved as fulfilling the data science requirement and be supervised by a faculty member working in a data science related field.)	
6. Preparation of research for presentation at the Carleton Cognitive Science Spring Conference.		
Total Credits		**5.0**

Requirements - Research Project pathway (5.0 credits)

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
CGSC 5100 [0.5]	Issues in Cognitive Science	
3. 0.5 credit in:		0.5
CGSC 5101 [0.5]	Experimental Methods and Statistics	
4. 1.5 credits from:		1.5
CGSC 5001 [0.5]	Cognition and Artificial Cognitive Systems	
CGSC 5002 [0.5]	Experimental Research in Cognition	
CGSC 5003 [0.5]	Language and Cognition	
CGSC 5004 [0.5]	Cognition and Conceptual Issues	
CGSC 5005 [0.5]	Cognition and Neuroscience	
5. 1.0 credit in CGSC or other approved courses selected in consultation with the graduate supervisor.		1.0
6. 1.0 credit in:		1.0
CGSC 5908 [1.0]	Research Project (Project must be approved as fulfilling the data science requirement and be supervised by a faculty member working in a data science related field.)	
7. Preparation of research for presentation at the Cognitive Science Spring Conference.		
Total Credits		**5.0**

M.A. Communication with Collaborative Specialization in Data Science (5.0 credits)

Requirements - Coursework pathway (5.0 credits)

1. 0.5 credit in:		**0.5**
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		**1.0**
COMS 5101 [1.0]	Foundations of Communication Studies	
3. 0.5 credit in:		**0.5**
COMS 5605 [0.5]	Approaches to Communication Research	
4. 0.5 credit in:		**0.5**
COMS 5225 [0.5]	Critical Data Studies	
5. 0.5 credit from:		**0.5**
COMS 5203 [0.5]	Communication, Technology, Society	
COMS 5221 [0.5]	Science and the Making of Knowledge	
COMS 5224 [0.5]	Internet, Infrastructure, Materialities	
6. 2.0 credits in electives		**2.0**
Total Credits		**5.0**

Requirements - Research essay pathway (5.0 credits)

1. 0.5 credit in:		**0.5**
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		**1.0**
COMS 5101 [1.0]	Foundations of Communication Studies	
3. 0.5 credit in:		**0.5**
COMS 5605 [0.5]	Approaches to Communication Research	
4. 0.5 credit in:		**0.5**
COMS 5225 [0.5]	Critical Data Studies	
5. 1.0 credit in:		**1.0**
COMS 5908 [1.0]	Research Essay	
Research Essay on a Data Science topic approved by the Advisory Board representative from Communication in consultation with the graduate Committee of the Institute of Data Science.		
6. 1.5 credits in electives.		**1.5**
Total Credits		**5.0**

Requirements - Thesis pathway (5.0 credits)

1. 0.5 credit in:		**0.5**
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		**1.0**
COMS 5101 [1.0]	Foundations of Communication Studies	
3. 0.5 credit in:		**0.5**
COMS 5605 [0.5]	Approaches to Communication Research	
4. 0.5 credit in:		**0.5**
COMS 5225 [0.5]	Critical Data Studies	
5. 2.0 credits in:		**2.0**
COMS 5909 [2.0]	M.A. Thesis	
M.A. Thesis on a Data Science topic approved by the Advisory Board representative from Communication in consultation with the Graduate Committee of the Institute of Data Science.		
6. 0.5 credit in electives		**0.5**
Total Credits		**5.0**

M.C.S. Computer Science with Collaborative Specialization in Data Science (5.0 credits)

Requirements - Thesis pathway (5.0 credits)

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 2.0 credits in course work. Course work must include a minimum of 1.5 credits of OCICS courses in at least three different research areas. See OCICS course listing by research areas.		2.0
3. 2.5 credits in:		2.5
COMP 5905 [2.5]	M.C.S. Thesis (M.C.S. Thesis must be in an area of Data Science and requires approval from the Institute of Data Science. Each candidate submitting a thesis will be required to undertake an oral defence of the thesis.)	
Total Credits		**5.0**

M.A. Economics with Collaborative Specialization in Data Science (4.0 credits)

Requirements - Coursework pathway (4.0 credits)

1. 1.5 credits in:		1.5
ECON 5020 [0.5]	Microeconomic Theory	
ECON 5021 [0.5]	Macroeconomic Theory	
ECON 5027 [0.5]	Econometrics I	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 0.5 credit in:		0.5
ECON 5029 [0.5]	Methods of Economic Research including a research paper on a data science related topic	
4. 0.5 credit from:		0.5
ECON 5055 [0.5]	Financial Econometrics	
ECON 5361 [0.5]	Labour Economics I	
ECON 5362 [0.5]	Labour Economics II	
ECON 5700 [0.5]	Social and Economic Measurement	
ECON 5712 [0.5]	Micro-Econometrics	
ECON 5713 [0.5]	Time-Series Econometrics	
or approved Special Topics course (ECON 5880) in the area of Data Science		
5. 0.5 credit in ECON approved by the M.A. Supervisor of the Department of Economics		0.5
6. 0.5 credit in Data Science elective (which may be an additional course from the preceding list) approved by the M.A. Supervisor of the Department of Economics		0.5
Total Credits		**4.0**

Requirements - Thesis pathway (4.0 credits)

1. 1.5 credits in:		1.5
ECON 5020 [0.5]	Microeconomic Theory	
ECON 5021 [0.5]	Macroeconomic Theory	
ECON 5027 [0.5]	Econometrics I	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	

3. 1.5 credit in:		1.5
ECON 5909 [1.5]	M.A. Thesis	
on a data science topic approved by the Data Science governance committee		
4. 0.5 credit from:		0.5
ECON 5055 [0.5]	Financial Econometrics	
ECON 5361 [0.5]	Labour Economics I	
ECON 5362 [0.5]	Labour Economics II	
ECON 5700 [0.5]	Social and Economic Measurement	
ECON 5712 [0.5]	Micro-Econometrics	
ECON 5713 [0.5]	Time-Series Econometrics	
or approved Special Topics course (ECON 5880) in the area of Data Science		
Total Credits		**4.0**

M.A.Sc. Electrical and Computer Engineering with Collaborative Specialization in Data Science (5.0 credits)

Requirements - by Thesis (5.0 credits)

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit from data science elective courses:		0.5
SYSC 5001 [0.5]	Simulation and Modeling	
SYSC 5004 [0.5]	Optimization for Engineering Applications	
SYSC 5101 [0.5]	Design of High Performance Software	
SYSC 5103 [0.5]	Software Agents	
SYSC 5104 [0.5]	Methodologies For Discrete-Event Modeling And Simulation	
SYSC 5201 [0.5]	Computer Communication	
SYSC 5207 [0.5]	Distributed Systems Engineering	
SYSC 5303 [0.5]	Interactive Networked Systems and Telemedicine	
SYSC 5306 [0.5]	Mobile Computing Systems	
SYSC 5401 [0.5]	Adaptive and Learning Systems	
SYSC 5405 [0.5]	Pattern Classification and Experiment Design	
SYSC 5407 [0.5]	Planning and Design of Computer Networks	
SYSC 5500 [0.5]	Designing Secure Networking and Computer Systems	
SYSC 5703 [0.5]	Integrated Database and Cloud Systems	
3. 1.5 credits in courses		1.5
4. 2.5 credits in:		2.5
SYSC 5909 [2.5]	M.A.Sc. Thesis	
in the area of data science (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)		
Total Credits		**5.0**

M.Eng. Electrical and Computer Engineering with Collaborative Specialization in Data Science (4.5 credits)

Requirements - by Project (4.5 credits)

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit from data science elective courses:		1.0
SYSC 5001 [0.5]	Simulation and Modeling	
SYSC 5004 [0.5]	Optimization for Engineering Applications	
SYSC 5101 [0.5]	Design of High Performance Software	
SYSC 5103 [0.5]	Software Agents	
SYSC 5104 [0.5]	Methodologies For Discrete-Event Modeling And Simulation	
SYSC 5201 [0.5]	Computer Communication	
SYSC 5207 [0.5]	Distributed Systems Engineering	
SYSC 5303 [0.5]	Interactive Networked Systems and Telemedicine	
SYSC 5306 [0.5]	Mobile Computing Systems	
SYSC 5401 [0.5]	Adaptive and Learning Systems	
SYSC 5405 [0.5]	Pattern Classification and Experiment Design	
SYSC 5407 [0.5]	Planning and Design of Computer Networks	
SYSC 5500 [0.5]	Designing Secure Networking and Computer Systems	
SYSC 5703 [0.5]	Integrated Database and Cloud Systems	
3. 2.5 credits in courses, which may include up to an additional 0.5 credit in project		2.5
4. 0.5 credit in:		0.5
SYSC 5900 [0.5]	Systems Engineering Project	
in the area of data science		
Total Credits		**4.5**

Requirements - by Coursework (4.5 credits)

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.5 credits from data science elective courses:		1.5
SYSC 5001 [0.5]	Simulation and Modeling	
SYSC 5004 [0.5]	Optimization for Engineering Applications	
SYSC 5101 [0.5]	Design of High Performance Software	
SYSC 5103 [0.5]	Software Agents	
SYSC 5104 [0.5]	Methodologies For Discrete-Event Modeling And Simulation	
SYSC 5201 [0.5]	Computer Communication	
SYSC 5207 [0.5]	Distributed Systems Engineering	
SYSC 5303 [0.5]	Interactive Networked Systems and Telemedicine	
SYSC 5306 [0.5]	Mobile Computing Systems	
SYSC 5401 [0.5]	Adaptive and Learning Systems	
SYSC 5405 [0.5]	Pattern Classification and Experiment Design	
SYSC 5407 [0.5]	Planning and Design of Computer Networks	
SYSC 5500 [0.5]	Designing Secure Networking and Computer Systems	
SYSC 5703 [0.5]	Integrated Database and Cloud Systems	
3. 0.5 credit in:		0.5
SYSC 5902 [0.5]	Research Methods for Engineers	
4. 2.0 credits in courses		2.0
Total Credits		**4.5**

M.A. Geography with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
GEOG 5000 [0.5]	Approaches to Geographical Inquiry	
3. 2.5 credits in:		2.5
GEOG 5909 [2.5]	M.A. Thesis (in the specialization and including oral examination of the thesis)	
4. 0.5 credit in:		0.5
GEOG 5905 [0.5]	Masters Research Workshop	
5. 1.0 credit in approved graduate-level electives		1.0
6. In addition to the formal requirements, M.A. students are required to attend the Departmental Seminar series, and the Graduate Field Camp.		
Total Credits		**5.0**

M.Sc. Geography with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
GEOG 5001 [0.5]	Modeling Environmental Systems	
3. 0.5 credit in:		0.5
GEOG 5905 [0.5]	Masters Research Workshop	
4. 0.5 credit in Physical Geography selected from:		0.5
GEOG 5002 [0.5]	Quantitative Analysis for Geographical Research	
GEOG 5103 [0.5]	Hydrologic Principles and Methods	
GEOG 5104 [0.5]	Advanced Biogeography	
GEOG 5107 [0.5]	Field Study and Methodological Research	
GEOG 5303 [0.5]	Geocryology	
GEOG 5307 [0.5]	Soil Resources	
GEOG 5803 [0.5]	Seminar in Geomatics	
GEOG 5804 [0.5]	Geographic Information Systems	
GEOG 5900 [0.5]	Graduate Tutorial	
up to 0.5 credit in GEOG or GEOM at the 4000 level, with departmental approval		
5. 3.0 credits in:		3.0
GEOG 5906 [3.0]	M.Sc. Thesis (in the specialization and including oral examination of the thesis)	
6. In addition to the formal requirements, M.Sc. students are required to attend the DGES Departmental Seminar series, and the Graduate Field Camp.		
Total Credits		**5.0**

M.Sc. Health Sciences with Collaborative Specialization in Data Science (5.5 credits)

Requirements (5.5 credits):

1. 0.5 credit in:		0.5
HLTH 5903 [0.5]	Current Topics in Interdisciplinary Health Sciences	
2. 0.5 credit from:		0.5
HLTH 5902 [0.5]	Seminars in Interdisciplinary Health Sciences for MSc	
or elective, approved by Thesis Supervisor and Graduate Advisor		
3. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
4. 0.0 credit in:		0.0
HLTH 5905 [0.0]	Final Research Seminar Presentation for MSc (Must be completed within one month of thesis defence)	
5. 4.0 credits in:		4.0
HLTH 5909 [4.0]	MSc Thesis (in the specialization)	
6. Twice-yearly meetings with the thesis Graduate Advisory Committee, with students meeting a level of progress as determined by the Committee.		
Total Credits		**5.5**

M.A. History with Collaborative Specialization in Data Science (4.5 credits)

Requirements:

1. 0.5 credit in:		0.5
HIST 5003 [0.5]	Historical Theory and Method	
2. 1.5 credits in HIST at the graduate level of which only 0.5 credit may be taken in a designated public history course; with departmental permission, up to 0.5 credit of courses with historical content may be taken from another unit at Carleton University, at the University of Ottawa, or at another accredited institution.		1.5
3. 0.5 credit in:		0.5
HIST 5706 [0.5]	Digital History	
4. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
5. 0.5 credit in:		0.5
HIST 5900 [0.5]	Directed Research	
6. 1.0 credit in:		1.0
HIST 5908 [1.0]	M.A. Research Essay (in the specialization)	
Total Credits		**4.5**

M.A. International Affairs with Collaborative Specialization in Data Science (5.0 credits)

Requirements - Thesis pathway:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		1.0
INAF 5016 [0.5]	Statistical Analysis for International Affairs	
INAF 5017 [0.25]	International Policymaking in Canada: Structure and Process	
INAF 5018 [0.25]	Law and International Affairs	
3. 0.5 credit in Economics, successfully completed by the end of the second term from: (see Note 1, below)		0.5
INAF 5009 [0.5]	International Aspects of Economic Development	

INAF 5205 [0.5]	Economics of Conflict	
INAF 5214 [0.5]	Economics for Defence and Security	
INAF 5308 [0.5]	International Trade: Theory and Policy	
INAF 5309 [0.5]	International Finance: Theory and Policy	
INAF 5600 [0.5]	The Economics of Human Development	
INAF 5703 [0.5]	International Public Economics	
4. 2.0 credits in:		2.0
INAF 5909 [2.0]	M.A. Thesis (in the specialization)	
5. 1.0 credit in Field or Elective courses		1.0
6. Successful completion of second language proficiency examination (See Note 4, below)		
Total Credits		**5.0**

Requirements - Research essay pathway:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		1.0
INAF 5016 [0.5]	Statistical Analysis for International Affairs	
INAF 5017 [0.25]	International Policymaking in Canada: Structure and Process	
INAF 5018 [0.25]	Law and International Affairs	
3. 0.5 credit in Economics, successfully completed by the end of the second term, from: (See Note 1, below)		0.5
INAF 5009 [0.5]	International Aspects of Economic Development	
INAF 5205 [0.5]	Economics of Conflict	
INAF 5214 [0.5]	Economics for Defence and Security	
INAF 5308 [0.5]	International Trade: Theory and Policy	
INAF 5309 [0.5]	International Finance: Theory and Policy	
INAF 5600 [0.5]	The Economics of Human Development	
INAF 5703 [0.5]	International Public Economics	
4. 1.0 credit in:		1.0
INAF 5908 [1.0]	Research Essay (in the specialization)	
5. 2.0 credits in Field or Elective Courses (See Note 3, below)		2.0
6. Successful completion of second language proficiency examination (See Note 4, below)		
Total Credits		**5.0**

Requirements - Coursework pathway:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		1.0
INAF 5016 [0.5]	Statistical Analysis for International Affairs	
INAF 5017 [0.25]	International Policymaking in Canada: Structure and Process	
INAF 5018 [0.25]	Law and International Affairs	
3. 0.5 credit in specialization: (see Note 1, below)		0.5
INAF 5904 [0.5]	Quantitative Research Methods	
INAF 6002 [0.5]	Quantitative Research Methods	
4. 0.5 credit in Economics, successfully completed by the end of the second term, from: (see Note 2, below)		0.5
INAF 5009 [0.5]	International Aspects of Economic Development	
INAF 5205 [0.5]	Economics of Conflict	
INAF 5214 [0.5]	Economics for Defence and Security	
INAF 5308 [0.5]	International Trade: Theory and Policy	
INAF 5309 [0.5]	International Finance: Theory and Policy	
INAF 5600 [0.5]	The Economics of Human Development	
INAF 5703 [0.5]	International Public Economics	
5. 2.5 credits in Field or Elective courses (See Note 3, below)		2.5
6. Successful completion of second language proficiency examination (see Note 4, below)		
Total Credits		**5.0**

Notes:

1. The course must include at least one major assignment with a significant data science component. The selected course must be approved by the School and Institute for Data Science. An accepted data science specialization course from outside the School can be used for this requirement with approval.
2. All students must complete the 0.5 credit economics course for their designated field, or an approved alternate economics course. For students in the IEP field both INAF 5308 and INAF 5309 , or approved equivalent, must be completed.
3. For elective courses, 1.5 credits of the total required 5.0 credits may be selected from courses offered in other departments, with a maximum of 1.0 credit from a single department and a maximum of 1.0 credit selected from fourth year undergraduate courses. Any course not identified as an INAF 5000-level course must be approved by the M.A. Program Supervisor.
4. Students must successfully complete an examination in second language proficiency administered by Carleton University's School of Linguistics and Language Studies, or meet the equivalent standard as determined by the School of Linguistics and Language Studies. Details of the language requirement are provided on the School website.

M.A.Sc. Digital Media with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
ITEC 5002 [0.5]	Fundamentals of Information Technology Research	
3. 1.0 credit from core courses:		1.0
ITEC 5010 [0.5]	Applied Programming I	
ITEC 5200 [0.5]	Entertainment Technologies	

ITEC 5201 [0.5]	Computer Animation Technologies	
ITEC 5202 [0.5]	Visual Effects Technologies	
ITEC 5203 [0.5]	Game Design and Development Technologies	
ITEC 5204 [0.5]	Emerging Interaction Techniques	
ITEC 5205 [0.5]	Design and Development of Data-Intensive Applications	
ITEC 5206 [0.5]	Data Protection and Rights Management	
ITEC 5207 [0.5]	Data Interaction Techniques	
ITEC 5208 [0.5]	Virtual Reality and 3D User Interfaces	
ITEC 5920 [0.5]	Special Topics in Digital Media	
4. 0.5 credit in electives, which may include up to 0.5 credit from a 4000-level course, or a 0.5 credit graduate course from another discipline, with permission from their graduate supervisor or the Associate Director of Graduate Studies in the School.		0.5
5. 2.5 credits in:		2.5
ITEC 5909 [2.5]	Master's Thesis (in the specialization)	
Total Credits		**5.0**

Note: No additional IT seminar requirements for this stream.

M.Sc. Physics
Medical Physics Stream with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
PHYS 5002 [0.5]	Statistical Data Analysis Techniques for Physics (or equivalent course in computing physics)	
3. 0.5 credit in:		0.5
PHYS 5203 [0.5]	Medical Radiation Physics	
4. 0.5 credits from:		0.5
PHYS 5204 [0.5]	Physics of Medical Imaging (for imaging)	
PHYS 5206 [0.5]	Medical Radiotherapy Physics (for therapy)	
PHYS 5207 [0.5]	Radiobiology (for biophysics)	
5. 0.5 additional credit in PHYS or PHYJ. With approval, an appropriate graduate-level course in engineering, computer science, business or law can be used.		0.5
6. 2.5 credits in		2.5
PHYS 5909 [2.5]	M.Sc. Thesis (on a data science topic approved by the Data Science governance committee and defended at an oral examination)	
7. Participation in the seminar series of the Ottawa-Carleton Institute for Physics		
Total Credits		**5.0**

M.Sc. Physics
Particle Physics Stream with Collaborative Specialization in Data Science (5.0 credits)

Requirements:

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
PHYS 5002 [0.5]	Statistical Data Analysis Techniques for Physics (or equivalent course in computing physics)	
3. 1.5 credit in:		1.5
PHYS 5602 [0.5]	Physics of Elementary Particles	
PHYS 5701 [0.5]	Intermediate Quantum Mechanics with Applications	
PHYS 5702 [0.5]	Relativistic Quantum Mechanics	
4. 2.5 credits in:		2.5
PHYS 5909 [2.5]	M.Sc. Thesis (on a data science topic approved by the Data Science governance committee and defended at an oral examination)	
5. Participation in the seminar series of the Ottawa-Carleton Institute of Physics		
Total Credits		**5.0**

M.A. Psychology
with Collaborative Specialization in Data Science (5.0 credits)

Notes:

1. Students must receive a minimum grade of A in each of the courses included in the Specialization.
2. Courses for each research area are listed on the departmental website: carleton.ca/psychology.

Requirements:

1. 1.0 credit in:		1.0
PSYC 5410 [0.5]	Foundations of the General Linear Model	
PSYC 5411 [0.5]	Extension of the General Linear Model	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 0.5 credit in PSYC at the 5000 level, excluding the professional development courses listed in Item 4 and excluding the elective statistics courses listed below.		0.5
4. 0.5 credit from the following professional development courses:		0.5
PSYC 5000 [0.5]	Introduction to Program Evaluation	
PSYC 5002 [0.5]	Ethics in Psychology	
PSYC 5003 [0.5]	Open Science and Methodological Improvements	
PSYC 5004 [0.5]	Knowledge Mobilization	
PSYC 5802 [0.5]	Special Topics: Professional Development	
PSYC 5903 [0.5]	Practicum in Psychology	
5. Completion of:		**0.0**
PSYC 5906 [0.0]	Pro-Seminar in Psychology	
6. 2.5 credits in:		2.5

PSYC 5909 [2.5]	M.A. Thesis (in the area of Data Science, which must be defended at an oral examination)	
Total Credits		**5.0**

Master of Public Policy and Administration with Collaborative Specialization in Data Science (7.0 credits)

Requirements - Coursework pathway:

1. 4.0 credits in core courses:		4.0
PADM 5120 [0.5]	Modern Challenges to Governance	
PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change	
PADM 5122 [0.5]	Public Management: Principles and Approaches	
PADM 5123 [0.5]	Public Management in Practice	
PADM 5125 [0.5]	Qualitative Methods for Public Policy	
PADM 5127 [0.5]	Microeconomics for Policy Analysis	
PADM 5128 [0.5]	Macroeconomics for Policy Analysis	
PADM 5129 [0.5]	Capstone Course	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 1.0 credit in data science core courses:		1.0
PADM 5126 [0.5]	Quantitative Methods for Public Policy	
PADM 5218 [0.5]	Analysis of Socio-economic Data	
4. 0.5 credit from data science electives:		0.5
COMP 5111 [0.5]	Data Management for Business Intelligence	
COMP 5209 [0.5]	Visual Analytics	
COMP 5305 [0.5]	Advanced Database Systems	
COMP 5306 [0.5]	Data Integration	
PADM 5219 [0.5]	Advanced Statistical Policy Analysis	
PADM 5372 [0.5]	Policy Seminar (Data Science Specialization)	
PADM 5391 [0.5]	Directed Studies (Data Science Specialization)	
5. 1.0 credit in approved elective (see School website for details)		1.0
Total Credits		**7.0**

Requirements - Research essay pathway:

1. 4.0 credits in core courses:		4.0
PADM 5120 [0.5]	Modern Challenges to Governance	
PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change	
PADM 5122 [0.5]	Public Management: Principles and Approaches	
PADM 5123 [0.5]	Public Management in Practice	
PADM 5125 [0.5]	Qualitative Methods for Public Policy	
PADM 5127 [0.5]	Microeconomics for Policy Analysis	
PADM 5128 [0.5]	Macroeconomics for Policy Analysis	
PADM 5129 [0.5]	Capstone Course	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 1.0 credit in data science core courses:		1.0
PADM 5126 [0.5]	Quantitative Methods for Public Policy	
PADM 5218 [0.5]	Analysis of Socio-economic Data	
3. 0.5 credit in approved elective (see School website for details)		0.5
4. 1.0 credit in:		1.0
PADM 5908 [1.0]	Research Essay (on a Data Science topic approved by the MPPA Graduate Supervisor and the Data Science governance committee)	
Total Credits		**7.0**

Master of Public Policy and Administration with Collaborative Specialization in Data Science (Advanced completion, 5.0 credits)

Requirements - Coursework pathway (Advanced completion, 5.0 credits):

1. 2.5 credits from core courses:		2.5
PADM 5120 [0.5]	Modern Challenges to Governance	
PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change	
PADM 5122 [0.5]	Public Management: Principles and Approaches	
PADM 5123 [0.5]	Public Management in Practice	
PADM 5125 [0.5]	Qualitative Methods for Public Policy	
PADM 5127 [0.5]	Microeconomics for Policy Analysis	
PADM 5128 [0.5]	Macroeconomics for Policy Analysis	
PADM 5129 [0.5]	Capstone Course	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 0.5 credit from data science core courses:		0.5
PADM 5126 [0.5]	Quantitative Methods for Public Policy	
PADM 5218 [0.5]	Analysis of Socio-economic Data	
4. 0.5 credit from data science electives:		0.5
COMP 5111 [0.5]	Data Management for Business Intelligence	
COMP 5209 [0.5]	Visual Analytics	
COMP 5305 [0.5]	Advanced Database Systems	
COMP 5306 [0.5]	Data Integration	
PADM 5219 [0.5]	Advanced Statistical Policy Analysis	
PADM 5372 [0.5]	Policy Seminar (Data Science Specialization)	
PADM 5391 [0.5]	Directed Studies (Data Science Specialization)	
5. 1.0 credit in approved elective (see School website for details)		1.0
Total Credits		**5.0**

Requirements - Research essay pathway (Advanced completion, 5.0 credits):

1. 2.5 credits from core courses:		2.5
PADM 5120 [0.5]	Modern Challenges to Governance	
PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change	

PADM 5122 [0.5]	Public Management: Principles and Approaches	
PADM 5123 [0.5]	Public Management in Practice	
PADM 5125 [0.5]	Qualitative Methods for Public Policy	
PADM 5127 [0.5]	Microeconomics for Policy Analysis	
PADM 5128 [0.5]	Macroeconomics for Policy Analysis	
PADM 5129 [0.5]	Capstone Course	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
3. 0.5 credit from data science core courses:		0.5
PADM 5126 [0.5]	Quantitative Methods for Public Policy	
PADM 5218 [0.5]	Analysis of Socio-economic Data	
3. 0.5 credit in approved elective (see School website for details)		0.5
4. 1.0 credit in:		1.0
PADM 5908 [1.0]	Research Essay (on a Data Science topic approved by the MPPA Graduate Supervisor and the Data Science governance committee)	
Total Credits		**5.0**

M.A. Sociology with Collaborative Specialization in Data Science (5.0 credits)

Requirements - Thesis pathway (5.0 credits):

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		1.0
SOCI 5005 [0.5]	Recurring Debates in Social Thought	
SOCI 5809 [0.5]	The Logic of the Research Process	
3. 1.0 credit in:		1.0
SOCI 5102 [0.5]	Multiple Regression Analysis	
SOCI 5104 [0.5]	Advanced Multivariate Analysis	
4. 0.5 credit in SOCI at the graduate level (not including those listed above). May be selected from courses at the 4000-level, with department permission.		0.5
5. 2.0 credits in:		2.0
SOCI 5909 [2.0]	M.A. Thesis (in the specialization)	
6.0 An oral examination on the candidate's thesis and program		
Total Credits		**5.0**

Requirements – Research Essay pathway (5.0 credits):

1. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
2. 1.0 credit in:		1.0
SOCI 5005 [0.5]	Recurring Debates in Social Thought	
SOCI 5809 [0.5]	The Logic of the Research Process	
3. 1.0 credit in:		1.0
SOCI 5102 [0.5]	Multiple Regression Analysis	
SOCI 5104 [0.5]	Advanced Multivariate Analysis	
4. 1.5 credits in SOCI at the graduate level (not including those listed above). With department permission 0.5 credit may be selected from courses at the 4000-level.		1.5
5. 1.0 credit in:		1.0
SOCI 5908 [1.0]	M.A. Research Essay (in the specialization)	
6. An oral examination on the candidate's research essay and program		
Total Credits		**5.0**

Regulations

See the General Regulations section of this Calendar, as well as regulations pertaining to the specific collaborative programs offering the data science specialization.

Admission

Students who are enrolled in a master's program in one of the participating units may apply to the Data Science governance committee for admission to the Collaborative Program. Admission to the program is determined by the governance committee and will normally take place before the end of October the year of admittance in one of the participating master's programs.

Admission requirements to the Collaborative Master's with Specialization in Data Science are:

- Registration in the master's program of one of the participating units
- Approval of a student's program of study by the Data Science governance committee and the student's home department. Students in a thesis program will be expected to choose a thesis topic that is directly related to Data Science. Students in an approved course work program will be required to take some elective courses in designated or approved courses with significant Data Science content.