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:

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

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

Requirements:

BIOM 5800 [0.0]	Biomedical Engineering Seminar	
	Discussificat Facilities also Occasions	
6. 0.0 credit in:		0.0
BIOM 5909 [2.5]	M.A.Sc. Thesis (in the specialization)	
5. 2.5 credits in:		2.5
	ve courses taken either at Carleton ty of Ottawa with the approval of the Associate Director	0.5
3. 1.0 credit in BIOM	1 (BMG) courses	1.0
DATA 5000 [0.5]	Data Science Seminar	
2. 0.5 credit in:		0.5
BIOM 5010 [0.5]	Introduction to Biomedical Engineering	
i. o.o oroait iii.		0.5
1. 0.5 credit in:		0.5

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 BIO	M (BMG) courses	2.0

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

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:

		the specialization)	
	BIOM 5900 [1.5]	Biomedical Engineering Project (in	
6.	1.5 credit in:		1.5
	BIOM 5800 [0.0]	Biomedical Engineering Seminar	
5.	0.0 credit in:		
U		ive courses at either Carleton ity of Ottawa with the approval of the Associate Director	1.0
3.	1.5 credits in BIO	M (BMG) courses	1.5
	DATA 5000 [0.5]	Data Science Seminar	
2.	0.5 credit in:		0.5
	BIOM 5010 [0.5]	Introduction to Biomedical Engineering	

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	

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M at the graduate level, which i credit in another discipline, with partment.	0
	3
M.Sc. Thesis (in the specialization)	
miles. Thesis (in the openialization)	5
tive Science ve Specialization in Data dits)	
sis pathway (5.0 credits)	
	0
Data Science Seminar	
	0
Issues in Cognitive Science	
·	0
Experimental Methods and Statistics	
C or other approved courses, from e disciplines, selected in consultation pervisor.	1
	2
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.)	
ring Conference.	5
earch Project pathway (5.0 credits)	_
	0
Data Science Seminar	_
	0
Issues in Cognitive Science	
	0
Experimental Methods and Statistics	,
0 111 1 1 1 0 111	1
Systems	
Cognition	
C or other approved courses selected	1
ne graduate supervisor.	
ne graduate supervisor.	1
	1
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	1
	tive Science ve Specialization in Data dits) sis pathway (5.0 credits) Data Science Seminar Issues in Cognitive Science Experimental Methods and Statistics C or other approved courses, from edisciplines, selected in consultation servisor. 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.) Earch for presentation at the Carleton ring Conference. Pata Science Seminar Issues in Cognitive Science Experimental Methods and Statistics Cognition and Artificial Cognitive Systems Experimental Research in Cognition and Conceptual Issues Cognition and Neuroscience C or other approved courses selected

	ation		6. 0.5 credit in electi	VC3	0.
	ve Specialization in Data		Total Credits		5.
Science (5.0 cred	•		M.C.S. Compute	r Science	
	rsework pathway (5.0 credits)			ve Specialization in Data	
1. 0.5 credit in:		0.5	Science (5.0 cred	dits)	
DATA 5000 [0.5]	Data Science Seminar		Requirements - The	sis pathway (5.0 credits)	
2. 1.0 credit in:		1.0	1. 0.5 credit in:	, (,	0.
COMS 5101 [1.0]	Foundations of Communication Studies		DATA 5000 [0.5]	Data Science Seminar	-
3. 0.5 credit in:	Cladics	0.5	2. 2.0 credits in cour	rse work. Course work must include	2.0
COMS 5605 [0.5]	Approaches to Communication Research	0.0		dits of OCICS courses in at least ch areas. See OCICS course listing	
4. 0.5 credit in:		0.5	3. 2.5 credits in:		2.
COMS 5225 [0.5]	Critical Data Studies			M.C.S. Thoois (M.C.S. Thoois must	۷.۰
5. 0.5 credit from:		0.5	COMP 5905 [2.5]	M.C.S. Thesis (M.C.S. Thesis must be in an area of Data Science and	
COMS 5203 [0.5]	Communication, Technology, Society			requires approval from the Institute of Data Science. Each candidate	
COMS 5221 [0.5]	Science and the Making of Knowledge			submitting a thesis will be required to undertake an oral defence of the thesis.)	
COMS 5224 [0.5]	Internet, Infrastructure, Materialities	0.0	Total Credits		5.0
6. 2.0 credits in elect	lives	2.0	Total Gredits		5.0
Total Credits		5.0	M.A. Economics		
Requirements - Rese	earch essay pathway (5.0 credits)			ve Specialization in Data	
1. 0.5 credit in:	,	0.5	Science (4.0 cred		
DATA 5000 [0.5]	Data Science Seminar		•	·	
2. 1.0 credit in:		1.0		rsework pathway (4.0 credits)	
COMS 5101 [1.0]	Foundations of Communication		1. 1.5 credits in:		1.
	Studies		ECON 5020 [0.5]	Microeconomic Theory	
3. 0.5 credit in:		0.5	ECON 5021 [0.5]	Macroeconomic Theory	
COMS 5605 [0.5]	Approaches to Communication		ECON 5027 [0.5] 2. 0.5 credit in:	Econometrics I	0.5
	Research		DATA 5000 [0.5]	Data Science Seminar	0.
4. 0.5 credit in:		0.5	3. 0.5 credit in:	Data Science Seminal	0.5
COMS 5225 [0.5]	Critical Data Studies		ECON 5029 [0.5]	Methods of Economic Research	0.
5. 1.0 credit in:		1.0		paper on a data science related topic	
COMS 5908 [1.0]	Research Essay		4. 0.5 credit from:	Daper on a data science related topic	0.5
	Data Science topic approved by the			Financial Econometrics	0.:
,	sentative from Communication in graduate Committee of the Institute of		ECON 5055 [0.5]		
Data Science.	graduate Committee of the institute of		ECON 5361 [0.5]	Labour Economics I Labour Economics II	
6. 1.5 credits in elect	tives	1.5	ECON 5362 [0.5]		
Total Credits		5.0	ECON 5700 [0.5]	Social and Economic Measurement	
iolai Gieulis		3.0	ECON 5712 [0.5]	Micro-Econometrics	
Requirements - Thes	sis pathway (5.0 credits)		ECON 5713 [0.5]	Time-Series Econometrics	
1. 0.5 credit in:		0.5	or approved Special area of Data Scien	al Topics course (ECON 5880) in the	
DATA 5000 [0.5]	Data Science Seminar			N approved by the M.A. Supervisor of	0.4
2. 1.0 credit in:		1.0	the Department of Ec		0.3
COMS 5101 [1.0]	Foundations of Communication Studies		6. 0.5 credit in Data	Science elective (which may be an the preceding list) approved by the	0.
3. 0.5 credit in:		0.5	M.A. Supervisor of the	e Department of Economics	
COMS 5605 [0.5]	Approaches to Communication Research		Total Credits		4.0
4. 0.5 credit in:		0.5		sis pathway (4.0 credits)	
COMS 5225 [0.5]	Critical Data Studies		1. 1.5 credits in:		1.
5. 2.0 credits in:		2.0	ECON 5020 [0.5]	Microeconomic Theory	
COMS 5909 [2.0]	M.A. Thesis		ECON 5021 [0.5]	Macroeconomic Theory	
M A Thosis on a Data	a Science topic approved by the		ECON 5027 [0.5]	Econometrics I	
Advisory Board repres	sentative from Communication in Graduate Committee of the Institute		2. 0.5 credit in: DATA 5000 [0.5]	Data Science Seminar	0.

3. 1.5 credit in: ECON 5909 [1.5] M.A. Thesis on a data science topic approved by the Data Science governance committee 4. 0.5 credit from: ECON 5055 [0.5] Financial Econometrics 1.5 SYSC 5001 [0.5] Simulation and II SYSC 5004 [0.5] Optimization for Applications SYSC 5101 [0.5] Design of High II Software SYSC 5103 [0.5] Software Agents	Modeling
on a data science topic approved by the Data Science governance committee 4. 0.5 credit from: Applications SYSC 5101 [0.5] Design of High I Software	-
governance committee SYSC 5101 [0.5] Design of High I Software	Engineering
4. U.S Credit Holl.	Performance
ECON 5055 [0.5] Financial Economotrics 5750.5 IU.3 IU.5 III.5 IU.3 IU.5 III.5 IU.3 IU.5 III.5 II	
Modeling And S	For Discrete-Event
EVEC 5304 [0.5] Labour Economics II	
COOK 3700 [0.3] Social and Economic Measurement	tems Engineering
EVEC 5202 [0.5] Micro-Economicutes	vorked Systems and
Telemedicine	
or approved Special Topics course (ECON 5880) in the area of Data Science SYSC 5306 [0.5] Mobile Computi	ing Systems
lotal Credits 4.0	earning Systems
M.A.Sc. Electrical and Computer Engineering SYSC 5405 [0.5] Pattern Classific Experiment Des	
	esign of Computer
SYSC 5500 [0.5] Designing Secu	re Networking and
Requirements - by Thesis (5.0 credits) Comparing Sector Conference System 1. 0.5 credit in:	
DATA 5000 [0.5] Data Science Seminar SySC 5703 [0.5] Integrated Datal Systems	base and Cloud
 0.5 credit from data science elective courses: 0.5 2.5 credits in courses, which may in 	nclude up to an 2.5
SYSC 5001 [0.5] Simulation and Modeling additional 0.5 credit in project	
SYSC 5004 [0.5] Optimization for Engineering 4. 0.5 credit in:	0.5
Applications SYSC 5900 [0.5] Systems Engine SYSC 5101 [0.5] Design of High Performance in the area of data science	eering Project
Software Total Credits	4.5
SYSC 5103 [0.5] Software Agents	
SYSC 5104 [0.5] Methodologies For Discrete-Event Modeling And Simulation Requirements - by Coursework (4.5 of the course of the	credits) 0.5
SYSC 5201 [0.5] Computer Communication DATA 5000 [0.5] Data Science Sc	eminar
SYSC 5207 [0.5] Distributed Systems Engineering 2. 1.5 credits from data science election	ive courses: 1.5
CVCC E202 [0 E] Interactive Networked Cyctems and	Modeling
SYSC 5303 [0.5] Interactive Networked Systems and SYSC 5001 [0.5] Simulation and	
Telemedicine SYSC 5004 [0.5] Optimization for	
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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 4. 2.5 credits in: 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 Telemedicine SYSC 5004 [0.5] Optimization for Applications SYSC 5101 [0.5] Design of High Is Software SYSC 5103 [0.5] Software Agents SYSC 5104 [0.5] Methodologies Is Modeling And Signal Sysc 5207 [0.5] Distributed Syst Sysc 5303 [0.5] Interactive Networks SYSC 5306 [0.5] Mobile Computing Sysc Sysc 5405 [0.5] Adaptive and Learning Sysc Sysc 5405 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Planning and Design of Computer Systems SYSC 5407 [0.5] Planning and Design of Computer Systems SYSC 5407 [0.5] Pattern Classification and Sysc Sysc 5407 [0.5] Planning and Design of Computer Systems SYSC 5407 [0.5] Pattern Classification and Sysc Sysc Sysc Sysc Sysc Sysc Sysc Sysc	Performance s For Discrete-Event Simulation munication tems Engineering vorked Systems and ing Systems earning Systems cation and sign esign of Computer are Networking and ems
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 4. 2.5 credits in: 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 M.Eng. Electrical and Computer Engineering with Collaborative Specialization in Data SYSC 5004 [0.5] Optimization for Applications SYSC 5101 [0.5] Design of High I Software Agents SYSC 5103 [0.5] Software Agents SYSC 5104 [0.5] Methodologies I Modeling And S SYSC 5201 [0.5] Computer Common SYSC 5207 [0.5] Distributed Systems SYSC 5303 [0.5] Interactive Network Telemedicine SYSC 5306 [0.5] Mobile Computing Systems SYSC 5401 [0.5] Adaptive and Lesson Sysc 5405 [0.5] Pattern Classific Experiment Design Sysc 5407 [0.5] Planning and Double Computing Systems SYSC 5407 [0.5] Planning and Double Computer Systems SYSC 5500 [0.5] Designing Securation Systems SYSC 5703 [0.5] Integrated Datal Systems	Performance s For Discrete-Event Simulation munication tems Engineering vorked Systems and ing Systems earning Systems cation and sign esign of Computer are Networking and ems base and Cloud
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 4. 2.5 credits in: 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 Mobile Computing Systems SYSC 5004 [0.5] Design of High I Software Systems SYSC 5101 [0.5] Design of High I Software SYSC 5103 [0.5] Software Agents SYSC 5104 [0.5] Methodologies I Modeling And S SYSC 5207 [0.5] Distributed Syst SYSC 5207 [0.5] Distributed Syst SYSC 5303 [0.5] Interactive Networks SYSC 5306 [0.5] Mobile Computing Systems SYSC 5405 [0.5] Mobile Computing Systems SYSC 5405 [0.5] Pattern Classification and Experiment Design at heavy similar and Computer Engineering with Collaborative Specialization in Data Science (4.5 credits) SYSC 5703 [0.5] Integrated Data Systems 3. 0.5 credit in:	Performance s For Discrete-Event Simulation munication tems Engineering vorked Systems earning Systems cation and sign esign of Computer are Networking and ems base and Cloud
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 4. 2.5 credits in: 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 Mequirements - by Project (4.5 credits) SYSC 5902 [0.5] Research Methodologies Integrated Database Systems SYSC 5201 [0.5] Computer Comm SYSC 5207 [0.5] Distributed Systems SYSC 5303 [0.5] Integrated Database Systems SYSC 5306 [0.5] Mobile Computing Systems SYSC 5306 [0.5] Mobile Computing Systems SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Pattern Classification and Experiment Design Systems SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Designing Secure Networks SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Designing Secure Networks SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Designing Secure Networks SYSC 5407 [0.5] Designing Secur	Performance s For Discrete-Event Simulation munication tems Engineering vorked Systems and sing Systems carring Systems cation and sign esign of Computer are Networking and ems base and Cloud 0.5 ods for Engineers
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 5500 [0.5] Integrated Database and Cloud Systems 3. 1.5 credits in courses 4. 2.5 credits in: SYSC 5909 [2.5] M.A.Sc. Thesis in the area of data science (each candidate submitting at thesis will be required to undertake an oral defence of the thesis) Total Credits Requirements - by Project (4.5 credits) Telemedicine SYSC 5004 [0.5] Optimization for Applications SYSC 5004 [0.5] Optimization for Applications SYSC 5101 [0.5] Design of High I Software Agents SYSC 5103 [0.5] Software Agents SYSC 5104 [0.5] Methodologies I Modeling And SYSC 5207 [0.5] Distributed Syst SYSC 5207 [0.5] Distributed Syst SYSC 5207 [0.5] Distributed Syst SYSC 5303 [0.5] Interactive Networks SYSC 5207 [0.5] Mobile Computer Systems SYSC 5306 [0.5] Mobile Computer Systems SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Pattern Classification and Systems SYSC 5407 [0.5] Pattern Classification in Data SYSC 5500 [0.5] Designing Secure Networks Systems SYSC 5500 [0.5] Designing Secure Networks Systems SYSC 5703 [0.5] Integrated Data Systems SYSC 5703 [0.5] Research Methodologies Integrated Data Systems SYSC 5700 [0.5] Research Methodologies Integrated Data Systems	Performance s For Discrete-Event Simulation munication tems Engineering vorked Systems earning Systems cation and sign esign of Computer are Networking and ems base and Cloud

M.A. Geography			HLTH 5903 [0.5]	Current Topics in Interdisciplinary	
	ve Specialization in Data		2 O E avadit frame	Health Sciences	0.5
Science (5.0 cred	dits)		2. 0.5 credit from:	O analysis in betanding in the analysis the	0.5
Requirements:			HLTH 5902 [0.5]	Seminars in Interdisciplinary Health Sciences for MSc	
1. 0.5 credit in:		0.5	or elective approv	ed by Thesis Supervisor and	
DATA 5000 [0.5]	Data Science Seminar		Graduate Advisor	ed by Triesis Supervisor and	
2. 0.5 credit in:		0.5	3. 0.5 credit in:		0.5
GEOG 5000 [0.5]	Approaches to Geographical		DATA 5000 [0.5]	Data Science Seminar	0.0
	Inquiry		4. 0.0 credit in:	Data ocience ociminal	0.0
3. 2.5 credits in:		2.5	HLTH 5905 [0.0]	Final Research Seminar	0.0
GEOG 5909 [2.5]	M.A. Thesis (in the specialization and including oral examination of the thesis)		TIETTI 3903 [0.0]	Presentation for MSc (Must be completed within one month of thesis defence)	
4. 0.5 credit in:		0.5	5. 4.0 credits in:	4.00.0 40.000)	4.0
GEOG 5905 [0.5]	Masters Research Workshop		HLTH 5909 [4.0]	MSc Thesis (in the specialization)	7.0
5. 1.0 credit in appro	oved graduate-level electives	1.0		tings with the thesis Graduate	
6. In addition to the fo	ormal requirements, M.A. students are Departmental Seminar series, and		Advisory Committee progress as determined	e, with students meeting a level of ined by the Committee.	
Total Credits		5.0	Total Credits		5.5
M.Sc. Geography	ve Specialization in Data	3.0	M.A. History with Collaborativ Science (4.5 cre	ve Specialization in Data dits)	
•	uitaj		Requirements:		
Requirements:			1. 0.5 credit in:		0.5
1. 0.5 credit in:		0.5	HIST 5003 [0.5]	Historical Theory and Method	
DATA 5000 [0.5]	Data Science Seminar		2. 1.5 credits in HIS	T at the graduate level of which only	1.5
2. 0.5 credit in:		0.5	*	en in a designated public history	
GEOG 5001 [0.5]	Modeling Environmental Systems			ental permission, up to 0.5 credit of	
3. 0.5 credit in:		0.5		al content may be taken from another	
GEOG 5905 [0.5]	Masters Research Workshop		at another accredited	ersity, at the University of Ottawa, or	
4. 0.5 credit in Physi	ical Geography selected from:	0.5	3. 0.5 credit in:	mondation.	0.5
GEOG 5002 [0.5]	Quantitative Analysis for Geographical Research		HIST 5706 [0.5]	Digital History	
GEOG 5103 [0.5]	Hydrologic Principles and Methods		4. 0.5 credit in:	Data Oaissa a Oassisaa	0.5
GEOG 5104 [0.5]	Advanced Biogeography		DATA 5000 [0.5]	Data Science Seminar	
GEOG 5107 [0.5]	Field Study and Methodological		5. 0.5 credit in:		0.5
	Research		HIST 5900 [0.5]	Directed Research	
GEOG 5303 [0.5]	Geocryology		6. 1.0 credit in:		1.0
GEOG 5307 [0.5]	Soil Resources		HIST 5908 [1.0]	M.A. Research Essay (in the	
GEOG 5803 [0.5]	Seminar in Geomatics			specialization)	
GEOG 5804 [0.5]	Geographic Information Systems		Total Credits		4.5
GEOG 5900 [0.5]	Graduate Tutorial		M.A. Internation	al Affairs	
up to 0.5 credit in 0 with departmental	GEOG or GEOM at the 4000 level, approval			ve Specialization in Data	
5. 3.0 credits in:		3.0	•	,	
GEOG 5906 [3.0]	M.Sc. Thesis (in the specialization		Requirements - The	sis patnway:	
	and including oral examination of		1. 0.5 credit in:		0.5
	the thesis)		DATA 5000 [0.5]	Data Science Seminar	
are required to attend	ormal requirements, M.Sc. students the DGES Departmental Seminar		2. 1.0 credit in: INAF 5016 [0.5]	Statistical Analysis for International	1.0
series, and the Gradu	ate Field Camp.			Affairs	
Total Credits	0000	5.0	INAF 5017 [0.25]	International Policymaking in Canada: Structure and Process	
M.Sc. Health Sci			INAF 5018 [0.25]	Law and International Affairs	
with Collaborative Science (5.5 cree	ve Specialization in Data dits)			omics, successfully completed by the m from: (see Note 1, below)	0.5
Requirements (5.5 c	redits):		INAF 5009 [0.5]	International Aspects of Economic	
1. 0.5 credit in:	•	0.5		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 complet	ion of second language proficiency	
ex	camination (See Note	e 4, below)	
	otal Credits		5.0
	•	earch 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	
		omics, successfully completed by the n, 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)	
	2.0 credits in Field elow)	or Elective Courses (See Note 3,	2.0
	Successful complet camination (See Note	ion of second language proficiency e 4, below)	
To	otal Credits		5.0
P	aguiromente Com	reawork nathway	
	equirements - Cour	Sework patriway:	0.5
Τ.	0.5 credit in:	Data Science Seminar	0.5
2	DATA 5000 [0.5]	Data Science Seminar	4.0
2.	1.0 credit in:	Otatistical Applicate for lateral discoul	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.	· ·	alization: (see Note 1, below)	0.5
	INAF 5904 [0.5]	Quantitative Research Methods	

To	Total Credits					
	Successful complete camination (see Note	on of second language proficiency 4, below)				
	2.5 credits in Field elow)	or Elective courses (See Note 3,	2.5			
	INAF 5703 [0.5]	International Public Economics				
	INAF 5600 [0.5]	The Economics of Human Development				
	INAF 5309 [0.5]	International Finance: Theory and Policy				
	INAF 5308 [0.5]	International Trade: Theory and Policy				
	INAF 5214 [0.5]	Economics for Defence and Security				
	INAF 5205 [0.5]	Economics of Conflict				
	INAF 5009 [0.5]	International Aspects of Economic Development				
		omics, successfully completed by the n, from: (see Note 2, below)	0.5			
	INAF 6002 [0.5]	Quantitative Research Methods				

Notes:

- 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.
- 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 cor	e courses:	1.0
	ITEC 5010 [0.5]	Applied Programming I	
	ITEC 5200 [0.5]	Entertainment Technologies	

To	tal Credits		5.0
	ITEC 5909 [2.5]	Master's Thesis (in the specialization)	
5.	2.5 credits in:		2.5
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	
	ITEC 5920 [0.5]	Special Topics in Digital Media	
	ITEC 5208 [0.5]	Virtual Reality and 3D User Interfaces	
	ITEC 5207 [0.5]	Data Interaction Techniques	
	ITEC 5206 [0.5]	Data Protection and Rights Management	
	ITEC 5205 [0.5]	Design and Development of Data- Intensive Applications	
	ITEC 5204 [0.5]	Emerging Interaction Techniques	
	ITEC 5203 [0.5]	Game Design and Development Technologies	
	ITEC 5202 [0.5]	Visual Effects Technologies	
	ITEC 5201 [0.5]	Computer Animation Technologies	

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:

rtoquii ciliciito.		
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)	
an appropriate gradua	in PHYS or PHYJ. With approval, te-level course in engineering, siness 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 s Carleton Institute for P	seminar series of the Ottawa- Physics	
Total Credits		5.0

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

Requirements:

Total Credits		5.0
5. Participation in the Carleton Institute of P	seminar series of the Ottawa- hysics	
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)	
4. 2.5 credits in:		2.5
PHYS 5702 [0.5]	Relativistic Quantum Mechanics	
PHYS 5701 [0.5]	Intermediate Quantum Mechanics with Applications	
PHYS 5602 [0.5]	Physics of Elementary Particles	
3. 1.5 credit in:		1.5
PHYS 5002 [0.5]	Statistical Data Analysis Techniques for Physics (or equivalent course in computing physics)	
2. 0.5 credit in:		0.5
DATA 5000 [0.5]	Data Science Seminar	
1. 0.5 credit in:		0.5
requirements.		

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	
professional developm	C at the 5000 level, excluding the nent courses listed in Item 4 and statistics courses listed below.	0.5
4. 0.5 credit from the courses:	e following professional development	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		3. 1.0 credit in data	science core courses:	1.0
	Science, which must be defended at an oral examination)		PADM 5126 [0.5]	Quantitative Methods for Public Policy	
Total Credits		5.0	PADM 5218 [0.5]	Analysis of Socio-economic Data	
	Policy and Administration ve Specialization in Data		0.5 credit in approdetails)	oved elective (see School website for	0.5
Science (7.0 cre	-		4. 1.0 credit in:		1.0
•	,		PADM 5908 [1.0]	Research Essay (on a Data	
Requirements - Cou		4.0		Science topic approved by the MPPA Graduate Supervisor and	
1. 4.0 credits in core		4.0		the Data Science governance	
PADM 5120 [0.5]	Modern Challenges to Governance			committee)	
PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change		Total Credits		7.0
PADM 5122 [0.5]	Public Management: Principles and Approaches			Policy and Administration ve Specialization in Data	
PADM 5123 [0.5]	Public Management in Practice			ced completion, 5.0 credits)	
PADM 5125 [0.5]	Qualitative Methods for Public Policy		Requirements - Cou	rsework pathway (Advanced	
PADM 5127 [0.5]	Microeconomics for Policy Analysis		completion, 5.0 cred	,	2.5
PADM 5128 [0.5]	Macroeconomics for Policy		1. 2.5 credits from 0		2.5
	Analysis		PADM 5120 [0.5]	Modern Challenges to Governance	
PADM 5129 [0.5]	Capstone Course		PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change	
2. 0.5 credit in:		0.5	PADM 5122 [0.5]	Public Management: Principles and	
DATA 5000 [0.5]	Data Science Seminar		1 ADW 3122 [0.5]	Approaches	
	science core courses:	1.0	PADM 5123 [0.5]	Public Management in Practice	
PADM 5126 [0.5]	Quantitative Methods for Public Policy		PADM 5125 [0.5]	Qualitative Methods for Public Policy	
PADM 5218 [0.5]	Analysis of Socio-economic Data		PADM 5127 [0.5]	Microeconomics for Policy Analysis	
4. 0.5 credit from da	ata science electives:	0.5	PADM 5128 [0.5]	Macroeconomics for Policy	
COMP 5111 [0.5]	Data Management for Business Intelligence		PADM 5129 [0.5]	Analysis Capstone Course	
COMP 5209 [0.5]	Visual Analytics		2. 0.5 credit in:	Capstone Course	0.5
COMP 5305 [0.5]	Advanced Database Systems		DATA 5000 [0.5]	Data Science Seminar	0.5
COMP 5306 [0.5]	Data Integration		• •	ita science core courses:	0.5
PADM 5219 [0.5]	Advanced Statistical Policy Analysis		PADM 5126 [0.5]	Quantitative Methods for Public Policy	0.5
PADM 5372 [0.5]	Policy Seminar (Data Science Specialization)		PADM 5218 [0.5]	Analysis of Socio-economic Data	
PADM 5391 [0.5]	Directed Studies (Data Science		4. 0.5 credit from da		0.5
	Specialization) oved elective (see School website for	1.0	COMP 5111 [0.5]	Data Management for Business Intelligence	
details)	(COMP 5209 [0.5]	Visual Analytics	
Total Credits		7.0	COMP 5305 [0.5]	Advanced Database Systems	
		- • •	COMP 5306 [0.5]	Data Integration	
Requirements - Res 1. 4.0 credits in core	e courses:	4.0	PADM 5219 [0.5]	Advanced Statistical Policy Analysis	
PADM 5120 [0.5]	Modern Challenges to Governance		PADM 5372 [0.5]	Policy Seminar (Data Science	
PADM 5121 [0.5]	Policy Analysis: The Practical Art of Change		PADM 5391 [0.5]	Specialization) Directed Studies (Data Science	
PADM 5122 [0.5]	Public Management: Principles and Approaches			Specialization)	1.0
PADM 5123 [0.5]	Public Management in Practice		details)	oved elective (see School website for	1.0
PADM 5125 [0.5]	Qualitative Methods for Public Policy		Total Credits	and a second the second	5.0
PADM 5127 [0.5]	Microeconomics for Policy Analysis		Requirements - Rescompletion, 5.0 cred	earch essay pathway (Advanced	
PADM 5128 [0.5]	Macroeconomics for Policy		1. 2.5 credits from o		2.5
	Analysis		PADM 5120 [0.5]	Modern Challenges to Governance	2.3
PADM 5129 [0.5]	Capstone Course		PADM 5120 [0.5] PADM 5121 [0.5]	Policy Analysis: The Practical Art of	
2. 0.5 credit in:		0.5	1 ADW 5121 [0.3]	Change	
DATA 5000 [0.5]	Data Science Seminar			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.		ta science core courses:	0.5
	PADM 5126 [0.5]	Quantitative Methods for Public Policy	
	PADM 5218 [0.5]	Analysis of Socio-economic Data	
	0.5 credit in approetails)	ved elective (see School website for	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)	
To	otal Credits		5.0
		e Specialization in Data	
S		lits) iis pathway (5.0 credits):	
S	equirements - Thes 0.5 credit in:	is pathway (5.0 credits):	0.5
S R 1.	equirements - Thes 0.5 credit in: DATA 5000 [0.5]		
S R 1.	equirements - Thes 0.5 credit in:	Data Science Seminar Recurring Debates in Social	0.5
S R 1.	equirements - Thes 0.5 credit in: DATA 5000 [0.5] 1.0 credit in:	is pathway (5.0 credits): Data Science Seminar	
S R 1.	equirements - Thes 0.5 credit in: DATA 5000 [0.5] 1.0 credit in: SOCI 5005 [0.5]	Data Science Seminar Recurring Debates in Social Thought	
S R 1.	equirements - Thes 0.5 credit in: DATA 5000 [0.5] 1.0 credit in: SOCI 5005 [0.5] SOCI 5809 [0.5]	Data Science Seminar Recurring Debates in Social Thought	1.0
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3. 4.	equirements - Thes 0.5 credit in: DATA 5000 [0.5] 1.0 credit in: SOCI 5005 [0.5] SOCI 5809 [0.5] 1.0 credit in: SOCI 5102 [0.5] SOCI 5104 [0.5] 0.5 credit in SOCI	Data Science Seminar Recurring Debates in Social Thought The Logic of the Research Process Multiple Regression Analysis Advanced Multivariate Analysis at the graduate level (not including ay be selected from courses at the	1.0
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3. 4. 4. 5. 6. pr To R. 1.	equirements - Thes 0.5 credit in: DATA 5000 [0.5] 1.0 credit in: SOCI 5005 [0.5] 1.0 credit in: SOCI 5809 [0.5] 1.0 credit in: SOCI 5102 [0.5] SOCI 5104 [0.5] 0.5 credit in SOCI ose listed above). M 000-level, with depar 2.0 credits in: SOCI 5909 [2.0] 0 An oral examination or an exami	Data Science Seminar Recurring Debates in Social Thought The Logic of the Research Process Multiple Regression Analysis Advanced Multivariate Analysis at the graduate level (not including ay be selected from courses at the tment permission. M.A. Thesis (in the specialization) on on the candidate's thesis and	1.0 1.0 0.5 2.0
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3. 4. th 40 5. 6. pr Tc R. 1. 2.	equirements - Thes 0.5 credit in: DATA 5000 [0.5] 1.0 credit in: SOCI 5005 [0.5] SOCI 5809 [0.5] 1.0 credit in: SOCI 5102 [0.5] SOCI 5104 [0.5] 0.5 credit in SOCI ose listed above). M one listed above is listed above of the listed above	Data Science Seminar Recurring Debates in Social Thought The Logic of the Research Process Multiple Regression Analysis Advanced Multivariate Analysis at the graduate level (not including ay be selected from courses at the trment permission. M.A. Thesis (in the specialization) on on the candidate's thesis and earch Essay pathway (5.0 credits): Data Science Seminar Recurring Debates in Social Thought	1.0 1.0 0.5 2.0 5.0 0.5

Advanced Multivariate Analysis

1.5

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.

SOCI 5104 [0.5]

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.