Carleton UNIVERSITY
Canada's Capital University

Office of the Vice-Provost and Associate Vice-President (Academic)

memorandum

DATE: October 22, 2020

TO: Senate

FROM: Dr. Dwight Deugo, Vice-Provost and Associate Vice-President (Academic), and Chair, Senate Quality Assurance and Planning Committee

RE: 2021-22 Calendar Curriculum Proposals
Graduate Major Modifications

Background

Following Faculty Board approval and, as part of academic quality assurance, major curriculum modifications are considered by the Senate Committee on Curriculum, Admissions and Studies Policy (SCCASP) and the Senate Quality Assurance and Planning Committee (SQAPC) before being recommended to Senate.

Library Reports (as required)

In electronic communication members of the Library staff, upon review of the proposals, confirmed no additional resources were required for the 2021-22 major modifications included below.

Documentation

Recommended calendar language, along with supplemental documentation as appropriate, are provided for consideration and approval.

Omnibus Motion

In order to expedite business with the multiple major modifications that are subject to Senate approval at this meeting, the following omnibus motion will be moved. Senators may wish to identify any of the following 2 major modifications that they feel warrant individual discussion that will then not be covered by the omnibus motion. Independent motions as set out below will nonetheless be written into the Senate minutes for those major modifications that Senators agree can be covered by the omnibus motion.

THAT Senate approve the major modifications as presented below with effect from Fall 2021.

Major Modifications

1. **Electrical and Computer Engineering – Concentration in Modelling and Simulation**
   SCCASP approval: October 6, 2020
   SQAPC approval: October 8, 2020

Senate Motion October 30, 2020

THAT Senate approve the introduction of the concentration in Modelling and Simulation to the Master of Applied Science and Master of Engineering programs in Electrical and Computer Engineering as presented with effect Fall 2021.

2. **Electrical and Computer Engineering – Concentration in Software Engineering**
   SCCASP approval: October 6, 2020
   SQAPC approval: October 8, 2020

Senate Motion October 30, 2020

THAT Senate approve the introduction of the concentration in software engineering to the Master of Applied Science, Master of Engineering and PhD programs in Electrical and Computer Engineering as presented with effect Fall 2021.

MEMORANDUM

To: Senate Quality Assurance and Planning Committee (SQAPC)

From: Yvan Labiche, Systems and Computer Engineering

CC: Larry Kostiuk, Dean, FED
Amir Hakami, Associate Dean, FED
Patrice Smith, Dean, FGPA
James Opp, Associate Dean, FGPA

Date: September 9, 2020

Re: Major Modification to M.A.Sc. and M.Eng. in Electrical and Computer Engineering (Track A2). Concentration in Modeling and Simulation

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Concept of the New Program

We are proposing two new concentrations in Modeling and Simulation; one for the Master of Engineering (M.Eng.), and one of the Master of Applied Science (M.A.Sc) offered by the Department of Systems and Computer Engineering to begin in the Fall of 2021.

The Department of Systems and Computer Engineering has a diverse group of experts conducting research and teaching courses in the field of Modeling and Simulation (M&S). M&S technologies are now used in decision-making by companies and government agencies (including, for example, experts in the Department of National Defence – DND, Public Health Agency of Canada, where simulation is being used for prediction of pandemics; as well as the top industries in the province, including Autodesk, CAE, GM and Ericsson among others). M&S is used extensively in defence for training, logistics, strategic airlift; in industry for supply chain, manufacturing or design of products in industry; and it is a main driving force in the design of communication equipment or autonomous vehicles.

We want to introduce concentrations focusing on the fundamentals of theory and application of M&S, building the first program of its kind in Canada.

Principal Goals of the Program

There are several M&S hubs in the USA (for instance, Old Dominion University and University of Central Florida) and the EU (including Brunel University in the UK; TU Berlin and KTH in Sweden). There is no program on M&S in Canada. Consequently, during the last few years, companies have sent their experts for advanced training elsewhere, primarily across our south boarder. Canadian defence M&S experts have been sent for training elsewhere in the last few years.

These concentrations will allow us to train Masters in Engineering and Masters in Applied Science candidates with technical and professional skills in M&S. The effort already has the support of DRDC/CORA at DND in Ottawa, which will send new students every year starting in September 2020

should we offer the concentrations. The availability of concentrations will allow DND to train their experts locally instead of using resources in US Universities.

The concentrations will allow us to increase the number of Domestic Masters students coming to SCE. We have a guaranteed intake coming from DND that will add between 2 and 6 new Domestic students every year (which represents between 10 and 30% of the Masters Domestic intake for the Department), and the concentrations could be attractive to other students interested in the field of Modeling and Simulation. The COVID-19 Pandemic has showed that there is a clear need of experts in modeling techniques, and in simulation methods, as well as data analysis. This is a unique opportunity to take advantage of these needs and putting Carleton in a leadership position in Ontario and Canada.

With respect to the M.Eng. program, the Department of Systems and Computer Engineering currently has a successful program in terms of enrollment (115 full-time M.Eng. students in 2019-2020). Approximately 20 students per year are trained in courses related to Modeling and Simulation.

Program Structure and Options

The Master of Engineering (M.Eng.) with concentration in Modeling and Simulation will be a course-based program intended on developing advanced Modeling and Simulation skills. Having the proposed Concentrations in Modeling and Simulation will allow us to provide structure to the existing M.Eng. program.

The degree requirements for the M.Eng. with concentration in Modeling and Simulation are presented by coursework and by project consistent with the way in which other M.Eng. programs are presented in Carleton University's Graduate Calendar.

A) M.Eng. by coursework requirements

1. 0.5 credits: 0.5
SYSC 5902 [0.5] Introduction to Research Methods

2. 2.0 credits from the Modeling and Simulation Core*: 2.0
SYSC 5001 - Simulation & Modelling
SYSC 5003 - Discrete Stochastic Models
SYSC 5004 - Optimization For Engineering Application
SYSC 5006 - Design of Real-Time and Distributed Systems
SYSC 5101 - Design of High-Performance Software
SYSC 5102 - Performance Measurement and Modeling of Distributed Applications
SYSC 5103 - Software Agents
SYSC 5104 - Methodologies For Discrete-Event Modeling And Simulation
SYSC 5207 - Distributed Systems Engineering
SYSC 5405 - Pattern Classification and Experiment Design

3. 2.0 credits in courses: 2.0
Including courses from the Modeling and Simulation Core*, OCIECE, School of Computer Science, School of Mathematics and Statistics, and Directed Studies (SYSC 5906). A non-comprehensive list of potential courses (with permission of the Department and Instructor in courses outside SCE) includes:

AERO 4304 - Computational Fluid Dynamics
BUSI 3308 – Simulation Methods in Business
EACJ 5102 - Intro to Embedded Systems
EACJ 5109 - Stochastic Processes
EACJ 5200 - Queuing Systems
EACJ 5203 - Distributed System Software
EACJ 5204 - Virtual Environments
EACJ 5386 - Automata and Neural Networks
EACJ 5406 - Methodes numeriques en genie
EACJ 5606 - Topics in Computers II: Computer Animation
EACJ 5808 - Topics in Computers II: Software Defined Networks & Cloud
EACJ 7116 - Introduction to Convex Optimization
ELEC 5506 - Simulation and Optimization of Electronic Circuits
ELEC 5508 - Computer Methods for Analysis and Design of VLSI Circuits
ELEC 5604 - Radar Systems
MECH 5008 - Experimental Methods in Fluid Mechanics
MECH 5205 - Building Performance Simulation
STAT 4555 - Monte Carlo Simulation
SYSC 5405 - Pattern Classification and Experiment Design
SYSC 5502 - Advanced Linear Systems
SYSC 5701 - Operating System Methods for Real-Time Applications
SYSC 5706 - Analytical Performance Models of Computer Systems
SYSC 5708 - Model-Driven Development of Real-Time and Distributed Software
SYSC 5709 - Advanced Topics in Software Engineering: Software Development in C
SYSC 5807 - Advanced Topics in Computer Systems: Resource Management in Distributed Systems

Total Credits 4.5
* Courses in the Modeling and Simulation Core will not require permission of the instructor to register for students in this concentration.

B) M.Eng. by Project requirements:

1. 0.5 credits: 0.5
SYSC 5902 [0.5] Introduction to Research Methods

2. 0.5 credits in project: 0.5
SYSC 5900 [0.5] Systems Engineering Project in Modeling and Simulation

3. 2.0 credits from the Modeling and Simulation Core*: 2.0
SYSC 5001 - Simulation & Modelling
SYSC 5003 - Discrete Stochastic Models
SYSC 5004 - Optimization For Engineering Application
SYSC 5006 - Design of Real-Time and Distributed Systems
SYSC 5101 - Design of High-Performance Software
SYSC 5102 - Performance Measurement and Modeling of Distributed Applications
SYSC 5103 - Software Agents

SYSC 5104 - Methodologies For Discrete-Event Modeling And Simulation
SYSC 5207 - Distributed Systems Engineering
SYSC 5405 - Pattern Classification and Experiment Design

4. 1.5 credits in courses, which may include up to an additional 0.5 credit in project: 1.5
Including courses from the Modeling and Simulation Core*, OCIECE, School of Computer Science, School of Mathematics and Statistics, and Directed Studies (SYSC 5906). A non-comprehensive list of potential courses (with permission of the Department and Instructor in courses outside SCE) includes:
AERO 4304 - Computational Fluid Dynamics
BUSI 3308 – Simulation Methods in Business
EACJ 5102 - Intro to Embedded Systems
EACJ 5109 - Stochastic Processes
EACJ 5200 - Queuing Systems
EACJ 5203 - Distributed System Software
EACJ 5204 - Virtual Environments
EACJ 5386 - Automata and Neural Networks
EACJ 5406 - Methodes numeriques en genie
EACJ 5606 - Topics in Computers II: Computer Animation
EACJ 5808 - Topics in Computers II: Software Defined Networks & Cloud
EACJ 7116 - Introduction to Convex Optimization
ELEC 5506 - Simulation and Optimization of Electronic Circuits
ELEC 5508 - Computer Methods for Analysis and Design of VLSI Circuits
ELEC 5604 - Radar Systems
MECH 5008 - Experimental Methods in Fluid Mechanics
MECH 5205 - Building Performance Simulation
STAT 4555 - Monte Carlo Simulation
SYSC 5405 - Pattern Classification and Experiment Design
SYSC 5502 - Advanced Linear Systems
SYSC 5701 - Operating System Methods for Real-Time Applications
SYSC 5706 - Analytical Performance Models of Computer Systems
SYSC 5708 - Model-Driven Development of Real-Time and Distributed Software
SYSC 5709 - Advanced Topics in Software Engineering: Software Development in C
SYSC 5807 - Advanced Topics in Computer Systems: Resource Management in Distributed Systems
SYSC 5807 - Advanced Topics in Computer Systems: Hardware & Software Co-Design

Total Credits 4.5
* Courses in the Modeling and Simulation Core will not require permission of the instructor to register for students in this concentration.

C) Master of Applied Science (M.A.Sc) with concentration in Modeling and Simulation

The Master of Applied Science (M.A.Sc) with concentration in Modeling and Simulation is a two-year research-intensive, thesis-based program. Students entering this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honors) BEng in Computer Engineering, Software Engineering, Computer Science, Computer Engineering, or Information Technology.

Requirements:

1. 1.5 credits from the Modeling and Simulation Core*: 1.5

SYSC 5001 - Simulation & Modelling
SYSC 5003 - Discrete Stochastic Models
SYSC 5004 - Optimization For Engineering Application
SYSC 5006 - Design of Real-Time and Distributed Systems
SYSC 5101 - Design of High-Performance Software
SYSC 5102 - Performance Measurement and Modeling of Distributed Applications
SYSC 5103 - Software Agents
SYSC 5104 - Methodologies For Discrete-Event Modeling And Simulation
SYSC 5207 - Distributed Systems Engineering
SYSC 5405 - Pattern Classification and Experiment Design
SYSC 5907 - Advanced Topics in Computer Systems: Hardware & Software Co-Design

2. 1.0 credits in courses: 1.0

Including courses from the Modeling and Simulation Core*, OCIECE, School of Computer Science, School of Mathematics and Statistics, and Directed Studies (SYSC 5906). A non-comprehensive list of potential courses (with permission of the Department and Instructor in courses outside SCE) includes:

AERO 4304 - Computational Fluid Dynamics
BUSI 3308 – Simulation Methods in Business
EACJ 5102 - Intro to Embedded Systems
EACJ 5109 - Stochastic Processes
EACJ 5200 - Queuing Systems
EACJ 5203 - Distributed System Software
EACJ 5204 - Virtual Environments
EACJ 5386 - Automata and Neural Networks
EACJ 5406 - Methodes numeriques en genie
EACJ 5606 - Topics in Computers II: Computer Animation
EACJ 5808 - Topics in Computers II: Software Defined Networks & Cloud
EACJ 7116 - Introduction to Convex Optimization
ELEC 5506 - Simulation and Optimization of Electronic Circuits
ELEC 5508 - Computer Methods for Analysis and Design of VLSI Circuits
ELEC 5604 - Radar Systems
MECH 5008 - Experimental Methods in Fluid Mechanics
MECH 5205 - Building Performance Simulation
STAT 4555 - Monte Carlo Simulation
SYSC 5405 - Pattern Classification and Experiment Design
SYSC 5502 - Advanced Linear Systems
SYSC 5701 - Operating System Methods for Real-Time Applications
SYSC 5706 - Analytical Performance Models of Computer Systems
SYSC 5708 - Model-Driven Development of Real-Time and Distributed Software
SYSC 5709 - Advanced Topics in Software Engineering: Software Development in C
SYSC 5807 - Advanced Topics in Computer Systems: Resource Management in Distributed Systems
SYSC 5807 - Advanced Topics in Computer Systems: Hardware & Software Co-Design

3. 2.5 credits in: 2.5

SYSC 5909 [2.5] M.A.Sc. Thesis in Modeling and Simulation (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)

Total Credits 5.0
* Courses in the Modeling and Simulation Core will not require permission of the instructor to register for students in this concentration.

Impact on Other Programs

We expect no impact in the enrollment numbers for the M.Eng. and M.A.Sc. in Electrical and Computer Engineering as the concentrations will make use of current resources in SCE, simply guiding the students to conduct research (M.A.Sc) or projects (M.Eng.) in Modeling and Simulation, and giving them the chance to organize their program to focus their skills in the field of M&S. The impact essentially amounts to a relabeling of the students already admitted within the department. This change could in fact improve the profile of the Department of Systems and Computer Engineering.

Specifically, for the M.Eng. program, these concentrations will enable more formalization thereby making it easier to route students to the appropriate courses. Consequently, the administrative workload is expected to diminish since we can use the Concentrations code to automatically allow students to take relevant courses.

Impact on Learning Outcomes and Curriculum Map (½ - 2 pages) (Only applicable if modification(s) will impact learning goals of the program, or program requirements)

There are no changes in the Learning Outcomes. This is equivalent to current M.Eng and M.A.Sc. in Electrical Engineering. The Concentration guides the students in taking courses relevant to the field of Modeling and Simulation, and ensures that the Thesis or Projects are in this area of interest.

Student Demand

There is a large number of companies that apply Modeling and Simulation in their daily operations. Graduates of our concentrations will have varied career opportunities with both SMEs (building tools, applying M&S for experimentation and studies) as well as Canadian corporations that need to face complex system level problems (Bombardier Aerospace, Hydro Canada, CSA), as well as the Defence industry and government agencies (Thales, DND, CAE), gaming (Ubisoft, Presagys, Electronic Arts), medical (e.g. BlueDrop, nGRAIN), or design (Autodesk Research). There is a substantial demand: over 4000 positions with salaries for junior M&S Analysts averaging $80K in Canada.[1] The MSV market will give a wide range of opportunities to our trainees. The application to governance has been made clear during the COVID-19 pandemics, where a number of modeling experts were needed to study the spread of the disease and help governments to make informed decisions based on advanced models and simulations. We expect a growing interest in this field in the next years. The introduction of these concentrations can enable Carleton University to be a leader in Canada in this area.

We have a large population of undergraduate students, but many of them do not continue to complete graduate studies and instead find employment in industry. Providing new concentrations can give them new skills to increase their marketability for a variety of industries and government agencies as discussed above. Similarly, we have approximately 20 students a year taking courses from the core list

[1] https://www.payscale.com/research/CA/Job=Simulation_Analyst/Salary

presented above. Having concentrations that recognizes these facts, and allow them to bundle different courses and improve their chances to be employed should be well received by students; in particular because many of them are already taking courses in the field and not being recognized as such.

As mentioned, these concentrations was initially based on a discussion with DND which is interested in sending fully funded students to the program, starting with 2 students in 2020, and increasing yearly to have a steady flow of students in the years to come. This is a concrete demand we are satisfying. Although 2 new domestic students may appear to be small, in a class of 20 this is an immediate increase of 10% in those courses, without any additional significant work on our part beyond putting the concentrations in place by using existing resources; as mentioned earlier this number also corresponds to a significant increase of the domestic intake for our graduate programs. On the other side, the department has now approximately 25 M.Eng. and 15 M.A.Sc. students conducting research or taking courses in fields related with Modeling and Simulation. Concentrations in Modeling and Simulation can give the students a competitive edge and increase their employability.

Resources

No new resources will be required. The Department of Systems and Computer Engineering has 34 Professors, as well as many Adjuncts and Contract Instructors, which deliver the courses included in the list above (even without these concentrations). The same professors supervise Masters students as their standard load. These concentrations will offer them with a bigger pool to select top students to conduct research.

. Student funding: Students are financially supported with Research Assistantships from their Supervisors. If, as expected, we increase the number of domestic candidates (from DND and local companies), the Department will receive new resources to be offered as TA/scholarships, directly derived from the increase in the domestic student intake. The University will be receiving extra funding from the government and no extra resources will be needed from the University. The DND students will be fully funded, and they will not need TA or scholarship positions, and will bring full tuition and the University will obtain BIUs from those students. So, in fact, we expect the students will bring funding (not spend it) to be distributed between other students in the Department.

. Administrative support: The Chair of the Department and the Associate Chair of Graduate Studies will assist in terms of intake of applicants. Student files will be managed by the Department of Systems and Computer Engineering. It is expected that the introduction of these concentrations will help the administrative process by enabling the process for checking the enrollment in the concentrations to be automated. It is expected that this will in fact reduce the administrative overhead of the Graduate Assistant within the department.

. Library: There is no need for additional library resources resulting from the introduction of these Concentrations.

. Space: There is no need for additional space resulting from the direct introduction of the M.Eng. and M.A.Sc concentrations in Modeling and Simulation. We expect a higher proportion of domestic students in the overall enrollment, but minimum change to the overall admission numbers (10% extra every year),

so space is not a major issue. We will grow in the long-term together with the Department and will require more space only when the whole department does.

. Equipment: There is no need for additional equipment resulting from the introduction of these concentrations.

New Program Proposal

Date Submitted: 06/24/20 10:21 am

Viewing: TBD-2005 : M.Eng. Electrical and Computer Engineering with Concentration in Modeling and Simulation

Last edit: 09/28/20 2:44 pm

Last modified by: sarahcleary

Changes proposed by: gabrielwainer

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. **PRE SCCASP**
8. **SCCASP**
9. **SQAPC**
10. **Senate**
11. CalEditor

Approval Path

1. 06/11/20 5:40 pm Yvan Labiche (yvanlabiche): Rollback to Initiator
2. 06/20/20 8:23 am Yvan Labiche (yvanlabiche): Rollback to Initiator
3. 06/27/20 10:47 am Yvan Labiche (yvanlabiche): Approved for SYST ChairDir GR
4. 09/01/20 7:24 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
5. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
6. 09/09/20 12:19 pm Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
7. 09/09/20 12:24 pm Sandra Bauer (sandrabauer): Approved for GRAD FCC
8. 09/23/20 10:51 am Sandra Bauer (sandrabauer): Approved for GRAD FBoard
9. 09/28/20 2:45 pm Sarah Cleary

(sarahcleary): Approved for PRE SCCASP
10. 10/13/20 12:04 pm Erika Strathearn (erikastrathearn): Approved for SCCASP
11. 10/13/20 2:56 pm Christina Noja (christinanoja): Approved for SQAPC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2005
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	Master of Applied Science
Title	M.Eng. Electrical and Computer Engineering with Concentration in Modeling and Simulation

Program Requirements

M.Eng. Electrical and Computer Engineering with Concentration in Modeling and Simulation (4.5 credits)

Requirements - by project

1. 0.5 credit in:		**0.5**
SYSC 5902 [0.5]	**Research Methods for Engineers**	
2. 0.5 credit in project:		**0.5**
SYSC 5900 [0.5]	**Systems Engineering Project**	
3. 2.0 credits from modeling and simulation core courses:		**2.0**
SYSC 5001 [0.5]	**Simulation and Modeling**	
SYSC 5003 [0.5]	**Discrete Stochastic Models**	
SYSC 5004 [0.5]	**Optimization for Engineering Applications**	
SYSC 5006 [0.5]	**Design of Real-Time and Distributed Systems**	
SYSC 5101 [0.5]	**Design of High Performance Software**	
SYSC 5102 [0.5]	**Performance Measurement and Modeling of Distributed Applications**	
SYSC 5103 [0.5]	**Software Agents**	
SYSC 5104 [0.5]	**Methodologies For Discrete-Event Modeling And Simulation**	
SYSC 5207 [0.5]	**Distributed Systems Engineering**	
SYSC 5405 [0.5]	**Pattern Classification and Experiment Design**	
SYSC 5703 [0.5]	**Integrated Database and Cloud Systems**	

4. 1.5 credits in courses, which may include up to an additional 0.5 credit in project	**1.5**
Total Credits	4.5

Requirements - by coursework:

1. 0.5 credit in:	**0.5**
SYSC 5902 [0.5] Research Methods for Engineers	
2. 2.0 credits from modeling and simulation core courses:	**2.0**
SYSC 5001 [0.5] Simulation and Modeling	
SYSC 5003 [0.5] Discrete Stochastic Models	
SYSC 5004 [0.5] Optimization for Engineering Applications	
SYSC 5006 [0.5] Design of Real-Time and Distributed Systems	
SYSC 5101 [0.5] Design of High Performance Software	
SYSC 5102 [0.5] Performance Measurement and Modeling of Distributed Applications	
SYSC 5103 [0.5] Software Agents	
SYSC 5104 [0.5] Methodologies For Discrete-Event Modeling And Simulation	
SYSC 5207 [0.5] Distributed Systems Engineering	
SYSC 5405 [0.5] Pattern Classification and Experiment Design	
SYSC 5703 [0.5] Integrated Database and Cloud Systems	
3. 2.0 credits in courses	**2.0**
Total Credits	4.5

New Resources	No New Resources
Summary	Introduce Concentration in Modeling and Simulation for the MEng and MASc in Electrical and Computer Engineering.
Rationale	A large number of private and public sector agencies in Canada apply M&S in their daily operations. While there exist several M&S training hubs in the US and EU, there are no such programs in Canada, which necessitates that Canadian M&S experts be sent abroad for training. The department of Systems and Computer Engineering has a diverse group of experts conducting research and teaching in the field of M&S. This proposed program would be the first of its kind in Canada, and will increase the number of domestic masters students in the SCE.
Transition/Implementation	New Concentration
Program reviewer comments	**yvanlabiche (06/11/20 5:40 pm):** Rollback: as requested separately by email. **yvanlabiche (06/20/20 8:23 am):** Rollback: I have a few questions… The degree for the proposed change is said to be MASc. Yet you also discuss MEng. Should you have one for MASc and one for MEng? In courseleaf you have "* Courses in the Modeling and Simulation Core will not require permission of the instructor to register for students in this concentration." for the two MEng versions but not for MASc. Is this right? In core courses you have SYSC5807. Do you mean that any advanced topics in computer systems would be considered core? What if one year we offer one that has nothing to do with M&S? 5807 is also in the second list. To me, it should either be one to the other, not both. I see some UofO courses. Is this right? **sandrabauer (09/01/20 2:18 pm):** Created separate entries for MEng and MASc, formatted into CourseLeaf table format and made entries consistent with existing ECE program entries **sandrabauer (09/11/20 3:27 pm):** Edited summary and rationale **sarahcleary (09/28/20 2:44 pm):** Put courses in alpha numeric order for project, section 3 and for coursework section 2. Removed duplicate course (SYSC 5101) from project, section 3. Removed duplicate course (SYSC 5101) from coursework, section 2.

Key: 2005

New Program Proposal

Date Submitted: 09/01/20 2:03 pm

Viewing: TBD-2025 : M.A.Sc. Electrical and Computer Engineering with Concentration in Modeling and Simulation

Last edit: 09/28/20 2:51 pm

Last modified by: sarahcleary

Changes proposed by: sandrabauer

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. **PRE SCCASP**
8. **SCCASP**
9. **SQAPC**
10. **Senate**
11. CalEditor

Approval Path

1. 09/01/20 2:27 pm Sandra Bauer (sandrabauer): Approved for SYST ChairDir GR
2. 09/01/20 2:29 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
3. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
4. 09/09/20 12:19 pm Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
5. 09/09/20 12:24 pm Sandra Bauer (sandrabauer): Approved for GRAD FCC
6. 09/23/20 10:51 am Sandra Bauer (sandrabauer): Approved for GRAD FBoard
7. 09/28/20 2:52 pm Sarah Cleary (sarahcleary): Approved for PRE SCCASP
8. 10/13/20 12:04 pm Erika Strathearn (erikastrathearn): Approved for SCCASP
9. 10/13/20 2:56 pm Christina Noja

(christinanoja): Approved for SQAPC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2025
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	M.A.Sc. Electrical and Computer Engineering with Concentration in Modeling and Simulation

Program Requirements

M.A.Sc. Electrical and Computer Engineering with Concentration in Modeling and Simulation (5.0 credits)

Requirements - by thesis (5.0 credits)

1. 1.5 credits from modeling and simulation core courses:		**1.5**
SYSC 5001 [0.5]	**Simulation and Modeling**	
SYSC 5003 [0.5]	**Discrete Stochastic Models**	
SYSC 5004 [0.5]	**Optimization for Engineering Applications**	
SYSC 5006 [0.5]	**Design of Real-Time and Distributed Systems**	
SYSC 5101 [0.5]	**Design of High Performance Software**	
SYSC 5102 [0.5]	**Performance Measurement and Modeling of Distributed Applications**	
SYSC 5103 [0.5]	**Software Agents**	
SYSC 5104 [0.5]	**Methodologies For Discrete-Event Modeling And Simulation**	
SYSC 5207 [0.5]	**Distributed Systems Engineering**	
SYSC 5405 [0.5]	**Pattern Classification and Experiment Design**	
SYSC 5703 [0.5]	**Integrated Database and Cloud Systems**	
2. 1.0 credit in courses		**1.0**
3. 2.5 credits in:		**2.5**
SYSC 5909 [2.5]	**M.A.Sc. Thesis (in the area of modeling and simulation)**	
Total Credits		5.0

New Resources	No New Resources
Summary	Introduce Concentration in Modeling and Simulation for the MEng and MASc in Electrical and Computer Engineering.
Rationale	A large number of private and public sector agencies in Canada apply M&S in their daily operations. While there exist several M&S training hubs in the US and EU, there are no such

	programs in Canada, which necessitates that Canadian M&S experts be sent abroad for training. The department of Systems and Computer Engineering has a diverse group of experts conducting research and teaching in the field of M&S. This proposed program would be the first of its kind in Canada, and will increase the number of domestic masters students in the SCE.
Transition/Implementation	New concentration
Program reviewer comments	**sandrabauer (09/01/20 2:04 pm):** Created separate entry for MASc; formatted into CourseLeaf table and harmonized with existing presentation of other ECE programs **sandrabauer (09/11/20 3:27 pm):** Edited summary and rationale **sarahcleary (09/28/20 2:51 pm):** Put courses in alpha numeric order for section 1 and removed duplicate course (SYSC 5101).

Key: 2025

MEMORANDUM

To: Senate Quality Assurance and Planning Committee (SQAPC)

From: Yvan Labiche, Chair, Department of Systems and Computer Engineering

CC: Larry Kostiuk, Dean, Faculty of Engineering and Design
Amir Hakami, Associate Dean (Research & Graduate Studies), Faculty of Engineering and Design
Patrice Smith, Dean, FGPA
James Opp, Associate Dean, FGPA

Date: September 9, 2020

Subject: Major Modification to PhD, MASc, and MEng in Electrical and Computer Engineering Concentration in Software Engineering

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Concept of the New Program

Three new concentrations in Software Engineering are proposed, one for each of the Master of Engineering (MEng), Master of Applied Science (MASc), and Doctorate (PhD) programs offered by the Department of Systems and Computer Engineering to begin in the Fall of 2021.

Ultimately, the proposed concentrations in Software Engineering seek to align with the existing situation within the Department of Systems and Computer Engineering. There is a growing number of students obtaining an undergraduate degree in software engineering (at Carleton and in Canada in general), but we do not currently offer any explicit graduate concentrations in Software Engineering.

With respect to the MEng program, the Department of Systems and Computer Engineering currently has a highly successful program in terms of enrollment (115 full-time MEng students in 2019-2020). The highest demand for the MEng program and the graduate courses offered are in the general field of Software Engineering.

With respect to the MASc/PhD program, currently, in the Department of Systems and Computer Engineering, 28% of the faculty members conduct research in areas of software engineering. With two positions to be filled, this percentage will reach 32%.

Additionally, 59% of the graduate courses offered in the current graduate programs cover areas of software engineering.

Building from the popularity of the Software Engineering area, our expertise in Software Engineering research, and the needs for software experts (in Ottawa in particular, but in software industry hubs in Montréal, the GTA, Alberta and BC), we believe that we can further increase the profile and visibility of our MEng, MASc, and PhD programs by making it explicit that we offer ways for applicants to be trained in the field of Software Engineering. For this reason, we propose to offer a MEng, MASc, and PhD program with a Concentration in Software Engineering.

Principal Goals of the Program

The introduction of a MEng, MASc, and PhD program with a Concentration in Software Engineering will help the Department of Systems and Computer Engineering increase the Key Performance Indicators for FGPA. A primary goal of the proposed Concentration is to provide a more attractive graduate portfolio for Carleton University which will result in an increased enrolment of domestic (and international students) that is commensurate with the moderate growth of the graduate allocation agreed upon in Carleton University's Strategic Mandate Agreement (2017-2020). The proposed Concentration in Software Engineering aims to achieve this goal by building on the successful Bachelor's degree in Software Engineering, and the very high demand in skilled professionals in various software areas (artificial intelligence, cloud computing, autonomous systems, etc.) in which our department has expertise.

A MEng program with a Concentration in Software Engineering will also further allow us to triage our MEng students to courses that are best suited for them based on their background and wants. Many of our current MEng students have historically struggled in many of the Software Engineering related courses offered in the Department. Thus, attracting the students with the right background will also ensure their success and time-to-graduation.

15% of the current MASc and PhD graduate student population conduct research in areas of software engineering, even though the current programs offer a MEng, MASc and PhD in Electrical and Computer Engineering. Those students who typically enter such a program out of their Bachelor's degree are often logically confused and/or discouraged by the name "Electrical and Computer Engineering." Potential candidates perceive they are not suited for a degree program with that name, so they look elsewhere. This perception may also extend to employers, in academia or otherwise, and therefore might affect the employability of our current students.

Another effect of the name discrepancy is that many students do not enter into the program with a background in software engineering. One effect of this is that the Department of Systems and Computer Engineering has 459 undergraduate students in the Software Engineering undergraduate program, but only 15% graduate students are qualified to be Teaching Assistants (TAs) in 40 sections of courses specifically focussing on one or more software engineering topics. This is not enough and there is a lack of adequate TA support in our software engineering courses. Consequently, introducing these graduate concentrations would address the issue of finding Teaching Assistants that are qualified with helping with undergraduate courses offered in the software engineering area.

By ensuring that we attract more qualified students, we seek to produce higher quality graduates which will bring with it higher quality publications, scholarships, and grants.

Program Structure and Options

Master of Engineering (MEng) with a Concentration in Software Engineering

The Master of Engineering (MEng) with a Concentration in Software Engineering will be a course-based program intended on developing advanced software engineering skills and competencies. Having the proposed Concentration in Software Engineering will allow us to provide more structure to the existing MEng program. Indeed, MEng students in the Department require significant direction in making course

selections in the vast number of course offerings. They often do not know which courses are suitable for their background and goals.

For this reason, we propose to introduce a Software Engineering Bundle of courses. The Software Engineering Bundle is a pre-selected set of courses that we know are suitable for students with a background in Software Entering and which align with the goals and objectives for students wishing to embark on a career in Software Engineering. Therefore, students enrolled in the proposed concentration in Software Engineering (at the MEng, MASc, and PhD level) will not require permission of the instructor to enrol in these courses, unlike the current situation. It is important to note that the Software Engineering Bundle is expected to be updated regularly as new courses are introduced and existing courses updated.

Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology. Admission to the Concentration would be limited to Fall Admissions.

The degree requirements for the MEng with a Concentration in Software Engineering are presented by coursework and by project consistent with the way in which other MEng programs are presented in Carleton University's Graduate Calendar.

Requirements (by coursework):

1. 0.5 credits:	0.5
SYSC 5902 [0.5] Introduction to Research Methods	
2. 2.0 credits from the Software Engineering Bundle*:	2.0
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 5105 [0.5] Software Quality Engineering and Management	
SYSC 5206 [0.5] Resource Management on Distributed Systems	
SYSC 5207 [0.5] Distributed Systems Engineering	
SYSC 5500 [0.5] Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5] Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5] Integrated Database and Cloud Systems	
SYSC 5708 [0.5] Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5] Advanced Topics in Software Engineering	
SYSC 5803 [0.5] Logic Programming	

SYSC 5806 [0.5] Object Oriented Design of Real-Time and Distributed Systems	
SYSC 5807 [0.5] Advanced Topics in Computer Systems: Security Engineering	
3. 2.0 credits in courses:	2.0
including from the Software Engineering Bundle*, OCIECE, School of Computer Science, School of Mathematics and Statistics, Directed Studies (SYSC 5906)	
Total Credits	**4.5**

* Courses in the Software Engineering Bundle will not require permission of the instructor to register for students in this concentration.

Requirements (by project):

1. 0.5 credits:	0.5
SYSC 5902 [0.5] Introduction to Research Methods	
2. 0.5 credits in project:	0.5
SYSC 5900 [0.5] Systems Engineering Project	
in the area of Software Engineering	
3. 2.0 credits from the Software Engineering Bundle*:	2.0
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 5105 [0.5] Software Quality Engineering and Management	
SYSC 5206 [0.5] Resource Management on Distributed Systems	
SYSC 5207 [0.5] Distributed Systems Engineering	
SYSC 5500 [0.5] Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5] Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5] Integrated Database and Cloud Systems	
SYSC 5708 [0.5] Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5] Advanced Topics in Software Engineering	
SYSC 5803 [0.5] Logic Programming	
SYSC 5806 [0.5] Object Oriented Design of Real-Time and Distributed Systems	

SYSC 5807 [0.5] Advanced Topics in Computer Systems: Security Engineering	
4. 1.5 credits in courses, which may include up to an additional 0.5 credits in project in the area of Software Engineering:	1.5
including from the Software Engineering Bundle*, OCIECE, School of Computer Science, School of Mathematics and Statistics, Directed Studies (SYSC 5906)	
Total Credits	**4.5**

* Courses in the Software Engineering Bundle will not require permission of the instructor to register for students in this concentration.

Master of Applied Science (MASc) with a Concentration in Software Engineering

The Master of Applied Science (MASc) with a Concentration in Software Engineering is a two-year research-intensive, thesis-based program.

Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology.

Requirements:

1. 1.5 credits from the Software Engineering Bundle*:	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 5105 [0.5] Software Quality Engineering and Management	
SYSC 5206 [0.5] Resource Management on Distributed Systems	
SYSC 5207 [0.5] Distributed Systems Engineering	
SYSC 5500 [0.5] Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5] Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5] Integrated Database and Cloud Systems	
SYSC 5708 [0.5] Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5] Advanced Topics in Software Engineering	
SYSC 5803 [0.5] Logic Programming	
SYSC 5806 [0.5] Object Oriented Design of Real-Time and Distributed Systems	

SYSC 5807 [0.5] Advanced Topics in Computer Systems: Security Engineering	
2. 1.0 credits in courses:	1.0
including from the Software Engineering Bundle*, OCIECE, School of Computer Science, School of Mathematics and Statistics, and Directed Studies (SYSC 5906)	
3. 2.5 credits in:	2.5
SYSC 5909 [2.5] M.A.Sc. Thesis	
in the area of Software Engineering (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)	
Total Credits	**5.0**

* Courses in the Software Engineering Bundle will not require permission of the instructor to register for students in this concentration.

Doctorate (PhD) with a Concentration in Software Engineering

The Doctorate (PhD) with a Concentration in Software Engineering is a four-year research-intensive, thesis-based program.

Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a Master's degree in Software Engineering, Computer Science, Computer Engineering, or Information Technology.

Requirements:

1. 1.0 credits from the Software Engineering Bundle*:	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 5105 [0.5] Software Quality Engineering and Management	
SYSC 5206 [0.5] Resource Management on Distributed Systems	
SYSC 5207 [0.5] Distributed Systems Engineering	
SYSC 5500 [0.5] Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5] Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5] Integrated Database and Cloud Systems	
SYSC 5708 [0.5] Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5] Advanced Topics in Software Engineering	

SYSC 5803 [0.5] Logic Programming	
SYSC 5806 [0.5] Object Oriented Design of Real-Time and Distributed Systems	
SYSC 5807 [0.5] Advanced Topics in Computer Systems: Security Engineering	
2. 0.5 credits in courses:	0.5
including from the Software Engineering Bundle*, OCIECE, School of Computer Science, School of Mathematics and Statistics, and Directed Studies (SYSC 5906)	
3. A comprehensive examination involving written and oral examinations and a written thesis proposal, to take place before the end of the fourth term of registration. The comprehensive examination is composed of a major topic and a minor topic. One of them must be in the Software Engineering area.	
4. 8.5 credits in:	8.5
SYSC 6909 [8.5] Ph.D. Thesis	
in the area of Software Engineering (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)	
Total Credits	**10.0**

* Courses in the Software Engineering Bundle will not require permission of the instructor to register for students in this concentration.

Impact on Other Programs

We expect that there will be a minor impact on the number of students enrolled in the MASc/PhD programs in Electrical and Computer Engineering. This is due to the fact that students that we currently admit are admitted into this program even though they are more suited to be in the Software Engineering concentration. The impact essentially amounts to a re-labelling of the students already admitted within the department, moving them from the MASc or PhD Electrical and Computer Engineering to the MASc/PhD Concentration in Software Engineering. As discussed in more detail in the following section "Societal Need" we expect that this change could in fact improve the overall profile of the Department of Systems and Computer Engineering.

Specifically for the MEng program, this concentration will enable more formalization thereby making it easier to route students to the appropriate courses. Consequently, the administrative workload is expected to diminish since we can use the Concentration code to automatically allow students to take relevant courses.

Impact on Learning Outcomes and Curriculum Map (½ - 2 pages) (Only applicable if modification(s) will impact learning goals of the program, or program requirements)

The proposed concentrations in Software Engineering will enable students to obtain a more focussed degree by concentrating on developing advanced software engineering skills and competencies through

their coursework and/or thesis. This will be achieved by the proposed changes to the program requirements, particularly with the creation of the Software Engineering Bundle of courses (see "Program Structure and Options"). Otherwise, proposed concentrations will not impact the learning outcomes of the existing MEng, MASc, and PhD programs in Electrical and Computer Engineering.

Societal Need

In a constantly evolving world, with a more and more prevalent use of solutions based on information technology, it is paramount that institutions such as Carleton University adequately train graduates who can become highly qualified participants and contributors to a changing economy in the National Capital Region and Eastern Ontario. Building on Carleton University's strength of collaborative work with local communities, government and private organizations, it is not surprising that Advanced (Information) Technology is one of the strategic areas of program strength and expansion that the Ministry of Training, Colleges and Universities (MTCU) recognized in Carleton's Strategic Mandate Agreement (2017-2020). A Concentration in Software Engineering will help Carleton University contribute significantly to this objective. Graduates of a graduate program with a concentration in software engineering will be trained to help software development in multi-disciplinary/collaborative situations, including biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and (online) commerce. Several of these situations have a synergistic impact in one of Carleton University's key initiatives critical to the prosperity of the region and the province, specifically, intelligent systems (e.g., vehicle automation). Software engineering is one of the core enablers for these systems and it is therefore important Carleton University trains graduate students who can develop knowledge with long-term impact by contributing to real-world problem solving.

It is important to offer an attractive path at the graduate level for those students obtaining undergraduate degrees in Software Engineering both at Carleton and beyond. The introduction of these proposed programs can enable Carleton University to be a leader in Canada in this area.

Student Demand

BEng programs in Software Engineering are very successful across the country. Software Engineering is well-represented in the landscape of undergraduate programs in Canada. Software Engineering is a flagship program in the Department of Systems and Computer Engineering at the undergraduate level. In fact, Software Engineering is our largest undergraduate program (147 new first year students in Fall 2019, with a steady increase over the last 10 years). Software Engineering is also a very popular stream/specialization in computer science programs (99 new students in Fall 2019, also showing a steady increase over the years). However, Software Engineering is poorly represented in the landscape of graduate programs in Canada.

Within the Department of Systems and Computer Engineering, 40% of the undergraduate students graduate from the Software Engineering program (note that this percentage is expected to significantly increase in the coming years), but only 2% of the students graduating from our undergraduate Software Engineering program continue to graduate studies in the department. This is in contrast to 17% of the undergraduate students graduating from the Biomedical and Electrical Engineering program, of which 6% continue to graduate studies in the department. We believe the fact we offer graduate programs in

Biomedical and Electrical Engineering partly explains these different percentages. This supports the need for a dedicated program that is appropriately named.

We conducted a survey of the current graduate students in the Department of Systems and Computer Engineering asking: If there was a concentration in the program you are in would you have applied? We received 62 responses with 83.9% of them responding "YES."

Similarly, we conducted a survey of the current undergraduate students in their third and fourth year within the Software Engineering and Computer Systems Engineering programs offered by the Department of Systems and Computer Engineering asking two questions:

1. Are you interested in applying for a Master's program in our department?
2. If there was a Master's program with a Concentration in Software Engineering in our department, would you apply for it?

We received 95 responses with 66.3% of responding "YES" to Question 1 and 71.9% responding "YES" to Question 2. More notably, we had 11 respondents (11.6%) reply "NO" to Question 1 and "YES" to Question 2 demonstrating that these students would change their mind about applying for graduate studies in the Department if a concentration in Software Engineering was an available option.

Resources

Faculty Resources

Currently, 28% of the faculty members in the Department of Systems and Computer Engineering conduct research, teaching, and supervise students in areas of Software Engineering. The Department of Systems and Computer Engineering also has three positions to be filled in the software Engineering area. Therefore, additional faculty hiring to support the MEng/MASc/PhD programs does not appear to be required.

Contract Instructors

Currently, the Department of Systems and Computer Engineering has three (3) contract instructors teaching graduate levels courses in Software Engineering. Additional contract instructors beyond the current numbers to support the MEng/MASc/PhD programs does not appear to be required.

Administrative Support

The Chair of the Department and the Associate Chair of Graduate Studies will assist in terms of intake of applicants. Student files will be managed by the Department of Systems and Computer Engineering. It is expected that the introduction of this concentration will help the administrative process by enabling the process for checking the enrollment in the concentration to be automated. It is expected that this will in fact reduce the administrative overhead of the Graduate Assistant within the department.

Library Resources

There is no need for additional library resources resulting from the introduction of this Concentration.

Space

There is no need for additional space resulting from the introduction of an MEng program with a Concentration in Software Engineering.

Regarding the MASc and PhD Concentrations in Software Engineering, based on the numbers that we are reporting, we do not expect to grow immediately. Instead, we expect that students that would normally apply to and be admitted in the MASc/PhD in Electrical and Computer Engineering will be converted to be in the Concentration in the short-term. Aligned with the goals of the proposed Concentration, with the expected higher conversion of our own BEng students into graduate students, we expect a higher proportion of domestic students in the overall enrollment, but with no change to the overall admission numbers, more space would not be required.

Moreover, each year, the Department of Systems and Computer Engineering receives a quota from FGPA of domestic graduate students that we aim to achieve. Between 2015-2018, each year we had room for 8-10 new domestic PhD students and 18-22 new domestic MASc students, but only 5-12 (average 8) new domestic PhD students and 8-11 new domestic MASc students were registered. Therefore, the Department currently has room to grow.

However, as mentioned above, a primary goal of the proposed Concentration is to increase enrolment of domestic (and international students) commensurate with the moderate growth of the graduate allocation agreed upon in Carleton University's Strategic Mandate Agreement (2017-2020). Therefore, we do envision growth over the long-term and we do envision space being required at that time.

Equipment

There does not appear to be a need for equipment resulting from the introduction of this Concentration.

Graduate Student Funding

Teaching assistant and scholarship support will be required from the Faculty of Graduate and Postdoctoral Affairs. Additional student funding may include research assistantships.

Program Change Request

New Program Proposal

Date Submitted: 09/01/20 7:09 pm

Viewing: **TBD-2026 : M.A.Sc. Electrical and Computer Engineering with Concentration in Software Engineering**

Last edit: 09/16/20 3:03 pm

Last modified by: sandrabauer

Changes proposed by: sandrabauer

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. PRE SCCASP
8. SCCASP
9. SQAPC
10. Senate
11. CalEditor

Approval Path

1. 09/01/20 9:48 pm Sandra Bauer (sandrabauer): Approved for SYST ChairDir GR
2. 09/01/20 9:49 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
3. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
4. 09/09/20 12:19 pm Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
5. 09/09/20 12:24 pm Sandra Bauer (sandrabauer): Approved for GRAD FCC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2026
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	M.A.Sc. Electrical and Computer Engineering with Concentration in Software Engineering

Program Requirements

M.A.Sc. Electrical and Computer Engineering

Concentration in Software Engineering (5.0 credits)

Requirements - thesis pathway:		
1. 1.5 credits from Software Engineering core:		**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 5105 [0.5]	**Software Quality Engineering and Management**	
SYSC 5206 [0.5]	**Resource Management on Distributed Systems**	
SYSC 5207 [0.5]	**Distributed Systems Engineering**	
SYSC 5500 [0.5]	**Designing Secure Networking and Computer Systems**	
SYSC 5701 [0.5]	**Operating System Methods for Real-Time Applications**	
SYSC 5703 [0.5]	**Integrated Database and Cloud Systems**	
SYSC 5708 [0.5]	**Model-Driven Development of Real-Time and Distributed Software**	
SYSC 5709 [0.5]	**Advanced Topics in Software Engineering**	
SYSC 5803 [0.5]	**Logic Programming**	
SYSC 5806 [0.5]	**Object Oriented Design of Real-Time and Distributed Systems**	
SYSC 5807 [0.5]	**Advanced Topics in Computer Systems**	
2. 1.0 credit in courses		**1.0**
3. 2.5 credits in:		**2.5**
SYSC 5909 [2.5]	**M.A.Sc. Thesis**	
in the area of Software Engineering (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)		
Total Credits		5.0

New Resources	No New Resources
Summary	Introduce Concentration in Software Engineering for MEng, MASc, PhD Electrical Engineering.
Rationale	Software engineering is one of the core enablers in biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and online commerce. There is an ongoing need for software experts in Ottawa as well as in the software industry hubs in Montreal, the GTA, Alberta and British Columbia. Advanced (Information) Technology is one of the strategic areas of program strength and expansion recognized by the MTCU in Carleton's Strategic Mandate Agreement (2017-2020) and we believe that our expertise in software engineering research and teaching can help to fulfil this need. A concentration in software engineering will increase the profile and visibility of our MEng, MASc and PhD programs, and offers an attractive path to graduate studies at Carleton for both Carleton undergraduate students and graduates from other institutions seeking training in this field. The concentrations will allow us to align with the undergraduate program in Software Engineering, retaining students who want to have a degree that reflects their area of research.
Transition/Implementation	The Master of Engineering (MEng) with a Concentration in Software Engineering will be a course-based program intended on developing advanced software engineering skills and competencies. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology. Admission to the Concentration would be limited to Fall Admissions. The Master of Applied Science (MASc) with a Concentration in Software Engineering is a two-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology. The Doctorate (PhD) with a Concentration in Software Engineering is a four-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a Master's degree in Software Engineering, Computer Science, Computer Engineering, or Information Technology.
Program reviewer comments	**sandrabauer (09/16/20 3:03 pm):** Edit summary/rationale per P&P

Key: 2026

Program Change Request

New Program Proposal

Date Submitted: 06/19/20 2:57 pm

Viewing: **TBD-2006 : M.Eng. Electrical and Computer Engineering with Concentration in Software Engineering**

Last edit: 09/16/20 3:04 pm

Last modified by: sandrabauer

Changes proposed by: jasonjaskolka

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. PRE SCCASP
8. SCCASP
9. SQAPC
10. Senate
11. CalEditor

Approval Path

1. 06/19/20 9:42 am Yvan Labiche (yvanlabiche): Rollback to Initiator
2. 06/20/20 8:21 am Yvan Labiche (yvanlabiche): Approved for SYST ChairDir GR
3. 09/01/20 7:24 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
4. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
5. 09/09/20 12:19 pm Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
6. 09/09/20 12:24 pm Sandra Bauer (sandrabauer): Approved for GRAD FCC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2006
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	M.Eng. Electrical and Computer Engineering with Concentration in Software Engineering

Program Requirements

M.Eng. Electrical and Computer Engineering with Concentration in Software Engineering (4.5 credits)

Requirements (by coursework):		
1. 0.5 credit in:		**0.5**
SYSC 5902 [0.5]	**Research Methods for Engineers**	
2. 2.0 credits from software engineering core courses:		**2.0**
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 5105 [0.5]	**Software Quality Engineering and Management**	
SYSC 5206 [0.5]	**Resource Management on Distributed Systems**	
SYSC 5207 [0.5]	**Distributed Systems Engineering**	
SYSC 5500 [0.5]	**Designing Secure Networking and Computer Systems**	
SYSC 5701 [0.5]	**Operating System Methods for Real-Time Applications**	
SYSC 5703 [0.5]	**Integrated Database and Cloud Systems**	
SYSC 5708 [0.5]	**Model-Driven Development of Real-Time and Distributed Software**	
SYSC 5709 [0.5]	**Advanced Topics in Software Engineering**	
SYSC 5803 [0.5]	**Logic Programming**	
SYSC 5806 [0.5]	**Object Oriented Design of Real-Time and Distributed Systems**	
SYSC 5807 [0.5]	**Advanced Topics in Computer Systems**	
3. 2.0 credits in courses		**2.0**
Total Credits		4.5
Requirements (by project):		
1. 0.5 credit in:		**0.5**
SYSC 5902 [0.5]	**Research Methods for Engineers**	
2. 0.5 credit in:		**0.5**
SYSC 5900 [0.5]	**Systems Engineering Project in the area of Software Engineering**	
3. 2.0 credits from software engineering core courses:		**2.0**
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 5104 [0.5]	**Methodologies For Discrete-Event Modeling And Simulation**	
SYSC 5105 [0.5]	**Software Quality Engineering and Management**	
SYSC 5206 [0.5]	**Resource Management on Distributed Systems**	
SYSC 5207 [0.5]	**Distributed Systems Engineering**	
SYSC 5500 [0.5]	**Designing Secure Networking and Computer Systems**	
SYSC 5701 [0.5]	**Operating System Methods for Real-Time Applications**	
SYSC 5703 [0.5]	**Integrated Database and Cloud Systems**	
SYSC 5708 [0.5]	**Model-Driven Development of Real-Time and Distributed Software**	
SYSC 5709 [0.5]	**Advanced Topics in Software Engineering**	
SYSC 5803 [0.5]	**Logic Programming**	
SYSC 5806 [0.5]	**Object Oriented Design of Real-Time and Distributed Systems**	
SYSC 5807 [0.5]	**Advanced Topics in Computer Systems**	
4. 1.5 credits in courses, which may include up to an additional 0.5 credits in project in the area of Software Engineering		**1.5**
Total Credits		4.5

New Resources No New Resources

Summary	Summary Introduce Concentration in Software Engineering for MEng, MASc, PhD Electrical Engineering.
Rationale	Software engineering is one of the core enablers in biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and online commerce. There is an ongoing need for software experts in Ottawa as well as in the software industry hubs in Montreal, the GTA, Alberta and British Columbia. Advanced (Information) Technology is one of the strategic areas of program strength and expansion recognized by the MTCU in Carleton's Strategic Mandate Agreement (2017-2020) and we believe that our expertise in software engineering research and teaching can help to fulfil this need. A concentration in software engineering will increase the profile and visibility of our MEng, MASc and PhD programs, and offers an attractive path to graduate studies at Carleton for both Carleton undergraduate students and graduates from other institutions seeking training in this field. The concentrations will allow us to align with the undergraduate program in Software Engineering, retaining students who want to have a degree that reflects their area of research.
Transition/Implementation	The Master of Engineering (MEng) with a Concentration in Software Engineering will be a course-based program intended on developing advanced software engineering skills and competencies. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology. Admission to the Concentration would be limited to Fall Admissions. The Master of Applied Science (MASc) with a Concentration in Software Engineering is a two-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology. The Doctorate (PhD) with a Concentration in Software Engineering is a four-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a Master's degree in Software Engineering, Computer Science, Computer Engineering, or Information Technology.
Program reviewer comments	**yvanlabiche (06/19/20 9:42 am):** Rollback: Jason, I spotted something wrong in the courseleaf entry. The second project course for MEng is not 5901: 5901 does not exist; it should be 5903. To fix this, and be consistent with the default MEng program, why not simply removing "and System Engineering Project (SYSC 5900 or SYSC 5901) in the area of Software Engineering" because the text for item 4 already has "which may include up to an additional 0.5 credit in project:" ? And then change "which may include up to an additional 0.5 credit in project:" into "which may include up to an additional 0.5 credit in project in the area of Software Engineering:" Yvan. **sandrabauer (09/01/20 7:21 pm):** Broke items out into discrete entries for MASc, MEng, PhD Standardized presentation and terminology to conform with unit's existing program entries **sandrabauer (09/16/20 3:04 pm):** Edited summary & rationale per P&P

Key: 2006

Program Change Request

New Program Proposal

Date Submitted: 09/01/20 7:17 pm

Viewing: **TBD-2027 : PhD Electrical and Computer Engineering with Concentration in Software Engineering**

Last edit: 09/16/20 3:05 pm

Last modified by: sandrabauer

Changes proposed by: sandrabauer

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. PRE SCCASP
8. SCCASP
9. SQAPC
10. Senate
11. CalEditor

Approval Path

1. 09/01/20 9:50 pm Sandra Bauer (sandrabauer): Approved for SYST ChairDir GR
2. 09/01/20 9:51 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
3. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
4. 09/15/20 10:29 am Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
5. 09/15/20 10:30 am Sandra Bauer (sandrabauer): Approved for GRAD FCC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2027
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	PhD Electrical and Computer Engineering with Concentration in Software Engineering

Program Requirements

Ph.D. Electrical and Computer Engineering

with Concentration in Software Engineering (10.0 credits)

Requirements:		
1. 1.0 credit from software engineering core 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 5105 [0.5]	**Software Quality Engineering and Management**	
SYSC 5206 [0.5]	**Resource Management on Distributed Systems**	
SYSC 5207 [0.5]	**Distributed Systems Engineering**	
SYSC 5500 [0.5]	**Designing Secure Networking and Computer Systems**	
SYSC 5701 [0.5]	**Operating System Methods for Real-Time Applications**	
SYSC 5703 [0.5]	**Integrated Database and Cloud Systems**	
SYSC 5708 [0.5]	**Model-Driven Development of Real-Time and Distributed Software**	
SYSC 5709 [0.5]	**Advanced Topics in Software Engineering**	
SYSC 5803 [0.5]	**Logic Programming**	
SYSC 5806 [0.5]	**Object Oriented Design of Real-Time and Distributed Systems**	
SYSC 5807 [0.5]	**Advanced Topics in Computer Systems**	
2. 0.5 credit in courses		**0.5**
3. 0.0 credit in comprehensive examination (one topic of which must be in the area of software engineering)		
4. 8.5 credits in:		**8.5**
SYSC 6909 [8.5]	**Ph.D. Thesis**	
in the area of Software Engineering (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)		
Total Credits		10.0

New Resources	No New Resources
Summary	Introduce Concentration in Software Engineering for MEng, MASc, PhD Electrical Engineering.
Rationale	Software engineering is one of the core enablers in biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and online commerce. There is an ongoing need for software experts in Ottawa as well as in the software industry hubs in Montreal, the GTA, Alberta and British Columbia. Advanced (Information) Technology is one of the strategic areas of program strength and expansion recognized by the MTCU in Carleton's Strategic Mandate Agreement (2017-2020) and we believe that our expertise in software engineering research and teaching can help to fulfil this need. A concentration in software engineering will increase the profile and visibility of our MEng, MASc and PhD programs, and offers an attractive path to graduate studies at Carleton for both Carleton undergraduate students and graduates from other institutions seeking training in this field. The concentrations will allow us to align with the undergraduate program in Software Engineering, retaining students who want to have a degree that reflects their area of research.
Transition/Implementation	The Doctorate (PhD) with a Concentration in Software Engineering is a four-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a Master's degree in Software Engineering, Computer Science, Computer Engineering, or Information Technology.

Program reviewer comments	**sandrabauer (09/16/20 3:05 pm):** Edited summary & rationale per P&P

Key: 2027

New Program Proposal

Date Submitted: 06/19/20 2:57 pm

Viewing: TBD-2006 : M.Eng. Electrical and Computer Engineering with Concentration in Software Engineering

Last edit: 09/16/20 3:04 pm

Last modified by: sandrabauer

Changes proposed by: jasonjaskolka

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. **PRE SCCASP**
8. **SCCASP**
9. **SQAPC**
10. **Senate**
11. CalEditor

Approval Path

1. 06/19/20 9:42 am Yvan Labiche (yvanlabiche): Rollback to Initiator
2. 06/20/20 8:21 am Yvan Labiche (yvanlabiche): Approved for SYST ChairDir GR
3. 09/01/20 7:24 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
4. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
5. 09/09/20 12:19 pm Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
6. 09/09/20 12:24 pm Sandra Bauer (sandrabauer): Approved for GRAD FCC
7. 09/23/20 10:51 am Sandra Bauer (sandrabauer): Approved for GRAD FBoard
8. 09/28/20 3:13 pm Sarah Cleary (sarahcleary): Approved for PRE SCCASP
9. 10/13/20 12:04 pm Erika Strathearn

(erikastrathearn): Approved for SCCASP
10. 10/13/20 2:56 pm Christina Noja (christinanoja): Approved for SQAPC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2006
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	M.Eng. Electrical and Computer Engineering with Concentration in Software Engineering

Program Requirements

M.Eng. Electrical and Computer Engineering with Concentration in Software Engineering (4.5 credits)

Requirements (by coursework):

1. 0.5 credit in: **0.5**

SYSC 5902 [0.5]	Research Methods for Engineers	

2. 2.0 credits from software engineering core courses: **2.0**

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 5105 [0.5]	Software Quality Engineering and Management	
SYSC 5206 [0.5]	Resource Management on Distributed Systems	
SYSC 5207 [0.5]	Distributed Systems Engineering	
SYSC 5500 [0.5]	Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5]	Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5]	Integrated Database and Cloud Systems	
SYSC 5708 [0.5]	Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5]	Advanced Topics in Software Engineering	
SYSC 5803 [0.5]	Logic Programming	
SYSC 5806 [0.5]	Object Oriented Design of Real-Time and Distributed Systems	
SYSC 5807 [0.5]	Advanced Topics in Computer Systems	

3. 2.0 credits in courses	**2.0**
Total Credits	4.5

Requirements (by project):

1. 0.5 credit in:	**0.5**
SYSC 5902 [0.5] Research Methods for Engineers	
2. 0.5 credit in:	**0.5**
SYSC 5900 [0.5] Systems Engineering Project in the area of Software Engineering	
3. 2.0 credits from software engineering core courses:	**2.0**
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 5104 [0.5] Methodologies For Discrete-Event Modeling And Simulation	
SYSC 5105 [0.5] Software Quality Engineering and Management	
SYSC 5206 [0.5] Resource Management on Distributed Systems	
SYSC 5207 [0.5] Distributed Systems Engineering	
SYSC 5500 [0.5] Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5] Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5] Integrated Database and Cloud Systems	
SYSC 5708 [0.5] Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5] Advanced Topics in Software Engineering	
SYSC 5803 [0.5] Logic Programming	
SYSC 5806 [0.5] Object Oriented Design of Real-Time and Distributed Systems	
SYSC 5807 [0.5] Advanced Topics in Computer Systems	
4. 1.5 credits in courses, which may include up to an additional 0.5 credits in project in the area of Software Engineering	**1.5**
Total Credits	4.5

New Resources	No New Resources
Summary	Summary Introduce Concentration in Software Engineering for MEng, MASc, PhD Electrical Engineering.
Rationale	Software engineering is one of the core enablers in biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and online commerce. There is an ongoing need for software experts in Ottawa as well as in the software industry hubs in Montreal, the GTA, Alberta and British Columbia. Advanced (Information) Technology is one of the strategic areas of program strength and expansion recognized by the MTCU in Carleton's Strategic Mandate Agreement (2017-2020) and we believe that our expertise in software engineering research and teaching can help to fulfil this need. A concentration in software engineering will increase the profile and visibility of our MEng, MASc and PhD programs, and offers an attractive path to graduate studies at Carleton for both Carleton undergraduate students and graduates from other institutions seeking training in this field. The concentrations will allow us to align with the undergraduate program in Software Engineering, retaining students who want to have a degree that reflects their area of research.
Transition/Implementation	The Master of Engineering (MEng) with a Concentration in Software Engineering will be a course-based program intended on developing advanced software engineering skills and competencies. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in

Software Engineering, Computer Science, Computer Engineering, or Information Technology. Admission to the Concentration would be limited to Fall Admissions.

The Master of Applied Science (MASc) with a Concentration in Software Engineering is a two-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a (Honours) BEng in Software Engineering, Computer Science, Computer Engineering, or Information Technology.

The Doctorate (PhD) with a Concentration in Software Engineering is a four-year research-intensive, thesis-based program. Students entering into this concentration will require an appropriate background by demonstrating that they have obtained the equivalent of a Master's degree in Software Engineering, Computer Science, Computer Engineering, or Information Technology.

Program reviewer comments

yvanlabiche (06/19/20 9:42 am): Rollback: Jason, I spotted something wrong in the courseleaf entry. The second project course for MEng is not 5901: 5901 does not exist; it should be 5903. To fix this, and be consistent with the default MEng program, why not simply removing "and System Engineering Project (SYSC 5900 or SYSC 5901) in the area of Software Engineering" because the text for item 4 already has "which may include up to an additional 0.5 credit in project:" ? And then change "which may include up to an additional 0.5 credit in project:" into "which may include up to an additional 0.5 credit in project in the area of Software Engineering:" Yvan.
sandrabauer (09/01/20 7:21 pm): Broke items out into discrete entries for MASc, MEng, PhD Standardized presentation and terminology to conform with unit's existing program entries
sandrabauer (09/16/20 3:04 pm): Edited summary & rationale per P&P

Key: 2006

New Program Proposal

Date Submitted: 09/01/20 7:17 pm

Viewing: TBD-2027 : PhD Electrical and Computer Engineering with Concentration in Software Engineering

Last edit: 09/16/20 3:05 pm

Last modified by: sandrabauer

Changes proposed by: sandrabauer

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. **PRE SCCASP**
8. **SCCASP**
9. **SQAPC**
10. **Senate**
11. CalEditor

Approval Path

1. 09/01/20 9:50 pm Sandra Bauer (sandrabauer): Approved for SYST ChairDir GR
2. 09/01/20 9:51 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
3. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
4. 09/15/20 10:29 am Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
5. 09/15/20 10:30 am Sandra Bauer (sandrabauer): Approved for GRAD FCC
6. 09/23/20 10:51 am Sandra Bauer (sandrabauer): Approved for GRAD FBoard
7. 09/28/20 3:16 pm Sarah Cleary (sarahcleary): Approved for PRE SCCASP
8. 10/13/20 12:04 pm Erika Strathearn (erikastrathearn): Approved for SCCASP
9. 10/13/20 2:56 pm Christina Noja

(christinanoja): Approved for SQAPC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2027
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	PhD Electrical and Computer Engineering with Concentration in Software Engineering

Program Requirements

Ph.D. Electrical and Computer Engineering with Concentration in Software Engineering (10.0 credits)

Requirements:

1. 1.0 credit from software engineering core 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 5105 [0.5] Software Quality Engineering and Management**
- **SYSC 5206 [0.5] Resource Management on Distributed Systems**
- **SYSC 5207 [0.5] Distributed Systems Engineering**
- **SYSC 5500 [0.5] Designing Secure Networking and Computer Systems**
- **SYSC 5701 [0.5] Operating System Methods for Real-Time Applications**
- **SYSC 5703 [0.5] Integrated Database and Cloud Systems**
- **SYSC 5708 [0.5] Model-Driven Development of Real-Time and Distributed Software**
- **SYSC 5709 [0.5] Advanced Topics in Software Engineering**
- **SYSC 5803 [0.5] Logic Programming**
- **SYSC 5806 [0.5] Object Oriented Design of Real-Time and Distributed Systems**
- **SYSC 5807 [0.5] Advanced Topics in Computer Systems**

2. 0.5 credit in courses 0.5

3. 0.0 credit in comprehensive examination (one topic of which must be in the area of software engineering)

4. 8.5 credits in: 8.5

- **SYSC 6909 [8.5] Ph.D. Thesis**

in the area of Software Engineering (each candidate submitting a thesis will be required to undertake an oral

defence of the thesis)

Total Credits	10.0

New Resources	No New Resources
Summary	Introduce Concentration in Software Engineering for MEng, MASc, PhD Electrical Engineering.
Rationale	Software engineering is one of the core enablers in biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and online commerce. There is an ongoing need for software experts in Ottawa as well as in the software industry hubs in Montreal, the GTA, Alberta and British Columbia. Advanced (Information) Technology is one of the strategic areas of program strength and expansion recognized by the MTCU in Carleton's Strategic Mandate Agreement (2017-2020) and we believe that our expertise in software engineering research and teaching can help to fulfil this need. A concentration in software engineering will increase the profile and visibility of our MEng, MASc and PhD programs, and offers an attractive path to graduate studies at Carleton for both Carleton undergraduate students and graduates from other institutions seeking training in this field. The concentrations will allow us to align with the undergraduate program in Software Engineering, retaining students who want to have a degree that reflects their area of research.
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Program reviewer comments	**sandrabauer (09/16/20 3:05 pm):** Edited summary & rationale per P&P

Key: 2027

New Program Proposal

Date Submitted: 09/01/20 7:09 pm

Viewing: TBD-2026 : M.A.Sc. Electrical and Computer Engineering with Concentration in Software Engineering

Last edit: 09/16/20 3:03 pm

Last modified by: sandrabauer

Changes proposed by: sandrabauer

In Workflow

1. **SYST ChairDir GR**
2. **ENG Dean**
3. **GRAD Dean**
4. **PRE GRAD FCC**
5. **GRAD FCC**
6. **GRAD FBoard**
7. **PRE SCCASP**
8. **SCCASP**
9. **SQAPC**
10. **Senate**
11. CalEditor

Approval Path

1. 09/01/20 9:48 pm Sandra Bauer (sandrabauer): Approved for SYST ChairDir GR
2. 09/01/20 9:49 pm Sandra Bauer (sandrabauer): Approved for ENG Dean
3. 09/08/20 2:34 pm Sandra Bauer (sandrabauer): Approved for GRAD Dean
4. 09/09/20 12:19 pm Sandra Bauer (sandrabauer): Approved for PRE GRAD FCC
5. 09/09/20 12:24 pm Sandra Bauer (sandrabauer): Approved for GRAD FCC
6. 09/23/20 10:51 am Sandra Bauer (sandrabauer): Approved for GRAD FBoard
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9. 10/13/20 2:56 pm Christina Noja

(christinanoja): Approved for SQAPC

Effective Date	2021-22
Workflow	majormod
Program Code	TBD-2026
Level	Graduate
Faculty	Faculty of Engineering and Design
Academic Unit	Department of Systems and Computer Engineering
Degree	
Title	M.A.Sc. Electrical and Computer Engineering with Concentration in Software Engineering

Program Requirements

M.A.Sc. Electrical and Computer Engineering
Concentration in Software Engineering (5.0 credits)

Requirements - thesis pathway:

1. 1.5 credits from Software Engineering core:		**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 5105 [0.5]	Software Quality Engineering and Management	
SYSC 5206 [0.5]	Resource Management on Distributed Systems	
SYSC 5207 [0.5]	Distributed Systems Engineering	
SYSC 5500 [0.5]	Designing Secure Networking and Computer Systems	
SYSC 5701 [0.5]	Operating System Methods for Real-Time Applications	
SYSC 5703 [0.5]	Integrated Database and Cloud Systems	
SYSC 5708 [0.5]	Model-Driven Development of Real-Time and Distributed Software	
SYSC 5709 [0.5]	Advanced Topics in Software Engineering	
SYSC 5803 [0.5]	Logic Programming	
SYSC 5806 [0.5]	Object Oriented Design of Real-Time and Distributed Systems	
SYSC 5807 [0.5]	Advanced Topics in Computer Systems	
2. 1.0 credit in courses		**1.0**
3. 2.5 credits in:		**2.5**
SYSC 5909 [2.5]	M.A.Sc. Thesis	
in the area of Software Engineering (each candidate submitting a thesis will be required to undertake an oral defence of the thesis)		

Total Credits	5.0
New Resources	No New Resources
Summary	Introduce Concentration in Software Engineering for MEng, MASc, PhD Electrical Engineering.
Rationale	Software engineering is one of the core enablers in biomedical applications, communication systems, machine intelligence, robotics and control, augmented and virtual reality, and online commerce. There is an ongoing need for software experts in Ottawa as well as in the software industry hubs in Montreal, the GTA, Alberta and British Columbia. Advanced (Information) Technology is one of the strategic areas of program strength and expansion recognized by the MTCU in Carleton's Strategic Mandate Agreement (2017-2020) and we believe that our expertise in software engineering research and teaching can help to fulfil this need. A concentration in software engineering will increase the profile and visibility of our MEng, MASc and PhD programs, and offers an attractive path to graduate studies at Carleton for both Carleton undergraduate students and graduates from other institutions seeking training in this field. The concentrations will allow us to align with the undergraduate program in Software Engineering, retaining students who want to have a degree that reflects their area of research.
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Program reviewer comments	**sandrabauer (09/16/20 3:03 pm):** Edit summary/rationale per P&P

Key: 2026