# **Building Engineering**

This section presents the requirements for programs in:

- M.A.Sc. Building Engineering
- M.A.Sc. Building Engineering with Concentration in Building Performance
- M.A.Sc. Building Engineering with Concentration in Fire Safety
- M.A.Sc. Building Engineering with Concentration in Heritage Conservation
- M.Eng. Building Engineering
- M.Eng. Building Engineering with Concentration in Building Performance
- M.Eng. Building Engineering with Concentration in Fire Safety
- M.Eng. Building Engineering with Concentration in Heritage Conservation
- Ph.D. Building Engineering
- Ph.D. Building Engineering with Concentration in Building Performance
- Ph.D. Building Engineering with Concentration in Fire Safety
- Ph.D. Building Engineering with Concentration in Heritage Conservation

#### **Program Requirements**

#### M.A.Sc. Building Engineering (5.0 credits)

#### **Requirements:**

1. 0.5 credit in:

BLDG 5101 [0.5] Introduction to Building Engineering **2. 1.0 credit from** the following list. Other courses may be used, with Supervisor recommendation and Director approval.

4	piovai.	
	ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation
	ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation
	BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering
	BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage
	BLDG 5202 [0.5]	Structural Assessment of Historic Buildings
	BLDG 5301 [0.5]	Building Energy Management and Optimization
	BLDG 5302 [0.5]	Building Services Engineering
	CDNS 5403 [0.5]	Heritage Conservation and Sustainability
	CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering
	CIVE 5610 [0.5]	Fire Dynamics I
	CIVE 5612 [0.5]	Fire Modeling
	CIVE 5613 [0.5]	Fire Dynamics II
	CIVE 5614 [0.5]	Design for Fire Resistance
	CIVE 5615 [0.5]	Fire Behaviour of Materials
	ENVE 5104 [0.5]	Indoor Environmental Quality

	MECH 5205 [0.5]	Building Performance Simulation	
3.	1.0 credit in appro	ved electives	1.0
4.	2.5 credits in:		2.5
	BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)	

5.0

5.0

#### **Total Credits**

#### M.A.Sc. Building Engineering with Concentration in Building Performance (5.0 credits)

#### **Requirements:**

quiremento.		
0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
t. Other courses may	y be used, with Supervisor	1.5
BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
ENVE 5104 [0.5]	Indoor Environmental Quality	
BLDG 5302 [0.5]	Building Services Engineering	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
MECH 5205 [0.5]	Building Performance Simulation	
0.5 credit in approv	ved electives	0.5
2.5 credits in:		2.5
BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)	
	0.5 credit in: BLDG 5101 [0.5] 1.5 credits in the c t. Other courses may commendation and I BLDG 5103 [0.5] ENVE 5104 [0.5] BLDG 5302 [0.5] BLDG 5301 [0.5] MECH 5205 [0.5] 0.5 credit in approv 2.5 credits in:	0.5 credit in:BLDG 5101 [0.5]Introduction to Building Engineering1.5 credits in the concentration, from the followingcommendation and Director approval.BLDG 5103 [0.5]Advanced Research Methods for Building EngineeringENVE 5104 [0.5]Indoor Environmental QualityBLDG 5302 [0.5]Building Services EngineeringBLDG 5301 [0.5]Building Energy Management and OptimizationMECH 5205 [0.5]Building Performance Simulation0.5 credit in approved electives2.5 credits in:BLDG 5909 [2.5]M.A.Sc. Thesis (in the area of the

#### **Total Credits**

0.5

1.0

#### M.A.Sc. Building Engineering with Concentration in Fire Safety (5.0 credits)

#### Requirements:

#### M.A.Sc. Building Engineering with Concentration in Heritage Conservation (5.0 credits)

#### **Requirements:**

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
	concentration, from the following y be used, with Supervisor Director approval.	1.5

	ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
	ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
	CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
	BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage	
	BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
	CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
3.	0.5 credit in approv	ved electives	0.5
4.	2.5 credits in:		2.5
	BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)	
Тс	otal Credits		5.0

## M.Eng. Building Engineering (5.0 credits)

#### Requirements - Coursework pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
2. 0.5 credit from Bu courses:	ilding Performance concentration	0.5
BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
ENVE 5104 [0.5]	Indoor Environmental Quality	
MECH 5205 [0.5]	Building Performance Simulation	
3. 0.5 credit from Fir	e Safety concentration courses:	0.5
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
CIVE 5610 [0.5]	Fire Dynamics I	
CIVE 5612 [0.5]	Fire Modeling	
CIVE 5613 [0.5]	Fire Dynamics II	
CIVE 5614 [0.5]	Design for Fire Resistance	
CIVE 5615 [0.5]	Fire Behaviour of Materials	
4. 0.5 credit from He courses:	ritage Conservation concentration	0.5
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
5. 1.0 credit in additional already used to fulfil It	onal concentration courses, not ems 2-4 above	1.0
6. 1.5 credits in appr	oved electives	1.5
Total Credits		5.0

#### Requirements - Project pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
	ne following list. Other courses may sor recommendation and Director	2.0
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
CIVE 5610 [0.5]	Fire Dynamics I	
CIVE 5612 [0.5]	Fire Modeling	
CIVE 5613 [0.5]	Fire Dynamics II	
CIVE 5614 [0.5]	Design for Fire Resistance	
ENVE 5104 [0.5]	Indoor Environmental Quality	
MECH 5205 [0.5]	Building Performance Simulation	
3. 1.0 credits in appr	roved electives	1.0
4. 1.0 credit in:		1.0
BLDG 5900 [1.0]	M.Eng. Project	
Total Credits		5.0

#### M.Eng. Building Engineering with Concentration in Building Performance (5.0 credits)

Requirements - Coursework pathway:

1.	1.0 credit in:		1.0
	BLDG 5101 [0.5]	Introduction to Building Engineering	
	BLDG 5102 [0.5]	Introduction to Research Methods	
lis		oncentration, from the following / be used, with Supervisor Director approval.	2.0
	BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
	BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
	BLDG 5301 [0.5]	Building Energy Management and Optimization	
	ENVE 5104 [0.5]	Indoor Environmental Quality	
	MECH 5205 [0.5]	Building Performance Simulation	
3.	2.0 credits in appro	oved electives	2.0
То	tal Credits		5.0
Re	equirements - Proje	ct pathway:	
1.	1.0 credit in:		1.0

BLDG 5101 [0.5] Introduction to Building Engineering

BLDG 5102 [0.5] Introduction to Research Methods

**2. 2.0 credits in** the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.

	BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
	BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
	BLDG 5301 [0.5]	Building Energy Management and Optimization	
	ENVE 5104 [0.5]	Indoor Environmental Quality	
	MECH 5205 [0.5]	Building Performance Simulation	
3.	1.0 credits in appro	oved electives	1.0
4.	1.0 credit in:		1.0
	BLDG 5900 [1.0]	M.Eng. Project	

#### **Total Credits**

#### M.Eng. Building Engineering with Concentration in Fire Safety (5.0 credits)

## Requirements - Coursework pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
	concentration, from the following y be used, with Supervisor Director approval.	2.0
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
CIVE 5610 [0.5]	Fire Dynamics I	
CIVE 5612 [0.5]	Fire Modeling	
CIVE 5613 [0.5]	Fire Dynamics II	
CIVE 5614 [0.5]	Design for Fire Resistance	
CIVE 5615 [0.5]	Fire Behaviour of Materials	
3. 2.0 credits in appr	roved electives	2.0
Total Credits		5.0
Requirements - Proj	ect pathway:	
1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
	concentration, from the following y be used, with Supervisor Director approval.	2.0
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
CIVE 5610 [0.5]	Fire Dynamics I	
CIVE 5610 [0.5] CIVE 5612 [0.5]	0 0	
	Fire Dynamics I	
CIVE 5612 [0.5]	Fire Dynamics I Fire Modeling	
CIVE 5612 [0.5] CIVE 5613 [0.5]	Fire Dynamics I Fire Modeling Fire Dynamics II	
CIVE 5612 [0.5] CIVE 5613 [0.5] CIVE 5614 [0.5]	Fire Dynamics I Fire Modeling Fire Dynamics II Design for Fire Resistance Fire Behaviour of Materials	1.0
CIVE 5612 [0.5] CIVE 5613 [0.5] CIVE 5614 [0.5] CIVE 5615 [0.5]	Fire Dynamics I Fire Modeling Fire Dynamics II Design for Fire Resistance Fire Behaviour of Materials	1.0 1.0
CIVE 5612 [0.5] CIVE 5613 [0.5] CIVE 5614 [0.5] CIVE 5615 [0.5] <b>3. 1.0 credits in</b> appr	Fire Dynamics I Fire Modeling Fire Dynamics II Design for Fire Resistance Fire Behaviour of Materials	

#### M.Eng. Building Engineering

2.0

5.0

## with Concentration in Heritage Conservation (5.0 credits)

Requirements - Proje	ect pathway:	
1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
	concentration, from the following y be used, with Supervisor Director approval.	2.0
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
3. 1.0 credits in appr	roved electives	1.0
4. 1.0 credit in:		1.0
BLDG 5900 [1.0]	M.Eng. Project	
Total Credits		5.0
Requirements - Cour	rsework pathway:	
Requirements - Cour 1. 1.0 credit in:	rsework pathway:	1.0
•	rsework pathway: Introduction to Building Engineering	1.0
1. 1.0 credit in:		1.0
<ol> <li>1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5]</li> <li>2. 2.0 credits in the olist. Other courses mainted</li> </ol>	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor	1.0
<ol> <li>1. 0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5]</li> <li>2. 0 credits in the other states and the states and</li></ol>	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor	
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses ma recommendation and	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in	
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses ma recommendation and ARCC 5401 [0.5]	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in Heritage Conservation Representation and Documentation	
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses ma recommendation and ARCC 5401 [0.5] ARCN 5100 [0.5]	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in Heritage Conservation Representation and Documentation in Architectural Conservation Advanced Research Methods for	
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses ma recommendation and ARCC 5401 [0.5] ARCN 5100 [0.5] BLDG 5103 [0.5]	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in Heritage Conservation Representation and Documentation in Architectural Conservation Advanced Research Methods for Building Engineering Advanced Building Characterization, Conservation and	
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses ma recommendation and ARCC 5401 [0.5] ARCN 5100 [0.5] BLDG 5103 [0.5] BLDG 5201 [0.5]	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in Heritage Conservation Representation and Documentation in Architectural Conservation Advanced Research Methods for Building Engineering Advanced Building Characterization, Conservation and Rehabilitation Heritage Heritage Conservation and Sustainability	
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses marecommendation and ARCC 5401 [0.5] ARCN 5100 [0.5] BLDG 5103 [0.5] BLDG 5201 [0.5] CDNS 5403 [0.5]	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in Heritage Conservation Representation and Documentation in Architectural Conservation Advanced Research Methods for Building Engineering Advanced Building Characterization, Conservation and Rehabilitation Heritage Heritage Conservation and Sustainability	2.0
1. 1.0 credit in: BLDG 5101 [0.5] BLDG 5102 [0.5] 2. 2.0 credits in the of list. Other courses marecommendation and ARCC 5401 [0.5] BLDG 5100 [0.5] BLDG 5103 [0.5] BLDG 5201 [0.5] CDNS 5403 [0.5] 3. 2.0 credits in appr Total Credits	Introduction to Building Engineering Introduction to Research Methods concentration, from the following by be used, with Supervisor Director approval. Workshop: Technical Studies in Heritage Conservation Representation and Documentation in Architectural Conservation Advanced Research Methods for Building Engineering Advanced Building Characterization, Conservation and Rehabilitation Heritage Heritage Conservation and Sustainability	2.0

Re	quirements.		
1.	0.5 credit in:		0.5
	BLDG 5101 [0.5]	Introduction to Building Engineering	
be		following list. Other courses may or recommendation and Director	1.0
	ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
	ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
	BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	

Total Credits			2.0
	BLDG 6909 [0.0]	Ph.D. Thesis	
4.	0.0 credit in:		
	BLDG 6901 [0.5]	Thesis Proposal	
3.	0.5 credit in:		0.5
	MECH 5205 [0.5]	Building Performance Simulation	
	ENVE 5104 [0.5]	Indoor Environmental Quality	
	CIVE 5615 [0.5]	Fire Behaviour of Materials	
	CIVE 5614 [0.5]	Design for Fire Resistance	
	CIVE 5613 [0.5]	Fire Dynamics II	
	CIVE 5612 [0.5]	Fire Modeling	
	CIVE 5610 [0.5]	Fire Dynamics I	
	CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
	CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
	BLDG 5302 [0.5]	Building Services Engineering	
	BLDG 5301 [0.5]	Building Energy Management and Optimization	
	BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
	BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage	

#### Ph.D. Building Engineering with Concentration in Building Performance (2.0 credits)

#### Requirements:

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
	oncentration, from the following y be used, with Supervisor Director approval.	1.0
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
BLDG 5302 [0.5]	Building Services Engineering	
ENVE 5104 [0.5]	Indoor Environmental Quality	
MECH 5205 [0.5]	Building Performance Simulation	
3. 0.5 credit in:		0.5
BLDG 6901 [0.5]	Thesis Proposal (in the area of the concentration)	
4. 0.0 credits in:		0.0
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	

### Total Credits

#### Ph.D. Building Engineering with Concentration in Fire Safety (10.0 credits)

Requirements:			
1. 0.5 credit in:		0.5	
BLDG 5101 [0.5]	Introduction to Building Engineering		
<b>2. 1.0 credit in</b> the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.			
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering		

CIVE 5012 [0.5]Fire ModelingCIVE 5013 [0.5]Fire Dynamics IICIVE 5014 [0.5]Design for Fire ResistanceCIVE 5015 [0.5]Fire Behaviour of Materials3. 0.5 credit in:BLDG 6901 [0.5]Thesis Proposal (in the area of the concentration)4. 8.0 credits in:BLDG 6909 [0.0]Ph.D. Thesis (in the area of the concentration)	8.0
CIVE 5613 [0.5]Fire Dynamics IICIVE 5614 [0.5]Design for Fire ResistanceCIVE 5615 [0.5]Fire Behaviour of Materials3. 0.5 credit in:BLDG 6901 [0.5]Thesis Proposal (in the area of the concentration)	8.0
CIVE 5613 [0.5]Fire Dynamics IICIVE 5614 [0.5]Design for Fire ResistanceCIVE 5615 [0.5]Fire Behaviour of Materials3. 0.5 credit in:BLDG 6901 [0.5]Thesis Proposal (in the area of the	0.0
CIVE 5613 [0.5]Fire Dynamics IICIVE 5614 [0.5]Design for Fire ResistanceCIVE 5615 [0.5]Fire Behaviour of Materials	
CIVE 5613 [0.5]Fire Dynamics IICIVE 5614 [0.5]Design for Fire Resistance	0.5
CIVE 5613 [0.5] Fire Dynamics II	
CIVE 5612 [0.5] Fire Modeling	
CIVE 5610 [0.5] Fire Dynamics I	

#### Ph.D. Building Engineering with Concentration in Heritage Conservation (10.0 credits)

#### Requirements:

R	equirements.		
1.	0.5 credit in:		0.5
	BLDG 5101 [0.5]	Introduction to Building Engineering	
lis		ncentration, from the following y be used, with Supervisor Director approval.	1.0
	BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation Heritage	
	BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
	CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
	ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
	ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
	BLDG 5103 [0.5]	Advanced Research Methods for Building Engineering	
3.	0.5 credit in:		0.5
	BLDG 6901 [0.5]	Thesis Proposal (in the area of the concentration)	
4.	8.0 credits in:		8.0
	BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
Total Credits			10.0

## Admission

2.0

#### M.A.Sc., M. Eng. Building Engineering

The normal requirement for admission to the M.A.Sc. and M.Eng. in Building Engineering is a bachelor's degree in an engineering or related program, with at least a B+ average. Applicants to the M.A.Sc. are required to include a research proposal statement.

#### Ph.D. Building Engineering

The normal requirement for admission to the Ph.D. Building Engineering is a master's degree in an engineering or related program, with at least a A- average. Applicants are required to include a research proposal statement.

Students registered in the M.A.Sc. Building Engineering program at Carleton University may be permitted to transfer into the Ph.D. program without completing the

master's program, provided they meet the following conditions:

- · completion of 2.5 credits of master's-level courses with a minimum average of A-,
- demonstration of exceptional research potential,
- formal application for admission to the PhD program no later than the fourth semester of initial registration in the M.A.Sc. program, and
- · permission from the Director of the Building Engineering programs.

#### Regulations

See the General Regulations section of this Calendar.

#### **Regularly Scheduled Break**

For immigration purposes, the summer term (May to August) for the MEng in Building Engineering is considered a regularly scheduled break approved by the University. Students should resume full-time studies in September.

#### **Building Engineering (BLDG) Courses**

#### BLDG 5101 [0.5 credit]

## Introduction to Building Engineering

Broad introductory and multi-disciplinary coverage of building engineering, with particular emphasis on building performance, heritage conservation, fire safety, and structures. Core competencies including research skills, communication of building engineering topics. Advanced methods for building design and restoration in the architectural, engineering, and construction field.

#### BLDG 5102 [0.5 credit]

#### Introduction to Research Methods

Broad introduction to theory and application of research methods in engineering. Key areas include conducting literature reviews; field, laboratory, and computational techniques; and designing, conducting, and presenting research.

Prerequisite(s): Enrolment in M.Eng. Building Engineering.

#### BLDG 5103 [0.5 credit]

#### Advanced Research Methods for Building Engineering

Broad set of technical and non-technical research skills to design, conduct, and publish research focused on building engineering. Key areas: defining research problems; literature reviews: methods to conduct research: inferential statistics; measurement and error analysis; design of experiments; presenting and publishing in scientific venues.

Prerequisite(s): enrollment in MASc Building Engineering, PhD Building Engineering, or BLDG 5702.

#### BLDG 5201 [0.5 credit] Advanced Building Characterization, Conservation

and Rehabilitation Heritage Supporting concepts and techniques for the identification, documentation, and conservation of heritage and existing buildings: advanced workshops by experts from key disciplines and practice areas in heritage conservation. Includes: Experiential Learning Activity Also listed as CIVE 5603.

#### BLDG 5202 [0.5 credit]

#### Structural Assessment of Historic Buildings

General concepts related to conservation of heritage structures; materials, construction techniques and structural components; classical structural analysis approaches: seismic behaviour, damage and collapse mechanisms of historic buildings; modern conservation criteria and practical implementation of repair or strengthening strategies.

Also listed as CIVE 5202.

#### BLDG 5301 [0.5 credit]

#### **Building Energy Management and Optimization**

Fault detection and diagnostics; preventive and predictive maintenance; predictive and adaptive control of indoor climate; advanced sensing technologies for the built environment; analysis and modelling using data from buildings; data mining; linear and generalized linear models; optimization methods; model selection and validation; inverse modelling.

#### BLDG 5302 [0.5 credit]

**Building Services Engineering** 

How buildings are designed and operated. The materials provide foundational knowledge to understand building services: mechanical, electrical, plumbing systems with associated controls.

Also offered at the undergraduate level, with different requirements, as ENVE 4107, for which additional credit is precluded.

#### BLDG 5900 [1.0 credit]

#### M.Eng. Project

Includes: Experiential Learning Activity

BLDG 5909 [2.5 credits] M.A.Sc. Thesis

BLDG 6901 [0.5 credit] Thesis Proposal

BLDG 6909 [8.0 credits] Ph.D. Thesis