

# 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:

<b>1. 0.5 credit in:</b>	0.5
BLDG 5101 [0.5]	Introduction to Building Engineering
<b>2. 1.0 credit from</b> the following list. Other courses may be used, with Supervisor recommendation and Director approval.	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
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	
<b>3. 1.0 credit in</b> approved electives		1.0
<b>4. 2.5 credits in:</b>		2.5
BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)	

**Total Credits** **5.0**

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

#### Requirements:

<b>1. 0.5 credit in:</b>	0.5
BLDG 5101 [0.5]	Introduction to Building Engineering
<b>2. 1.5 credits in</b> the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	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
<b>3. 0.5 credit in</b> approved electives	0.5
<b>4. 2.5 credits in:</b>	2.5
BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)

**Total Credits** **5.0**

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

#### Requirements:

<b>1. 0.5 credit in:</b>	0.5
BLDG 5101 [0.5]	Introduction to Building Engineering
<b>2. 1.5 credits in</b> the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	1.5
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
<b>3. 0.5 credit in</b> approved electives	0.5
<b>4. 2.5 credits in:</b>	2.5
BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)

**Total Credits** **5.0**

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

#### Requirements:

<b>1. 0.5 credit in:</b>	0.5
BLDG 5101 [0.5]	Introduction to Building Engineering
<b>2. 1.5 credits in</b> the concentration, from the following list. Other courses may be used, with Supervisor recommendation and 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	
<b>3. 0.5 credit in approved electives</b>		<b>0.5</b>
<b>4. 2.5 credits in:</b>		<b>2.5</b>
BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)	
<b>Total Credits</b>		<b>5.0</b>

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

#### Requirements - Coursework pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 0.5 credit from Building Performance concentration courses:</b>		<b>0.5</b>
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	
<b>3. 0.5 credit from Fire Safety concentration courses:</b>		<b>0.5</b>
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	
<b>4. 0.5 credit from Heritage Conservation concentration courses:</b>		<b>0.5</b>
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	
<b>5. 1.0 credit in additional concentration courses, not already used to fulfil Items 2-4 above</b>		<b>1.0</b>
<b>6. 1.5 credits in approved electives</b>		<b>1.5</b>
<b>Total Credits</b>		<b>5.0</b>

#### Requirements - Project pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits from the following list. Other courses may be used, with Supervisor recommendation and Director approval.</b>		<b>2.0</b>
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	
<b>3. 1.0 credits in approved electives</b>		<b>1.0</b>
<b>4. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5900 [1.0]	M.Eng. Project	
<b>Total Credits</b>		<b>5.0</b>

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

#### Requirements - Coursework pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.</b>		<b>2.0</b>
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	
<b>3. 2.0 credits in approved electives</b>		<b>2.0</b>
<b>Total Credits</b>		<b>5.0</b>

#### Requirements - Project pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	

BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits in</b>	the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	<b>2.0</b>
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	
<b>3. 1.0 credits in</b>	approved electives	<b>1.0</b>
<b>4. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5900 [1.0]	M.Eng. Project	
<b>Total Credits</b>		<b>5.0</b>

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

#### Requirements - Coursework pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits in</b>	the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	<b>2.0</b>
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	
<b>3. 2.0 credits in</b>	approved electives	<b>2.0</b>
<b>Total Credits</b>		<b>5.0</b>

#### Requirements - Project pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits in</b>	the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	<b>2.0</b>
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	
<b>3. 1.0 credits in</b>	approved electives	<b>1.0</b>
<b>4. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5900 [1.0]	M.Eng. Project	
<b>Total Credits</b>		<b>5.0</b>

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

#### Requirements - Project pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits in</b>	the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	<b>2.0</b>
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	
<b>3. 1.0 credits in</b>	approved electives	<b>1.0</b>
<b>4. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5900 [1.0]	M.Eng. Project	
<b>Total Credits</b>		<b>5.0</b>

#### Requirements - Coursework pathway:

<b>1. 1.0 credit in:</b>		<b>1.0</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5102 [0.5]	Introduction to Research Methods	
<b>2. 2.0 credits in</b>	the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.	<b>2.0</b>
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	
<b>3. 2.0 credits in</b>	approved electives	<b>2.0</b>
<b>Total Credits</b>		<b>5.0</b>

### Ph.D. Building Engineering (2.0 credits)

#### Requirements:

<b>1. 0.5 credit in:</b>		<b>0.5</b>
BLDG 5101 [0.5]	Introduction to Building Engineering	
<b>2. 1.0 credit from</b>	the following list. Other courses may be used, with Supervisor recommendation and Director approval.	<b>1.0</b>
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	
<b>3. 0.5 credit in:</b>		<b>0.5</b>
BLDG 6901 [0.5]	Thesis Proposal	
<b>4. 0.0 credit in:</b>		
BLDG 6909 [0.0]	Ph.D. Thesis	
<b>Total Credits</b>		<b>2.0</b>

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

#### Requirements:

<b>1. 0.5 credit in:</b>		<b>0.5</b>
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.		<b>1.0</b>
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	
<b>3. 0.5 credit in:</b>		<b>0.5</b>
BLDG 6901 [0.5]	Thesis Proposal (in the area of the concentration)	
<b>4. 0.0 credits in:</b>		<b>0.0</b>
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
<b>Total Credits</b>		<b>2.0</b>

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

#### Requirements:

<b>1. 0.5 credit in:</b>		<b>0.5</b>
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.		<b>1.0</b>
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	
<b>3. 0.5 credit in:</b>		<b>0.5</b>
BLDG 6901 [0.5]	Thesis Proposal (in the area of the concentration)	
<b>4. 8.0 credits in:</b>		<b>8.0</b>
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
<b>Total Credits</b>		<b>10.0</b>

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

#### Requirements:

<b>1. 0.5 credit in:</b>		<b>0.5</b>
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.		<b>1.0</b>
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	
<b>3. 0.5 credit in:</b>		<b>0.5</b>
BLDG 6901 [0.5]	Thesis Proposal (in the area of the concentration)	
<b>4. 8.0 credits in:</b>		<b>8.0</b>
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
<b>Total Credits</b>		<b>10.0</b>

### Admission

#### 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 M.A.Sc 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