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:		0.5
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.		1.0
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
BLDG 5103 [0.5]	Research Methods for Building Engineering	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
CIVE 5610 [0.5]	Fire Dynamics I	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
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	
MECH 5205 [0.5]	Building Performance Simulation	
3. 1.0 credit in approved electives		1.0
4. 2.5 credits in:		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:

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
2. 1.5 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		1.5
BLDG 5103 [0.5]	Research Methods for Building Engineering	
BLDG 5104 [0.5]	Indoor Environmental Quality	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
MECH 5205 [0.5]	Building Performance Simulation	
3. 0.5 credit in approved electives		0.5
4. 2.5 credits in:		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:

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
2. 1.5 credits in 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	
3. 0.5 credit in approved electives		0.5
4. 2.5 credits in:		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:

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	

2. 1.5 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		1.5
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
3. 0.5 credit in approved electives		0.5
4. 2.5 credits in:		2.5
BLDG 5909 [2.5]	M.A.Sc. Thesis (in the area of the concentration)	
Total 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 5103 [0.5]	Research Methods for Building Engineering	
2. 0.5 credit from Building Performance concentration courses:		0.5
BLDG 5104 [0.5]	Indoor Environmental Quality	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
MECH 5205 [0.5]	Building Performance Simulation	
3. 0.5 credit from Fire 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 Heritage Conservation concentration courses:		0.5
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
CIVE 5609 [0.5]	Fundamentals of Fire Safety Engineering	
5. 1.0 credit in additional concentration courses, not already used to fulfil Items 2-4 above		1.0
6. 1.5 credits in approved 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 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		2.0
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
BLDG 5302 [0.5]	Building Services Engineering	
BLDG 5104 [0.5]	Indoor Environmental Quality	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
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 5609 [0.5]	Fundamentals of Fire Safety Engineering	
MECH 5205 [0.5]	Building Performance Simulation	
3. 1.0 credits in approved 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 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		2.0
BLDG 5104 [0.5]	Indoor Environmental Quality	

BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
MECH 5205 [0.5]	Building Performance Simulation	
3. 2.0 credits in approved electives		2.0
Total Credits		**5.0**

Requirements - Project pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		2.0
BLDG 5104 [0.5]	Indoor Environmental Quality	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
MECH 5205 [0.5]	Building Performance Simulation	
3. 1.0 credits in approved 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 Fire Safety (5.0 credits)

Requirements - Coursework pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and 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 approved electives		2.0
Total Credits		**5.0**

Requirements - Project pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and 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. 1.0 credits in approved 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 Heritage Conservation (5.0 credits)

Requirements - Project pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		2.0
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
3. 1.0 credits in approved electives		1.0
4. 1.0 credit in:		1.0
BLDG 5900 [1.0]	M.Eng. Project	
Total Credits		**5.0**

Requirements - Coursework pathway:

1. 1.0 credit in:		1.0
BLDG 5101 [0.5]	Introduction to Building Engineering	
BLDG 5103 [0.5]	Research Methods for Building Engineering	
2. 2.0 credits in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and 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 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
3. 2.0 credits in approved electives		2.0
Total Credits		**5.0**

Ph.D. Building Engineering (2.0 credits)

Requirements:

1. 0.5 credit in:		0.5
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.		1.0

BLDG 5103 [0.5]	Research Methods for Building Engineering	
ARCN 5100 [0.5]	Representation and Documentation in Architectural Conservation	
ARCC 5401 [0.5]	Workshop: Technical Studies in Heritage Conservation	
CDNS 5403 [0.5]	Heritage Conservation and Sustainability	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies of Historic Buildings	
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	
MECH 5205 [0.5]	Building Performance Simulation	
3. 0.5 credit in:		0.5
BLDG 6901 [0.5]	Thesis Proposal	
4. 0.0 credit in:		
BLDG 6909 [0.0]	Ph.D. Thesis	
Total Credits		**2.0**

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	
2. 1.0 credit in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		1.0
BLDG 5103 [0.5]	Research Methods for Building Engineering	
BLDG 5104 [0.5]	Indoor Environmental Quality	
BLDG 5301 [0.5]	Building Energy Management and Optimization	
BLDG 5302 [0.5]	Building Services Engineering	
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 credit in:		0.0
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
Total Credits		**2.0**

Ph.D. Building Engineering with Concentration in Fire Safety (2.0 credits)

Requirements:

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
2. 1.0 credit in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		1.0
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. 0.5 credit in:		0.5
BLDG 6901 [0.5]	Thesis Proposal (in the area of the concentration)	
4. 0.0 credit in:		
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
Total Credits		**2.0**

Ph.D. Building Engineering with Concentration in Heritage Conservation (2.0 credits)

Requirements:

1. 0.5 credit in:		0.5
BLDG 5101 [0.5]	Introduction to Building Engineering	
2. 1.0 credit in the concentration, from the following list. Other courses may be used, with Supervisor recommendation and Director approval.		1.0
BLDG 5201 [0.5]	Advanced Building Characterization, Conservation and Rehabilitation	
BLDG 5202 [0.5]	Structural Assessment of Historic Buildings	
BLDG 5203 [0.5]	Advanced Computational Modeling Strategies 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]	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. 0.0 credits in:		0.0
BLDG 6909 [0.0]	Ph.D. Thesis (in the area of the concentration)	
Total Credits		**2.0**

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 M.Eng. Building Engineering (coursework and project pathways) is considered a regularly scheduled break approved by the University. Students should resume full-time studies in September.

Note: a Regularly Scheduled Break as described for immigration purposes does not supersede the requirement for continuous registration in Thesis, Research Essay, or Independent Research Project as described in Section 8.2 of the Graduate General Regulations.

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 5103 [0.5 credit]
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 MEng Building Engineering, MASc Building Engineering, PhD Building Engineering.

BLDG 5104 [0.5 credit]
Indoor Environmental Quality
Indoor environmental quality (air quality, thermal, visual, and acoustic comfort); physical and chemical parameters for characterization. Types and sources of indoor air pollution and discomfort; measurement techniques. Heating, ventilation, air conditioning, lighting practices and issues. Modeling of and design for indoor environmental quality.
Precludes additional credit for ENVE 4106.
Also offered at the undergraduate level, with different requirements, as ACSE 4106, for which additional credit is precluded.

BLDG 5201 [0.5 credit]
Advanced Building Characterization, Conservation and Rehabilitation
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 5203 [0.5 credit]
Advanced Computational Modeling Strategies of Historic Buildings
Introduction to conservation engineering; commonly used construction materials in historic buildings and their constitutive laws; Graphical and numerical methods to analyze masonry arches; Theory and application of discrete element method and its applications to assess masonry buildings.
Also listed as CIVE 5210.

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

BLDG 5900 [1.0 credit]
M.Eng. Project
Includes: Experiential Learning Activity

BLDG 5906 [0.5 credit]
Directed Studies
Supervised by a faculty member, students enrolled in this course will undertake a research project. A final report will be evaluated in determining the course grade.
Prerequisite(s): Open only to students in a Building Engineering Master's program.

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

BLDG 6901 [0.5 credit]
Thesis Proposal

BLDG 6906 [0.5 credit]
Directed Studies
Supervised by a faculty member, students enrolled in this course will undertake a research project. A final report will be evaluated in determining the course grade.
Prerequisite(s): Open only to students in the Building Engineering Ph.D. program.

BLDG 6909 [0.0 credit]
Ph.D. Thesis