



# PhD Program Guidelines & Qualifying Procedures

## Overview

The Doctoral program in Mechanical Engineering is governed by the policies of the Faculty of Graduate & Postdoctoral Studies (G+PS) studies; for most issues, your primary source of information should be the G+PS website: <https://www.grad.ubc.ca/current-students>.

Students will normally be required to spend a minimum of three winter sessions at the university. Those with a Master's degree (or equivalent) may have this period reduced and those who transfer from a Master's program to a PhD program require at least one year of residence following the transfer.

The PhD program should be completed in 4 years, but to meet this target you will need to work hard and plan well. In your first two terms, you will be busy becoming familiar with UBC and completing coursework. In addition, the work involved in 1 TA-ship is almost the same as one course. Some milestones (such as the literature review and defending your research proposal) are requirements for all PhD students, but most milestones will be unique to your research project. Therefore, you should develop, with the help of your supervisor, specific, tangible and realistic goals. Successful PhD students generally come to realize that it is their own responsibility to manage their time. Your supervisor is a helpful guide, coach, and mentor, but one who should become unnecessary by the time you defend your PhD thesis.

## Table of Contents

Overview .....	1
Supervision.....	3
Research Supervisor(s).....	3
Supervisory Committee .....	4
PhD Supervisory & Examination Committee Approval.....	4
Annual Research Progress Reports .....	5
Coursework.....	5
Literature Review.....	6
Timing.....	6
Assignment Email.....	7
Format and Evaluation.....	7



Examination Committee .....	7
Submission, defence, and evaluation of the paper .....	8
Virtual Literature Review Defence Protocols.....	8
Participants .....	9
Responsibilities of the Chair.....	9
Research Proposal Defence (RPD) .....	10
Examination Committee and Chair .....	10
Schedule.....	10
Written Proposal Format .....	10
Oral Defence .....	11
Virtual RPD Protocols.....	12
Participants .....	12
Responsibilities of the Chair.....	12
Appeal Process .....	13
Final Doctoral Exam & Graduation .....	14
Virtual Defence Protocols .....	15



## Supervision

### Research Supervisor(s)

At the time of admission to the program, the student will be offered a position with a research supervisor who is interested in supervising the student's research project. The supervisor's essential tasks are to provide academic guidance directed toward the completion of an PhD thesis of suitable quality, and to assist with the financial planning associated with the program. The primary supervisor is typically a full-time, regular faculty member in the Department of Mechanical Engineering holding the rank of assistant professor, associate professor or professor, and be a member of the Faculty of Graduate and Postdoctoral Studies.

A Mech emeritus faculty member may be appointed as the primary supervisor, contingent on approval by the Faculty of Applied Science and their continued membership in the Faculty of Graduate and Postdoctoral Studies. In this case, an eligible research-track faculty member from the appropriate research group should be appointed as co-supervisor. It is the duty of the co-supervisor to ensure that both the emeritus faculty member and the graduate student are familiar with the current policies, practices and expectations of the Department.

If the proposed supervisor is an associate member, an eligible tenure-track faculty member from an appropriate research area in the Department is appointed as co-supervisor. It is the duty of the co-supervisor to ensure that both the associate member and the graduate student are familiar with the current policies, practices, and expectations of the Department.

Full-time, regular UBC faculty members outside of the Department of Mechanical Engineering, as well as faculty holding the rank of associate member, honorary affiliate, or adjunct professor may co-supervise a student along with a regular Mech faculty member as primary supervisor.

For any non-G+PS member to act in a supervisory role, **a request for approval must first be submitted to the Faculty of Graduate and Postdoctoral Studies** and include a copy of the individual's curriculum vitae and a memo of support from the Graduate Advisor.

Within the first 3 months of residence, the primary supervisor may be changed at the request of the student, provided an alternative supervisor agrees to act. After this time, the supervisor normally becomes permanent. Changes to supervision are still possible after this time but must be approved by the Graduate Advisor and the Head of the Department.

In cases of absence from the campus of a month or more, the research supervisor should appoint an acting supervisor for each of their PhD students.



## Supervisory Committee

The program of each student is overseen by a supervisory committee consisting of the primary supervisor (and co-supervisor, if applicable), who normally acts as chairman of the committee, plus at least two additional committee members.

The committee is nominated by the student's supervisor and approved by the Graduate Advisor, and should include at least one member from outside the Department of Mechanical Engineering.

Committee members may include regular faculty members, senior instructors, honorary faculty, adjunct faculty, off-campus professionals as well as faculty members from other universities.

For any non-G+PS member to be added to the supervisory committee, **a request for approval must first be submitted to the Faculty of Graduate and Postdoctoral Studies** and include a copy of the individual's curriculum vitae and a memo of support from the Graduate Advisor.

It is in the best interests of the student, and a G+PS requirement, for the student to schedule a meeting with the supervisory committee every year, especially after admission to candidacy. The majority of cases with a very difficult doctoral examination or extended completion time occur when there are not regular meetings with the supervisory committee.

## PhD Supervisory & Examination Committee Approval

Students must have their supervisory committee and examination committees approved at various stages of their program by submitting the applicable form to Mech Student Services ([students@mech.ubc.ca](mailto:students@mech.ubc.ca)) by the deadline.

- Submit a *PhD Supervisory Committee Approval Form*
  - Within 12 months of starting the program
  - If any changes are made to supervisory roles (primary or co-supervisor) after admission to the program
  - If any changes are made to the supervisory committee member composition throughout the program.

Note that for any non-G+PS member to act in a supervisory role, **a request for approval must first be submitted to the Faculty of Graduate and Postdoctoral Studies** and include a copy of the individual's curriculum vitae and a memo of support from the Graduate Advisor.

- Submit a *PhD Literature Review Defence Examination Committee Approval Form*
  - At least one month prior to the literature review defense
- Submit a *PhD RPD Examination Committee Approval Form*
  - At least one month prior to the research proposal defense



## Annual Research Progress Reports

All PhD students should make systematic and consistent progress in their research. Meetings with the supervisory committee are to be scheduled by the student annually. Students must submit an *Annual Research Progress Report* by the applicable deadline below to MECH Student Services ([students@mech.ubc.ca](mailto:students@mech.ubc.ca)), detailing the achievements of the previous year and the objectives for the next year. Students who are fellowship holders and already submit an annual progress report to G+PS do not need to submit a second report.

Program Start	Submission Deadline
September	August 30
January	December 30

## Coursework

The department requires that incoming PhD students have a variety of skills and knowledge before they are admitted to the PhD program, including a broad understanding of Mechanical Engineering material and a demonstrated potential to perform novel research. These characteristics are to be demonstrated by completion of foundational coursework, the literature review, and the research proposal defence, within 16 months of the program start date. All PhD candidates in Mechanical Engineering must pass through this process.

The PhD program requires satisfactory completion of a minimum of 33 credits coursework. Up to 6 credits may be at the undergraduate level in courses numbered 300 to 499. This includes 12 credits of foundational coursework completed within the student's first two terms in their program, up to 18 credits obtained from an approved Master's degree (extent of credit exemption is assessed at the Literature Review defence), and the seminar course (if required) or one additional 3 credit course if not taking the seminar course. In all cases, the coursework plan should be approved by the student's research supervisor.

Only the following UBC courses will be accepted for PhD credit:

- 500-level graduate courses, provided that credit has not already been obtained for such courses;
- A maximum of 6 credits of senior undergraduate level (300 or 400-level) courses
- A maximum of 3 credits of directed studies courses (Mech 575 or Mech 591 designation)

A minimum mark of 68% must be obtained in all courses taken by a student enrolled in a doctoral program. When repeating a failed required course, a minimum mark of 74% must be obtained. Supplemental exams are not granted.

Students entering the program with an approved Master's degree may obtain exemption for up to 18 graduate-level credits from that program.



Thesis/Seminar: All PhD students are required to register in the thesis course year-round (both winter and summer terms). The student should select the section ID that corresponds with their research group.

- MECH 699 001/971 - Applied Solid Mechanics
- MECH 699 002/972 - Biomechanics and Biomedical Engineering
- MECH 699 003/973 - Computational Engineering
- MECH 699 004/974 - Energy and Environment
- MECH 699 005/975 - Fluid Mechanics
- MECH 699 006/976 - Manufacturing Automation and Robotics
- MECH 699 007/977 - Mechatronics and Instrumentation
- MECH 699 008/978 - Naval Architecture and Marine Engineering

The seminar course is mandatory for students who belong to the below research groups. Students should register in the relevant section in each winter term (no seminar will be held over the summer).

- Applied Solid Mechanics
- Biomechanics and Biomedical Engineering
- Energy and Environment
- Manufacturing Automation and Robotics
- Mechatronics and Instrumentation

## Literature Review

The student must prepare a paper on a specific topic assigned by the end of the student's 1st term by the supervisor. The paper must demonstrate critical thinking, and the question that is to be addressed in the paper should allow opportunity for the student to develop, articulate and support their own view on an issue. On the last day of the student's second term, the student must submit the literature review to the supervisory committee. The deadlines for the literature review in relation to the foundational coursework is described in the table below.

### Timing

Program Start	12 credits completed	Assignment Email received	Written paper submitted	Supervisory Committee Nomination form submitted	Defence
September	April 30	December 30	April 30	April 30	May 30
January	December 30	April 30	August 30	August 30	September 30



## Assignment Email

The supervisor should email the topic of the paper, with additional specifications for style, clarifications of the issues to be covered and 1-2 recommended papers is to the student and cc. Mech Student Services ([students@mech.ubc.ca](mailto:students@mech.ubc.ca)) at the end of the student's first term. This email will later be forwarded to the committee along with the paper submission so that they understand the starting point of the student's efforts.

## Format and Evaluation

The paper will be 2800 to 3200 words, including the bibliography and tables. A maximum of 4 figures may be included. Formatting details for the style of references and sections may be specified in the "assignment email". This short format is intended to test the student's ability to include the most important information in the paper; during the oral presentation there is opportunity to demonstrate a greater depth of knowledge as appropriate.

Preparing this literature review will involve many of the same research skills needed to complete a thesis:

- Ability to communicate clearly in writing
- Ability to read papers and books critically
- Ability to formulate an opinion on a research issue and support it logically with evidence from the literature.
- Ability to craft a properly formatted, error-free document

Considering these objectives above, it is NOT sufficient to simply collect and rephrase information from the literature related to a particular topic. Instead, the paper should be directed to a research question provided by the supervisor. This question should be specific and have a reasonable scope, such that it might be reasonably covered in the given format. At the same time, the question should be open-ended enough that alternative positions might be considered. The examiners must decide whether or not the student has adequately addressed the assignment and demonstrated the abilities listed above to the extent needed to successfully complete the PhD program. The expectations will depend on many factors, including the difficulty and nature of the assignment and the student's background. Generally, the level of effort expected is that of a term project in an ordinary course.

## Examination Committee

The student should work with their supervisor to form an examination committee. The committee should approximate the supervisory committee as well as the examination committee formed later on for the Research Proposal Defence.

For the literature review, quorum will be met with the primary supervisor, co-supervisor, if applicable, and three additional examiners, at least 1 from within the Department. The most senior member of the examination committee, excluding the supervisor, should act as Chair.

The student should nominate their Literature Review Examination Committee by submitting a *PhD Literature Review Defence Examination Committee Approval Form* to Mech Student Services



([students@mech.ubc.ca](mailto:students@mech.ubc.ca)) for approval by the Graduate Advisor at least one month prior to scheduling the defence.

### Submission, defence, and evaluation of the paper

At the end of the student's 2<sup>nd</sup> term, the paper should be submitted in pdf format via email to the examiners and Mech Student Services ([students@mech.ubc.ca](mailto:students@mech.ubc.ca)), including the original assignment email as an attachment. The paper is strictly the work of the student and not the supervisor, but in some cases, it might be necessary for the supervisor to provide clarifications after the original assignment email. In such cases, the clarifications should be appended to the assignment email.

The student should schedule a 1-hour meeting with the examining committee to take place by the last day of the month following the submission of the paper. In the meeting, the student will make a 20-minute presentation summarizing their paper, after which the committee will question the student on the literature review and supporting foundational material. The committee will then discuss the literature review, presentation and foundational coursework, as well as determine the extent of transfer credit to be granted from the student's Master's degree. The result of the meeting will be one of three outcomes, as determined by majority vote of committee members. The supervisor will have one of the votes in this process.

1. Invitation to proceed to the research proposal defence.
2. As above, but with requirements to complete additional specific courses
3. Student would be asked to withdraw from the PhD program.

The student should bring a copy of the *Part A1: Literature Review Defence Form* and *Part A2: Credit Transfer (and accompanying course outlines/transcripts, if required)* with them to their presentation and return the completed forms to Mech Student Services ([students@mech.ubc.ca](mailto:students@mech.ubc.ca)).

### Virtual Literature Review Defence Protocols

The student may choose to defend remotely via Zoom if this format is more appropriate or preferred. The defence should typically take place either in-person or virtually, however, a hybrid format may be considered in exceptional circumstances and requires the approval of the Graduate Advisor.

A virtual defence is when the student and all of the examining committee members join remotely via Zoom. The student and supervisor may choose to be in physical proximity for virtual defences, say in adjoining rooms. (Audio issues may occur if multiple people are joining a Zoom meeting on separate computers in the same physical space.)

The supervisor will normally set up the Zoom meeting. UNDER NO CIRCUMSTANCES should the Zoom meeting be created by the student.





It is important to note that while the approved Zoom platform is capable of supporting a virtual defence with multiple participants, the quality of both the audio and visual components will depend on the quality of each participant's internet connection. We recommend connecting from a location with a reliable internet connection. UBC VPN may be turned off if it is slowing down the video connection. Zoom allows testing the connection prior to the defence, and all participants should take the opportunity to do so. As we cannot control the quality of each participant's internet connection, participants should be prepared for technical issues (e.g. poor audio or visual quality, dropped connections) and the chair should be prepared to uphold the responsibilities as outlined below.

All required participants, outlined below, are presumed to have agreed to participate in a virtual defence.

### Participants

Virtual defences should be attended by Examining Committee, which should include the below participants:

- The supervisor
- Three other examiners, at least one from within the Department
- The most senior member of the examining committee, excluding the supervisor, should act as Chair

### Responsibilities of the Chair

1. Represent the Department of Mechanical Engineering following the procedures set out in the PhD Program Guidelines.
2. Moderate the defence proceedings; ensure fairness.
3. Outline the potential technical issues that may occur, encourage patience and kindness towards each other, and describe the chair's responsibility to suspend the defence if there are technical difficulties that compromise the defence.
4. Ensure that any questions posed by committee members are addressed by the student during the question period.
5. Chair the in-camera discussion of the examining committee and convey the outcome to the student.
6. Ensure the student is removed (either disconnected or in a break-out room) for the entirety of the in-camera discussion.

**Important note:** the Chair has the authority to discontinue a remote connection at any time they judge that it is interfering with the proper conduct of the examination. If one or more participants drop from the connection or lose audio, the defence must be halted until the participant's connection or audio is restored. If the connection or audio cannot be restored after 30 minutes or if the total amount of time lost exceeds 60 minutes, the Chair must suspend the defence immediately and the defence will be rescheduled



## Research Proposal Defence (RPD)

The RPD aims to ensure that the student has a worthwhile research topic, has clear goals, suitable preparation and other traits necessary to complete a PhD thesis.

### Examination Committee and Chair

The RPD Examination Committee should approximate the supervisory committee and examining committee of the Literature Review.

The committee should include three examiners. The Research Supervisor cannot be a member and can choose whether or not to attend the proposal defence. These three examiners should not all belong to the same research area. The most senior member of the examination committee should act as Chair.

The student should nominate their RPD Examining Committee by submitting a *PhD RPD Examination Committee Approval Form* to Mech Student Services ([students@mech.ubc.ca](mailto:students@mech.ubc.ca)) for approval by the Graduate Advisor at least one month prior to scheduling the defence.

### Schedule

Within 16 months of starting the program, the student will be asked to prepare, present and defend a proposal for their research. RPD examinations will be held July-December for students with a September start date, and January to May for students with a January start date. The student, in consultation with their supervisor and committee members, must arrange the scheduling of the exam. Allow at least 1 month to arrange the examination date.

### Written Proposal Format

The purpose of the proposal is to demonstrate that you have selected important research questions, that you bring new ideas or approaches to the problem, and that your plan to complete your PhD is feasible.

The structure of the proposal can be adjusted to suit the subject area and style of research, but following sections are included at minimum.

1. Title page with proposed thesis title, student name, examining committee, supervisor, Chair, time and location of the exam.
2. Statement of authorship indicating briefly (1 page) how the research supervisor contributed to the substantive and editorial preparation of the proposal. Explain how many drafts were reviewed with the supervisor and what information related to the proposal was provided directly by the supervisor (eg. grant proposals, key papers in the field...)
3. Copy of student's unofficial UBC transcript, showing successful completion of 12 credits of foundational coursework.
4. Copy of the Part B: RPD Approval Form and G+PS Recommendation for Advancement to Candidacy form, ready for signature by the Chairman and Graduate Advisor.
5. Literature review and motivation that finishes with a discussion of the important gaps in existing knowledge.



6. Work plan that indicates the actual technical approach to be taken and the expected timeline for achievement of the critical milestones. Students who have initial results of a study or pilot study results would be encouraged to include these results in the proposal in addition to proposing new work. It is suggested that this work plan will be shown as a Gantt chart, highlighting the key dependencies and critical path. In the work plan section, discuss whether there are important elements of risk in the research, and discuss your contingency plans in the event that these elements do not unfold as desired.
7. Statement of key contributions. This section recapitulates the important gaps in the literature that you plan to fill, the reason these are of practical or theoretical importance, and the novel ideas that you will bring to the research.

The proposal may not exceed 6000 words, including references and figure captions. It can include up to 6 figures including the Gantt chart. The proposal must be distributed to the supervisor, examiners and Chair at least 10 days prior to the exam, in hardcopy, Word/Open Office and pdf formats.

### Oral Defence

At the defence the student will make a 30-minute presentation on the proposed work. This is followed by questions intended to determine whether the student has the ability to complete a high-quality thesis as proposed in the written proposal. Questions can be on any aspect of the proposal.

The Chair's job is to ensure that the defence follows these procedures and in particular, he/she should ensure that the following questions are asked at some point during the exam if they are not clearly answered in the presentation:

1. What are the key aspects of novelty in the proposed research?
2. What insights or special ideas have you personally brought to this research?
3. What are the key elements of risk in the plan, and what is your strategy for dealing with this?

The total length of defence is normally 2.5 hours. The Research Supervisor may attend as a visitor and may be asked to provide the committee with verbal comments on the student's progress and research competence and experience. The supervisor would then be required to leave the room and the committee would deliberate regarding the student's evaluation and assignment of a pass or fail on the exam. The committee will also review the courses taken, academic record, and credits transferred during the examination and provide what feedback is necessary.

Students who fail the RPD will, at the discretion of the committee, be given the opportunity to retake the exam within four months of the original exam.

Students are required to submit the Part B: RPD Approval Form and the G+PS Recommendation for Advancement to Candidacy form to MECH Student Services after the defence. As soon as a student has satisfied all requirements, the department will recommend to the Faculty of Graduate Studies that the



student be advanced to candidacy. This status is entered on the University's Student Information System.

### Virtual RPD Protocols

The student may choose to hold their RPD remotely via Zoom if this format is more appropriate or preferred. The defence should typically take place either in-person or virtually, however, a hybrid format may be considered in exceptional circumstances and requires the approval of the Graduate Advisor.

A virtual defence is when the student and all of the examining committee members join remotely via Zoom. The student and supervisor may choose to be in physical proximity for virtual defences, say in adjoining rooms. (Audio issues may occur if multiple people are joining a Zoom meeting on separate computers in the same physical space.)

The supervisor will normally set up the Zoom meeting. UNDER NO CIRCUMSTANCES should the Zoom meeting be created by the student.

It is important to note that while the approved Zoom platform is capable of supporting a virtual defence with multiple participants, the quality of both the audio and visual components will depend on the quality of each participant's internet connection. We recommend connecting from a location with a reliable internet connection. UBC VPN may be turned off if it is slowing down the video connection. Zoom allows testing the connection prior to the defence, and all participants should take the opportunity to do so. As we cannot control the quality of each participant's internet connection, participants should be prepared for technical issues (e.g. poor audio or visual quality, dropped connections) and the chair should be prepared to uphold the responsibilities as outlined below.

All required participants, outlined below, are presumed to have agreed to participate in a virtual defence.

### Participants

Virtual defences should be attended by Examining Committee, which should include the following participants:

- Three examiners – should not include the Supervisor and should not all belong to the same research area.
- The Chair - must not be the Supervisor or one of the examiners and must be a Full Professor, Associate Professor or a Professor Emeriti in Mechanical Engineering.

### Responsibilities of the Chair

1. Represent the Department of Mechanical Engineering following the procedures set out in the PhD Program Guidelines.
2. Moderate the defence proceedings; ensure fairness.



3. Outline the potential technical issues that may occur, encourage patience and kindness towards each other, and describe the chair's responsibility to suspend the defence if there are technical difficulties that compromise the defence.
4. Ensure that any questions posed by committee members are addressed by the student during the question period.
5. Chair the in-camera discussion of the examining committee and convey the outcome to the student.
6. Ensure the student is removed (either disconnected or in a break-out room) for the entirety of the in-camera discussion.

**Important note:** the Chair has the authority to discontinue a remote connection at any time they judge that it is interfering with the proper conduct of the examination. If one or more participants drop from the connection or lose audio, the defence must be halted until the participant's connection or audio is restored. If the connection or audio cannot be restored after 30 minutes or if the total amount of time lost exceeds 60 minutes, the Chair must suspend the defence immediately and the defence will be rescheduled

### [Appeal Process](#)

The student can appeal the decision of the RPD committee to their supervisor who can in turn make a written appeal to the head of department who will consult with the graduate advisor and the examination committee.



## Final Doctoral Exam & Graduation

The Final Doctoral Examination process is an integral part and is the last step toward the conferral of the PhD degree. Although it is a complex process to navigate, you can reduce stress for yourself and those involved in your examination by being well-informed and well-organized.

The Faculty of Graduate Studies website provides a very comprehensive Doctoral Exam Guide and a number of tools that will help you prepare a timeline and plan of action.

Please carefully review the guide in its entirety here: <https://www.grad.ubc.ca/current-students/final-doctoral-exam/final-doctoral-examination-guide>

Below are the final key stages that you will need to progress through in order to complete your program:

1. **Nominate the External Examiner** - The Supervisor and Graduate Advisor nominate at least two people for the role of External Examiner (an arm's-length expert in the subject of the dissertation). Graduate and Postdoctoral Studies will select and invite the External Examiner.
2. **The External Examination** – The External Examiner reviews the dissertation and decides whether or not it is ready to proceed to the Final Oral Defence
3. **Form the Examination Committee**, which should consist of:
  - an External Examiner (not required to attend the Final Oral Defence)
  - two approved University Examiners
  - two or three members of the Candidate's Supervisory Committee (including the Research Supervisor)
  - an Examination Chair
4. **The Final Oral Defence** – The Examining Committee will hear the Candidate present their work and then question the Candidate. They will determine whether the culmination of work meets the standards required for a doctoral degree.
5. **Final Dissertation Submission** - Your thesis will be reviewed for formatting by the Faculty of Graduate and Postdoctoral Studies and approved for inclusion in cIRcle. Your program cannot be closed and you will not be eligible to graduate until the content and formatting of the thesis have been officially approved and you have received an official email confirming final approval of your thesis.

**NOTE:** When you submit the PDF of your final, defended dissertation to cIRcle, please also email a lay abstract to [students@mech.ubc.ca](mailto:students@mech.ubc.ca). The lay abstract should be a brief summary of your research, written in a way that can be easily understood by those unfamiliar with your work. Ideally, please include an image that is representative of your thesis work
6. **Graduation** - There are important steps you need to complete in order to officially graduate:
  - Apply to graduate on the SSC.
  - Make sure that your dissertation has been submitted to the Faculty of Graduate and Postdoctoral Studies.
  - Make sure that all courses you have taken have a grade entered for them.



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- Make sure your UBC financial account is settled.
- Submit your doctoral citation.

### Virtual Defence Protocols

The faculty of Graduate and Postdoctoral Studies does allow virtual exam defences via Zoom, but there are specific protocols that candidates must follow.

Please read through the virtual defence protocol document found on the G+PS website at the link below:

[https://www.grad.ubc.ca/sites/default/files/doc/page/docexams\\_virtual\\_exam\\_protocol.pdf](https://www.grad.ubc.ca/sites/default/files/doc/page/docexams_virtual_exam_protocol.pdf)