UNIVERSITY OF ALBERTA
FACULTY OF GRADUATE STUDIES & RESEARCH

PhD Program Learning Outcomes and Methods of Assessment

Example

This document provides an example of program articulated learning outcomes. The University of Alberta PhD Learning Outcomes within this template were developed by the University of Alberta, in addition to or in support of Alberta Credential Framework, and have been endorsed by FGSR Council.

Program Name:	Mechanical Engineering
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EXAMPLE: University of Alberta PhD Learning Outcomes and Methods of Assessment

Developed by the University of Alberta, in addition to or in support of Alberta Credential framework

KNOWLEDGE The ability to apply and exercise awareness of the limits of advanced level knowledge in a specialized field	
University of Alberta PhD Learning Outcomes	**Knowledge** learning outcomes are specifically defined within programs, in alignment with these requirements from the Alberta Credential Framework: 1. **Depth and Breadth of Knowledge** – Students will be able to independently undertake pure or applied research and professional skills at an advanced level, and translate knowledge to research or practice settings. Students will demonstrate a thorough understanding of a substantial body of knowledge with expertise in a specialized field that is at the forefront of an academic discipline or area of professional practice. 2. **Application of Knowledge** – Students will have the capacity to: ● undertake research at an advanced level, and ● contribute to the development of academic or professional skill, techniques, tools, practices, ideas, theories, approaches, and/or materials. 3. **Awareness of Limits of Knowledge** – Students will have an appreciation of the limitations of one's own work and discipline, of the complexity of knowledge, and of the potential contributions of other interpretations, methods, and disciplines.
Program-Specific Learning Outcomes	**Depth and Breadth of Knowledge** Student will demonstrate 1. advanced-level knowledge of the general field of Mechanical Engineering 2. expert knowledge in their field of specialization **Application of Knowledge** Student will demonstrate the capacity to: 1. undertake pure and/or applied research at an advanced level, and 2. contribute to the development of academic or professional skill, techniques, tools, practices, ideas, theories, approaches, and/or materials. **Awareness of Limits of Knowledge** Student will demonstrate 1. an appreciation of the limitations of one's own work and discipline, of the complexity of knowledge, and of the potential contributions of other interpretations, methods, and disciplines, 2. an ability to critically evaluate current research and research techniques and methodologies, and 3. an ability to address these gaps
Methods of Assessment	**Knowledge** Indicators will be assessed and provided regular oral and written formative feedback in the programs through the appropriate supervisor meetings, supervisory committee meetings, proposal and final thesis defence, specifically: **Depth and Breadth of Knowledge** 1. Through topic presentation, discussion during yearly supervisory committee meetings. 2. Through the successful completion of • MecE 680 – continuum mechanics

	• Eight ★3 graduate-level courses (post undergraduate degree), of which at least five courses must be MECE 3. by passing the candidacy examination or by completing all explicitly and formally detailed and justified committee requirements of a conditional pass in this examination. **Application of Knowledge** 1. Through research progress during yearly supervisory committee meetings. 2. Through the review, defence and approval of a PhD proposal by a candidacy examining committee. 3. Through the defence of a PhD thesis. **Awareness of Limits of Knowledge** Through conducting field of research appropriate review of the state of the art (literature, techniques, standards, etc.) and by developing relationships, networks, collaborations to identify and explain the research pertinent theory, approaches, techniques, and paradigms, the output of which is reviewed, defended and approved during of a PhD proposal by a candidacy examination committee and at the PhD defence examination. It is the responsibility of the supervisor to provide written, detailed and justified formative feedback, and corrective actions for deficiencies, if identified, in **Knowledge** to the student following each meeting and examination; it is the responsibility of the student to plan and undertake actions to address the feedback.

EXAMPLE: University of Alberta PhD Learning Outcomes and Methods of Assessment

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RESEARCH COMPETENCY The ability to conceptualize, design and implement research for the generation of new knowledge; to make informed judgments on complex issues, in a specialized field	
University of Alberta PhD Learning Outcomes	**Research Competency** learning outcomes are specified below and are to be augmented in programs using field specific requirements, as appropriate. Students will be able to: 1. Conceptualize, design, and implement research for the generation of new knowledge, applications, or understanding at the forefront of the discipline and to adjust the research design or methodology in the light of unforeseen problems. 2. Make informed judgments on complex issues in specialist fields, sometimes requiring new methods, such as being able to: ● Generate research questions/hypotheses based on experience, discipline specific expertise, and scholarly literature. ● Conceptualize, design, and implement a research project of significant scope to complete a thesis. ● Assess strengths and weaknesses of various methodological approaches relevant to a research question. ● Select, defend, and apply a methodological approach to answer a research question. ● Locate and/or generate information/data relevant to a research question. ● Situate a research question within the existing field specific knowledge and where appropriate outside the field and/or discipline. ● Organize information/data to reveal patterns/themes. ● Analyze information/data and synthesize information to generate new knowledge/understanding. ● Monitor research progress, refine, and pivot approach as needed.
Program-Specific Learning Outcomes	Students will be able to produce original research, or other advanced scholarship, of a quality to satisfy peer review, and to merit publication in their field.
Methods of Assessment	**Research Competency** Indicators will be assessed and provided regular oral and written formative feedback in the programs through the appropriate committee meetings, proposal and final thesis defence, specifically: • Through topic presentation, discussion during yearly supervisory committee meetings. • Through the review, defence and approval of a PhD proposal by a candidacy examining committee. • Through the review, defence and approval of a PhD proposal by a candidacy examining committee. • Through the completion, as first author, typically of **at least three** original archival **journal manuscripts** drafts for peer review as appropriate for the field and **at least two** presentations to field appropriate stakeholders at **national and/or international conferences, or industry** venues, while noting that completion of these indicators does not constitute completion of program research requirements. It is the responsibility of the supervisor to provide written, detailed and justified formative feedback, and corrective actions for deficiencies, if identified, in **Research Capacity** to the student following each meeting and examination; it is the responsibility of the student to plan and undertake actions to address the feedback.

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COMMUNICATION SKILLS The ability to demonstrate written communication, oral communication, and listening skills, and to communicate effectively and professionally with a broad audience	
University of Alberta PhD Learning Outcomes	**Communication Skills** learning outcomes are specified below and are to be augmented in programs using field specific requirements as appropriate. Students will be able to communicate complex and/or ambiguous ideas, issues, and conclusions clearly and effectively to specialist and non-specialist audiences, using: 1. written communication 2. oral communication <u>Beneficial Options</u> Students will be able to: ☒ communicate using technical, digital, or other methods ☒ use active listening skills
Program-Specific Learning Outcomes	Student will demonstrate the ability to write field appropriate publications aimed at peer review.
Methods of Assessment	**Communication** Indicators will be <u>assessed</u> and provided <u>regular oral and written formative feedback</u> in the program through the appropriate committee meetings, proposal and final thesis defence, and publications, specifically by: 1. Oral indicators: ● Student successfully presented and defended orally their doctoral **research proposal.** ● Student successfully presented and defended orally their doctoral **thesis.** 2. Written indicators ● Student successfully wrote their doctoral **research proposal.** ● Student successfully wrote their doctoral **thesis**. 3. Listening indicator: Completing active listening professional development programming and/or applying key concepts of active listening in professional settings and during supervisor meetings, supervisory committee meetings and candidacy and thesis exam. 4. Completing a professional development program that includes aspects of general communications and preferably social media. 5. Preparing for internal review drafts of publications for peer review. It is the responsibility of the supervisor to provide written, detailed and justified formative feedback, and corrective actions for deficiencies, if identified, in **Communication Skills** to the student following each meeting and examination; it is the responsibility of the student to plan and undertake actions to address the feedback.

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PROFESSIONAL CAPACITY/AUTONOMY The ability to research, reflect upon, and take ownership of the development of skills and career goals	
University of Alberta PhD Learning Outcomes	**Professional Capacity/Autonomy** learning outcomes are specified below and are to be augmented in programs using field specific requirements as appropriate. Students will be able to demonstrate: 1. The qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and largely autonomous initiative in complex situations 2. The intellectual independence to be academically and professionally engaged and current, developed in part through the Individual Development Plan process of: ● researching potential career options ● reflecting upon skills and competencies in the University of Alberta graduate attribute areas of creativity, communication, confidence, scholarship, ethical responsibility, critical thinking, and collaboration ● creating timelines and milestones for professional development, academic, and personal commitments ● reviewing progress regularly 3. The ability to evaluate the broader implications of applying knowledge to particular contexts. 4. The ability to receive, handle and act upon, and provide constructive feedback. <u>Beneficial Options</u> Students will be able to demonstrate: ☒ The ability to take initiative to identify need and provide service to a community. ☒ The ability to acquire new, or enhance existing leadership skills, including those required to teach or supervise students. ☒ The ability to take initiative to bring about positive change in academic, professional and personal contexts, guided by the principles of equity, diversity and inclusion (EDI).
Program-Specific Learning Outcomes	Student will demonstrate: 1. Self-direction and originality in tackling and solving problems and autonomy in planning and executing of research. 2. When students possess the required competencies to be offered a position in alignment with appropriate collective agreements processes and accreditation requirements, the ability to offer a course and/or be a teaching assistant in the field of Mechanical Engineering or a related field. 3. Field specific communication and networking skills. 4. Field specific safety training that emphasizes the importance of creating safe work environments for all.
Methods of Assessment	**Professional Capacity/Autonomy** Indicators will be <u>assessed</u> and provided <u>regular oral and written formative feedback</u> in the programs through student records of: **Professional Development** 1. Completing Individual Development Plan and submitting it to ENGG PD 01 within the first year of their program. 2. Completing some of the mandatory 8 hours of PD activities in the broad range of areas related to professional behaviors, the workplace, and career management and submitting proof of completion to ENGG PD 02 within the two years of their program.

	Other 1. Feedback • Documenting, and reviewing with their supervisor, feedback received during supervisor meetings, supervisory committee meetings and candidacy exam, and addressing identified issues. • Providing feedback to other team members, staff, as appropriate and/or through peer reviewing of field appropriate publications. 2. Completing some of the mandatory 8 hours of PD activities in the area of EDI and submitting proof of completion to ENGG PD 02 within the two years of their program. 3. Completing some of the mandatory 8 hours of PD activities in the area of leadership and submitting proof of completion to ENGG PD 02 within the two years of their program. 4. Completing service activities within the community (e.g. graduate club executives, university communities) **Program Specific** 1. Presenting and defending progress during yearly (or more frequent) formal supervisory committee meetings; progress and performance are to be kept in minutes of the meeting and with program designated forms. 2. When applicable to the student, successfully teaching or being a GTA for at least an undergraduate course in MecE, evaluated through USRI or GTA student and instructor evaluations. 3. Completing 4 hours of formal PD activities in the areas of communication and networking, and submitting proof of completion to ENGG PD 01 within the two years of their program. 4. Completing, • and submitting to supervisors completion documentation, specific training prior to receiving access to research labs (WHMIS, general safety, CSTS, or other as required) • **Immediately**, when becoming a direct, or in-direct, supervisor of other team members or students, technicians, the **Supervisory EHS Professional Development**. It is the responsibility of the supervisor to provide written, detailed and justified formative feedback, and corrective actions for deficiencies, if identified, in **Professional Capacity/Autonomy** to the student following each meeting and examination; it is the responsibility of the student to plan and undertake actions to address the feedback.

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ETHICS The ability to identify, explain, analyze, and propose solutions to ethical issues	
University of Alberta PhD Learning Outcomes	Ethics learning outcomes are specified below and are to be augmented in programs using field specific requirements as appropriate. Students will be able to: 1. Identify ethical concerns specific to their field of research, such as treatment of human and animal subjects, interdisciplinary research, and Indigenous research. 2. Recall, recognize, analyze, discuss and act in ethical matters in: • the subject field under investigation including those specific to course work, capstone project, thesis, scholarship and funding applications, • academic conduct, and • interactions with others in the community as stipulated in the code of student behaviour. 3. Propose solutions to ethical dilemmas and articulate what makes a particular course of action ethically defensible. 4. Identify ethical concerns in academic integrity, use and citation of sources, the misrepresentation of data and/or facts. 5. Recognize the importance of information and data handling (confidentiality, transparency, not falsifying data, etc). <u>Beneficial Options</u> ☐ Explain, recognize, and analyze ethical areas of responsibility held when teaching or mentoring within their field.
Program-Specific Learning Outcomes	Student will complete program specific ethic requirements in: • The technical and professional duties and responsibilities of the engineer. • Academic integrity and research ethics. • Intellectual property. • The ethics of the engineering profession; technical and professional organizations. • The impact of engineering decisions on society, including elements of equity, concepts of sustainable development and environmental stewardship, and public and worker safety • Health considerations including the context of the Alberta Occupational Health and Safety Act.
Methods of Assessment	**Ethics** Indicators will be <u>assessed</u> and provided <u>regular oral and written formative feedback</u> in the programs through student records of: 1. In the first year of their program, completing program course/workshops, FGSR workshops, or other approved formal activities in the area of ethics, which includes elements of: • Student code of conduct, • Plagiarism, • Copyright, and • Sexual violence 2. Successfully completing: • ENGG 600 in the first year of their program.

	• Research area specific ethics training (animal, human, etc.) prior to engaging in these research activities and no later than the candidacy exam. It is the responsibility of the supervisor to provide written, detailed and justified formative feedback, and corrective actions for deficiencies, if identified, in **Ethics** to the student following each meeting and examination; it is the responsibility of the student to plan and undertake actions to address the feedback.