

Department/Academic Unit: Mathematics and Engineering

Degree Program: PhD

Degree Level Expectations, Learning Outcomes, Indicators of Achievement and the Program Requirements that Support the Learning Outcomes

| Expectations (general descriptors from OCAV) | Learning Outcomes (program specific)** This degree is awarded to students who demonstrate... | Indicators of Achievement As evidenced by... | Relevant Courses and academic requirements (requirements that contribute to the achievement of learning outcomes and degree expectations) |
|---|---|--|--|
| Depth and breadth of knowledge | Learning outcome: Advanced graduate-level expertise in at least two subject areas (chosen from Analysis, Algebra, Probability and Statistics, and Geometry and Topology) and basic knowledge in a variety of other subject areas. | Indicators: (1) Performance in two or more core graduate-level courses (for advanced knowledge) and performance in introductory level graduate courses (for basic knowledge). (2) Demonstration of depth and breadth of knowledge in oral presentations forming part of the degree requirements. | Advanced knowledge: MATH 844, 891, 892, 893, 894, 895, 896 Basic knowledge: MATH 801, 802, 805, 806, 812, 813, 818, 825, 827, 830, 832, 834, 836, 837, 838, 843, 844, 872, 874, 877, 884, 891, 892, 893, 894, 895, 896, 901, 902, 903, 905, 912, 913, 915, 922, 923, 925, 932, 933, 935, 936, 937, 939, 942, 943, 945, 972, 973, 975 STAT 853, 854, 855, 856, 857, 862, 864, 865, 866, 867, 870, 871, 873, 886, 952, 953, 955, 962, 963, 965 Breadth of knowledge: Comprehensive exam, Thesis defence |
| Research and scholarship | Learning outcomes: (1) An ability to create new mathematical and/or statistical research. This includes being able to independently come up with ideas for research, and carry through an independent investigation of these. (2) An ability to identify open problems in a research area where progress is possible and important. | Indicator: Report writing and presentations, either as a part of explicit research activity, a course, or a seminar. | Comprehensive exam, MATH/STAT 999 |
| Application of Knowledge | Learning outcome: The ability to assimilate mathematical and/or statistical knowledge beyond the mere repetition of knowledge acquired in courses or preliminary | Indicator: Research activity, monitored by annual progress reports, culminating in the thesis defence. | MATH/STAT 999, Thesis defence |

research investigations. Facility with the application area as well as how mathematics and/or statistics contributes to this application.

Professional capacity/autonomy

Learning outcomes: (1) The ability to quickly learn new mathematical or statistical knowledge and understand when these are applicable to a new problem or area of application. There is an expectation that this learning should be done in an independent manner. (2) An understanding that students owe an obligation to the public at large when it comes to explaining the importance and relevance of mathematical and/or statistical research, both fundamental and applied.

Indicator: Independent research, monitored by annual progress reports, culminating in the thesis defence. The grasp by the student of the relevance of their work, the depth of their understanding, and their ability to put their work in context is assessed in oral presentations.

Comprehensive exam, Thesis defence

Communication Skills

Learning outcome: The ability to present their research in written and oral form using generally accepted professional practices and adhering to standards of quality and clarity of presentation commensurate with those of a professional mathematician or statistician.

Indicators: Written reports and oral presentations required by degree.

Comprehensive exam, Thesis defence

Awareness of limits of knowledge

Learning outcome: A mature and sophisticated awareness of how their research and levels of knowledge fit within what is already known and what is not yet known.

Indicators: (1) Final exams in advanced core courses, (2) summaries of research papers in seminars, and (3) presentation of research findings in the context of existing and future research.

MATH 844, 891, 892, 893, 894, 895, 896, MATH/STAT 999

Ability to recall and reproduce proofs of basic results

Learning outcome: A high level of familiarity with the fundamental results of their field, and an ability to reproduce their proofs or sketches of their proofs without assistance.

Indicators: (1) Final exams in advanced core courses and (2) oral presentations of research proposal and thesis.

MATH 844, 891, 892, 893, 894, 895, 896, Comprehensive exam, Thesis defence