

PMath 453/753

Functional Analysis

M W F: 13:30 - 14:20 Room: RCH 207

Instructor: L.W. Marcoux

Course Outline
September 2022

MC 5014

Basic Outline:

- Topological vector spaces
- Hahn-Banach Theorems
- Hahn-Banach Theorems, Open Mapping and Closed Graph Theorems
- Weak topologies, dual spaces, Tychonoff's Theorem, Banach-Alaoglu Theorem
- Banach and Hilbert spaces
- Bounded linear maps

Grading:

There will be 6 assignments. I will drop your lowest assignment score, meaning that I will average your assignment grade over the top 5 assignments. There will also be 6 online quizzes (all of which will count), and a final exam.

- Assignments: 40%, Quizzes: 18%, Final: 42%.

Textbook: I have written a **free!** set of notes for this course which you can download from the Learn website. These notes are also available on my Department webpage [<https://www.math.uwaterloo.ca/~lwmarcou/>].

Having said this, I am expecting and I am *strongly* encouraging you to consult various textbooks on Functional Analysis. The following is a very incomplete list of sources for you to consider.

- Bollobás, B., *Linear analysis, an introductory course*, Cambridge Mathematical Textbooks, Cambridge University Press, 1992.
- Conway, J.B., *A course in functional analysis*, Graduate Texts in Mathematics 96, Springer-Verlag, 1985.
- Dunford, N. and Schwartz, J., *Linear operators, I*, New York, Interscience, 1958. (This book is encyclopaedic in nature, but is still an excellent reference. The notation might at times be outdated.)
- Kadison, R.V. and Ringrose, J.R., *Fundamentals of the Theory of Operator Algebras*, Graduate Studies in Mathematics 15, American Mathematical Society, Providence, RI, 1997. [This is the book I followed in a previous incarnation of this course.]
- Morrison, T.J., *Functional Analysis, an introduction to Banach space theory*, Wiley-Interscience, 2001.
- Pryce, J.D., *Basic methods of Functional Analysis*, Hutchinson University Library, 1973.
- Rudin, W., *Functional analysis*, Tata McGraw-Hill, New Dehli, 1977.

Comments:

- And now a message from the University of Waterloo:

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

[Check www.uwaterloo.ca/academicintegrity/ for more information.]

- Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.
- Discipline: A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline, <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>. For typical penalties check Guidelines for the Assessment of Penalties, <http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>.
- Appeals: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.
- Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.